Carlsbad Oaks North
Habitat Conservation Area

(CNLM No: S034)
(USFWS: 2002B003)

Annual Work Plan
October 2010 - September 2011

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I. INTRODUCTION AND SUMMARY

This work plan has been developed from the guidelines for goals and objectives set forth in the City of Carlsbad Preserve Management Plan (PMP) for the Carlsbad Oaks North Habitat Conservation Area (HCA) dated January 2005 (Tierra Data 2005) and as agreed to by the United States Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG). This annual work plan also includes additional management activities that the Center for Natural Lands Management (CNLM, referred to in-text as the Center) feels are appropriate to protect and maintain the natural resources at the HCA in perpetuity.

The HCA covers 326 acres, of which 108.4 acres are located within a conservation easement (CE) on lands owned by the County of San Diego. The CE was transferred to the Center in November of 2005. The Center received funds to manage the CE portion in May of 2006 at which time management activities commenced. The Center received fee title for the remaining 219.6 acres from the previous owner, Techbilt Construction Corporation (Techbilt), in March of 2007.

The purpose of this work plan is to identify the tasks and budget required to complete the management activities for the upcoming management year that will begin on October 1, 2010 and end on September 30, 2011. This is the fifth annual work plan submitted for this HCA since receiving the original CE portion in May 2006. Unless otherwise stated, all tasks will be performed by the Center's Area Manager, Markus Spiegelberg, Center HCA Managers Patrick McConnell and Jessica Vinje.

Summary of Tasks and Goals for the Management year:

- Install and maintain existing signs and fences
- Map all sensitive wildlife species observed, note all animal species observed
- Continue census and habitat assessment efforts for the San Diego thornmint (*Acanthomintha ilicifolia*) and thread-leaved brodiaea (*Brodiaea filifolia*)
- Conduct coastal sage scrub (css) long-term monitoring
- Conduct coast live oak forest (clof) long-term monitoring
- Track dead zone extent in southern parcel in CE portion of HCA
- Begin restoring impacted thread-leaved brodiaea habitat
- Monitor and control nonnative, exotic plants in restoration and enhancement areas in coordination with the developer of the Carlsbad Oaks North business park
- Control non-native hollow-stem asphodel (*Asphodelus fistulosus*), artichoke thistle (*Cynara cardunculus*), Mexican fan palm (*Washingtonia robusta*), Canary Island date palm (*Phoenix canariensis*), shamal ash (*Fraxinus uhdei*), African fountain grass (*Pennisetum sataceum*), saltcedar (*Tamarix* sp.) and pampas grass (*Cortaderia selloana*)
- Work with contractors to remove exotic forbs in the eastern portion of the HCA
- Begin an exotic grass and litter removal study in the eastern portion of the HCA
- Conduct regular patrol visits
- Remove trash as necessary
- Remove construction fencing from sections of the HCA

- Conduct Conservation Easement compliance
- Prepare and provide to the wildlife agencies an annual report that describes the management activities and information gathered during the management year and includes a CE compliance report for the management year
- Draft position papers for Carlsbad Habitat Management Plan (HMP) covered sensitive plant species
- Draft a new management plan for the HCA
- Provide an accounting of funds to be spent in the management year

Appendix 1 (Task Schedule) identifies the approximate schedule of tasks for the upcoming management year. The location of the HCA is shown in Appendix 2.

II. MANAGEMENT ACTIVITIES

The following sections identify and describe the activities to be performed during the upcoming management 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 seven groups: Capital Improvements, Biological Surveys, Habitat Restoration and Maintenance, Public Services, Reporting, Office Maintenance, and Operations. Each of these categories will be discussed below.

A. CAPITAL IMPROVEMENTS

1. **Signage** Signs will be maintained at all of the major access points and along most of the perimeter to the HCA, and a few other needed locations. Older signs placed along the periphery of the property will continue to be replaced with No Trespassing signs. Additional signage may need to be replaced with more appropriate signs along access points and roadways along the eastern parcel boundaries to reflect the presence of the City trail. Each sign explains that the HCA is dedicated as a habitat conservation area, and that fire, mechanized travel, dumping and shooting are prohibited.

2. **Fencing** We will continue to install smooth-wire fencing along portions of the HCA that are showing signs of trespass. We will also remove more sections of plastic construction fencing along certain areas of HCA boundary. We will look for problem spots, or new entry points created by mountain bikers, motorized recreation, and runners, and close these off when they appear. We will continue to maintain existing fencing, and make repairs to vandalized fencing when necessary.

B. BIOLOGICAL SURVEYS

Biological monitoring activities at the HCA will follow items listed in the PMP. The Center has modified monitoring tasks outlined in the PMP to adjust the task time lines and some of the tasks which it finds to be unnecessary at this time. Below is a description of the tasks that will be accomplished during the upcoming management year. In addition, Table 1 outlines all tasks that will be completed at the HCA and an associated time line for the next 5 years.

Monitoring during the next year includes mapping of sensitive plants, habitat assessments for two of these sensitive species, the second year of coast live oak forest monitoring, includes the third year of a long-term css monitoring program, as well as initial cover and species richness estimates inside experimental exotic and thatch removal plots. Other sensitive plant and animal species will be mapped and counted when noted. All landmark data will be entered or stored in a Geographic Information System (GIS) database. A brief description of monitoring activities outlined by taxa is provided below:

1. Animal Use Monitoring

b. Small and Large Mammal Monitoring Sensitive mammals, such as southern mule deer (*Odocoileus hemionus*) and San Diego black-tailed jackrabbit (*Lepus californicus bennettii*) will be mapped when they are observed.

c. Amphibian and Reptile Monitoring Sensitive amphibians or reptiles, such as orange-throated whiptail *(Cnemidophorus hyperythrus*) and San Diego horned lizard (*Phrynosoma coronatum blainvilli*) will be mapped where noticed during the performance of other management activities.

2. Vegetation Sampling and Habitat Assessments

a. CSS long-term monitoring More long-term vegetation monitoring plots will be measured throughout the HCA as part of our objective to track changes in species cover, presence, and population attributes over time. More information about the justification for these plots, and the sampling design is provided in Appendix 3.

b. Clof monitoring Two coast live oak forest (clof) assessment plots were conducted nearby La Mirada Creek during the summer of 2010. We may conduct two more during the summer of 2011. See Appendix 4 for methods and rational. Measures taken include stand density, point intercept for canopy (taken with a densitometer), non-canopy point-intercept, ground cover, species richness, and diameter at breast height (dbh) for all oaks greater than 6 cm dbh. The Preserve Steward (TAIC Inc.) is currently developing a holistic coast live oak woodland assessment methodology that may be used henceforward in place of cover and diversity monitoring.

c. Scrub oak and summer holly mapping If time and budget allow, completion of a mapping effort for these two species will be accomplished during this management year.

Table 1. Schedule of Biological Monitoring Tasks

Management Year					
Monitoring task	**2010/2011**	**2011/2012**	**2012/2013**	**2013/2014**	**2014/2015**
Focused sensitive reptile surveys[1]	TBD[2]	TBD	TBD	TBD	TBD
Coastal California gnatcatcher surveys			X		
css vegetation data collection[3]	X	TBD	TBD	TBD	TBD
Thread-leaved brodiaea and San Diego thornmint surveys (including assessment of habitat)	X	X	TBD	TBD	TBD
Summer holly and Nuttall's scrub oak[4]	X	TBD	TBD	TBD	TBD
Other sensitive plant surveys	TBD	TBD	TBD	TBD	TBD
Clof assessments	TBD	TBD	TBD	TBD	TBD

1. Focused reptile surveys will occur in lieu of installing and monitoring pitfall arrays. Pitfall arrays will not be installed since the HCA is heavily used by the public. In the experience of the Center, these arrays would be vandalized. Incidental observations of individuals or signs (scat, tracks) will be mapped.
2. TBD = To Be Determined at some future time. Evolving habitat management needs may preclude monitoring for certain taxa during select years, depending on need and budget.
3. The Center initiated coastal sage scrub quantitative monitoring during the 2008-2009 management year. The Center plans on monitoring each plot on a tri-annual basis, and has stratified sampling by aspect and location throughout several preserves in order to visit a necessary amount of plots on a yearly basis, while visiting some plots every year in order to compare variation between sampling efforts.
4. Census and mapping was partially completed in the summer of 2007. Medical leave among personnel limited mapping effort in 2007-2008 management year. Weed removal needs precluded mapping efforts during 2008-2009 management year. If possible, mapping and censusing of these species will be accomplished this year.

d. San Diego thornmint and thread-leaved brodiaea habitat assessments Direct counts of both species will take place, estimates of vegetative cover by species and edaphic cover will be taken at sites where the species are found. For details on the rational and methodology for conducting the San Diego thornmint assessments, see the 2009-2010 Annual Report for this HCA (CNLM 2010).

e. Nutall's scrub oak and summer holly mapping Hundreds of individuals of each species were censused and mapped in the summer of 2007. The mapping was not accomplished as planned during 2008 or 2009. Budget permitting, we will accomplish more mapping for these species during summer 2011. With further information about location and population numbers, subsequent vegetation assessments can be designed which can inform management activities.

Some sensitive plant species in addition to those already listed will be censused and mapped where found throughout the HCA in spring 2010. These include previously found species such as San Diego goldenstar (*Muilla clevelandii*), small flowered morning glory (*Convolvulus simulans*), Palmer's grapplinghook (*Harpagonella palmeri*), and small flowered microseris (*Microseris douglasii* var. *platycarpha*). With further information about location and population numbers, subsequent vegetation assessments can be designed which can inform management activities. Some sensitive perennials known to occur in the HCA, such as spineshrub (*Adolphia californica*), western dichondra (*Dichondra occidentalis*), and San Diego sagewort (*Artemisia palmeri*) may be budgeted for mapping and censusing in future years.

C. HABITAT RESTORATION AND MAINTENANCE

Most of the HCA habitat is good quality, with little disturbance from nonnative species. There are nonnative exotic plants scattered throughout the HCA, however. The Center has budgeted for continuing the eradication efforts in riparian areas and in scrub habitat.

As per the wildlife agency permits for the Carlsbad Oaks North development, Techbilt and the regulatory agencies, Techbilt is responsible for the removal and maintenance of all "zero" tolerance nonnative plant species within the approved habitat restoration and enhancement projects (5-year maintenance period). The Center will continue to monitor and coordinate removal of nonnative exotics in the HCA with Techbilt when they are located.

Thread-leaved brodiaea habitat restoration The City of Carlsbad (the City) has acted responsibly for negligence on the part of the Parks Dept. in applying Roundup® herbicide on approximately 300 square feet of needlegrass grassland that contained at least 19 vegetative thread-leaved brodiaea. Funds have been approved by the City for replacement of brodiaea and other plants that were affected by the herbicide application. Brodiaea and other affected species seeds were collected on this and other nearby preserves. The brodiaea seed is being stored at Recon Nursery and will be sewn in October 2010. See Appendix 5 for a detailed description of the restoration rational and methods.

Priority weeds The Center has budgeted for, and will contract continued treatment of hollow-stem asphodel during the winter/spring of 2011. We are prioritizing the removal of hollow-stem asphodel, Mexican fan palm, Canary Island date palm, shamel ash, African fountain grass, saltcedar, artichoke thistle, and pampas grass. We will expand the selection of priority removal species as the above list becomes more manageable, and/or other threatening species emerge. The Preserve Manager will continue to treat Pampas grass and saltcedar as they are found throughout the HCA.

Upland forbs The Center has budgeted for 3 crew days of removing upland forbs such as black mustard (*Brassica nigra*), fennel (*Foeniculum vulgare*), poison hemlock (*Conium maculatum*), tocalote (*Centaurea melitensis*), milk thistle (*Silybum marianum*) and Italian thistle (*Carduus pycnocephalus*). The southeastern portions of the HCA harbor clay soils that are overrun with

these species. Over time, these soils can potentially be converted to native grassland, or habitat for rare forbs.

Grassland weed control experiment We wish to try a non-systemic herbicide (Sygenta *Reward*®) among remnant native grassland habitat along the eastern edges of the HCA to control non-native grasses and forbs. Controls, thatch removal, and herbicide thatch removal combinations will be included in the design. Cover and species richness data will be recorded from stratified random placement of quadrats in each replicate. We will ensure no listed sensitive species occur inside experimental plots. Another preserve is expected to be included in the overall design. It is too early in the planning stages to provide a methods document, but the rational is included herein:

We are have finished our fourth year of data collection on experimental thread-leaved brodiaea plots that have included as an effect the grass controlling herbicide Fusillade II. We have studied the responses of brodiaea, species richness, and cover among these experimental plots. Our data indicate that in disturbed grasslands, grass specific herbicide tends to favor the shift from exotic grass cover to exotic forb cover. Since exotic forbs are present throughout most grasslands, it stands to reason that this outcome may be the case in all or most areas. One conclusion may be that both grass-specific herbicide and broad-spectrum herbicide should be used together in managing grasslands and/or sensitive areas. However, the herbicide Reward® by Syngenta is a non-translocating broad-spectrum herbicide that has been shown to be efficient killing grasses and broad-leaved forbs. The perceived advantage of using a non-translocating herbicide over most conventional herbicides (that get translocated into plants and target respiratory or photosynthetic pathways) is that applying non-translocating herbicide to perennial plants will not as readily kill them as it will kill annual plants. A safe assumption is that native perennials have storage capacity that will enable them to rebound from the shock of the non-translocating herbicide, as they would from a fire or other disturbance. Thus, spot spraying to avoid native plants may not have to be rigidly adhered to, and in areas where there are little or no native annuals, this may be a workable solution to high non-native grass cover in native grasslands.

Dead zone We will continue mapping the extent of the dead zone that is resulting from water seepage from the edge of the HCA. Another area of dead vegetation was noted during CE compliance monitoring during the summer of 2009, and this also will be tracked for expansion.

Table 2. Sensitive plants present and threats 2010-2011

Name	Threats	Actions Planned
Thread-leaved brodiaea MHCP[1], FT[2]	Human disturbance Non-native grasses and forbs	Frequent patrol Yearly habitat assessments[3]
San Diego thornmint MHCP, FT	Human disturbance Non-native grasses and forbs	Frequent patrol Yearly habitat assessments
Small-flowered microseris CNPS List 4.2	Human disturbance Non-native grasses and forbs	Frequent patrol Habitat assessments yearly coincident with San Diego Thornmint
Western dichondra CNPS List 4.2	Human disturbance	Frequent patrol
Palmer's grapplinghook CNPS List 4.2	Human disturbance Non-native grasses and forbs	Frequent patrol
Summer holly MHCP, CNPS List 1B.2	Human Distrubance	Frequent patrol Habitat assessments
Nuttal's scrub oak MHCP, CNPS List 1B.1	Human disturbance	Frequent patrol Habitat assessments
Small flowered morning glory CNPS List 4.2	Human disturbance Non-native grasses and forbs	Frequent patrol Habitat assessments yearly coincident with San Diego Thornmint
California adolphia CNPS List 2.1	Human disturbance	Frequent patrol

1 MHCP refers to Multi Habitat Conservation Program for Northern San Diego County, these species are listed under the Carlsbad HMP (Habitat Management Plan), thereby requiring certain management measures to attain.
2 FT = Federally listed as threatened.
3 Habitat assessments determine whether weed removal activities are needed. For non-focus species, long-term css monitoring will determine trends in non-native cover that can then be actionable. Other direct threats to native cover such as trails or vandalism can be observed and noted during regular patrol activities.

D. PUBLIC SERVICES

Public services activities include the patrolling of the HCA, consulting with nearby businesses about perimeter landscaping, and responding to emergencies. However, other opportunities for public service may be forthcoming during the year with local groups and individuals interested in volunteering labor for HCA projects, and special interest field trips. Whenever possible, HCA management will try to accommodate these activities.

1. **Patrolling** Patrols will be performed approximately four times per month. The main patrol activities will be to ensure that the public does not use any of the illegal trails located on the HCA. Observations of sensitive animals, new human impacts, new weed infestations, and trash will be gathered during patrols as well.

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

E. REPORTING

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 City of Carlsbad 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. This task will be accomplished by a subcontractor, Cadre Environmental. This company will standardize all of the HCA GIS files/databases with all of the other Center GIS files/databases.

2. Reports

a. Year-End/Agency Reports A year-end report will be prepared by the HCA manager by early November 2011 detailing the results of the year's management activities. This report will include recommendations for the continuation of various activities for the following management year and will be submitted to the City of Carlsbad, USFWS and CDFG as required under for the 2011-2012 management year will be formulated by the end of the 2010-2011 management year and will be based upon experiences during previous years' operations. This work plan will be submitted to the City of Carlsbad, USFWS and CDFG.

b. Conservation Easement (CE) Compliance The HCA Manager will monitor compliance of Conservation Easement portion of the HCA (APN 209-050-25-00) to ensure the conservation values are maintained in perpetuity. This process insures CE's are being managed appropriately, and ensures continuity of process. Compliance visits are to be carried out during the later portion of the management year, and will be appended to each year's annual. Next management year will encompass the fifth CE Compliance visit cycle since inception of this HCA. For more information regarding reasoning and methodology, see the Annual Report 2009-2010 for this HCA.

d. Position Paper Preparation The Center is conducting rare plant and animal monitoring and research on our preserve system. Data are being collected and compiled on these plants and animals. The Center has allocated funds to draft position papers for selected City of Carlsbad's Covered Species (plants). These papers will summarize what is known and not known about each species and the Center will make recommendations on what research and/or management actions are needed for conservation and perpetual management of each species.

e. Management Plan Preparation It has been roughly five years since the initial management plan was drafted for this HCA (Tierra Data 2005). We have budgeted for a

large portion of an updated management plan to be completed during this management year.

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 Center personnel, and inspection of the HCA by Center administration. Funds have been allocated in the current budget for the HCA Managers to attend staff retreats or other meetings during the 2010-2011 year. Also included within this category of activity is the conduction of employee reviews.

III. WORKLOAD AND BUDGETS

A. SUPERVISION & STAFFING

The Area Manger will be supervised by the Center's Director of Science, Dr. Deborah Rogers. Tasks and hours will be coordinated by the Area Manager and approved by Dr Rogers. The Area Manager, Markus Spiegelberg will supervise the HCA Managers, Patrick McConnell and Jessica Vinje. Additionally, hours have been allocated for a Dr. Rogers to assist with document reviewing and scientific research conducted on Center HCA's.

B. BUDGETING

A budget of $39,129 has been allocated for this management year and is included here as Appendix 2. Every effort will be made by HCA Management to allocate time and expenses according to this estimated budget.

IV. REFERENCES

CNLM. Carlsbad Oaks Habitat Conservation Area (S034) Annual Report 2009-2010. December 2010.

Tierra Data. City of Carlsbad Management Plan for the Carlsbad Oaks North Habitat Conservation Area. January 2005.

V. APPENDICES

Appendix 1

Task Schedule

Task	October-December 2010	January-March 2011	April to June 2011	July to September 2011
Nonnative Plant Removal	X	X	X	X
Sensitive Plant Surveys		X	X	X
Habitat Assessments (Rare and clof)		X	X	X
CSS monitoring		X	X	
Grassland weed control study		X	X	
GIS/Database	X		X	
Fencing/Signage	X			X
Patrolling	X	X	X	X
Position Paper	X			X
Management Plan	X			
Reports				X

Appendix 2

HCA Location Maps

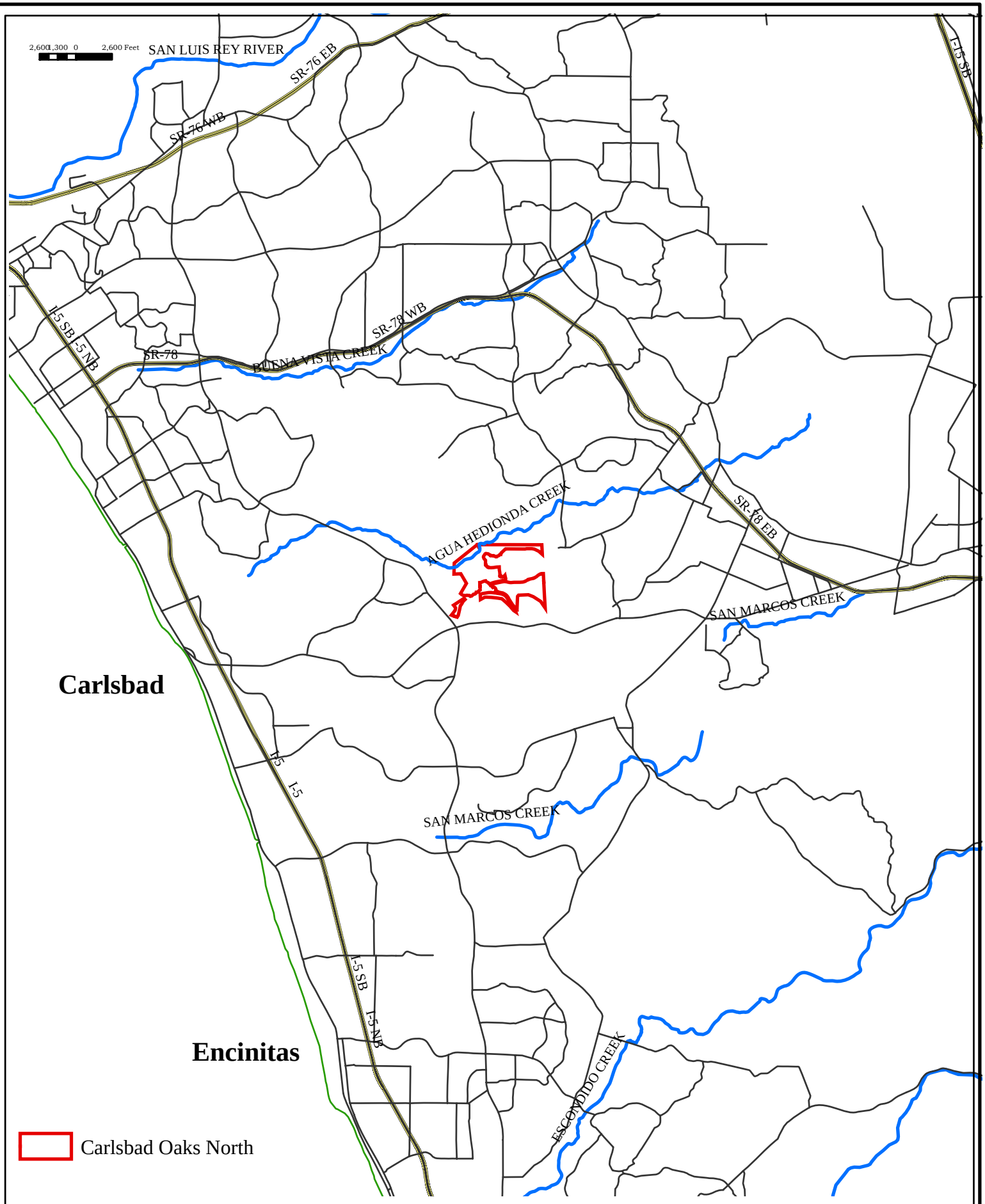

Figure 1
Preserve Vicinity
Carlsbad Oaks North Habitat Conservation Area - Carlsbad, CA

Center for Natural Lands Management

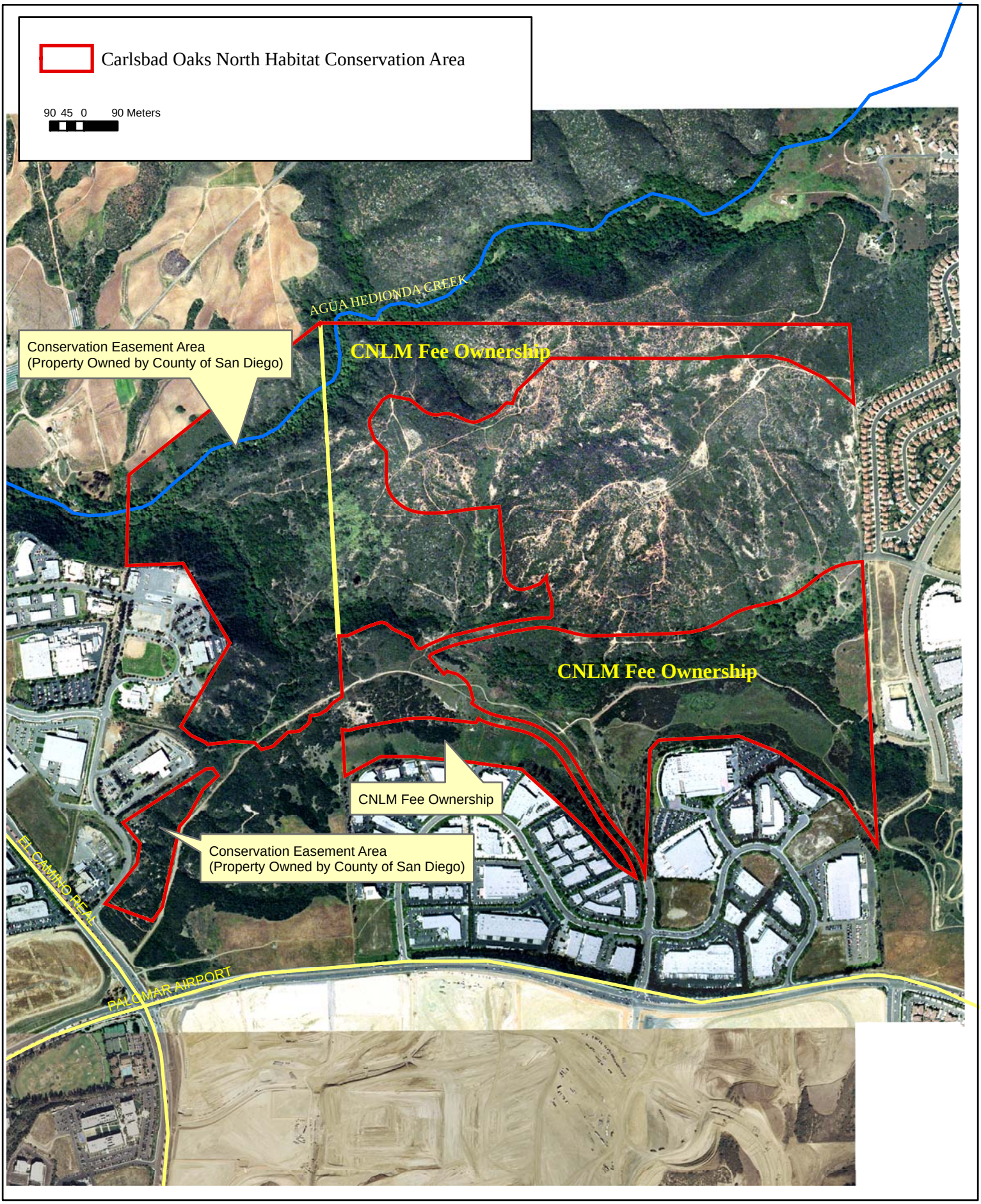

Figure 2
Preserve Location
Carlsbad Oaks North Habitat Conservation Area - Carlsbad, CA

Center for Natural Lands Management

Appendix 3
The Center for Natural Lands Management-San Diego: Coastal Sage Scrub Monitoring Plan

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. nonnative 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, nonnative 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 nonnative, 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 nonnative 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 nonnative 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, nonnative 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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Appendix 4

Coast Live Oak Forest Monitoring Methods

Background

This monitoring protocol has been developed to determine a precise baseline on the physical condition of the coast live oak woodlands present at Carlsbad Oaks North Habitat Conservation Area (HCA). For oak woodlands at the HCA the guidelines set forth in the City of Carlsbad Preserve Management Plan (PMP) for the Carlsbad Oaks North HCA dated January 2005 (Tierra Data 2005) only stipulate that condition and degree of habitat disturbance will be recorded. Although Californica Native Plant (CNPS) Vegetation Releve's can be employed as baseline measures, the recent observed decline in coast live oak (*Quercus agrifolia*) canopy coverage lead CNLM to conclude that changes in composition, density, and canopy coverage can and should be tracked over broad time-scales by using repeatable measures that minimize potential error between measurers. Two CNPS Rapid Assessments were performed on coast live oak woodland on La Mirada Creek in 2008 nearby the monitoring plots, and these can be used for additional evidence of change in composition and cover over time. A less intensive method of assessing forest health is currently being developed by the City of Carlsbad Preserve Steward (TAIC), and will include assessments of insect damage, among other things.

Methods

Plots were determined purposefully, based on the presence of a high canopy that shades much of the woodland floor. The plots are circular whereby all measures must fall within 25 meters of the center of the plot. Three different attributes are taken inside each 25 meter radius plot, and each will be explained in detail below:

1. Canopy, understory plant, and edaphic percent cover
2. Oak diameter at breast height (dbh)
3. Total species richness within the circle

Percent Cover

Percent cover is collected based on point-intercept methodology. A thin metal dowel and a meter tape are used to collect cover estimates. Each understory plant that this dowel vertically intersects at each 1-meter interval along the meter tape is entered into a spreadsheet as a hit. Meter tapes are set outward from the center point (center point can be marked by installing a piece of rebar, marked with a sub-meter GPS unit) in the four cardinal directions of north, east, south, and west. Each transect is 25 meters in length. One or more species are recorded per 1-meter interval beginning at 1 meter for a total of 25 points per transect and 100 points for all four transects. A hit is recorded in the spreadsheet as the species that is intersecting the dowel and more than one species can be intersected at each point. If an oak is in the understory and within the plot and is incident with the dowel, then its presence is recorded in the notes column of the spreadsheet. This is to keep changes in canopy cover in oaks separate from changes in

understory cover, so that if canopy cover decreases, the data will show this change accurately, and not merely include an increased understory response of oak recruits as the oak canopy change. Diameter at Breast Height (dbh) measures (described below) should also help reveal a shift from canopy to understory cover of oaks if drastic change does take place due to disease or windfall. In addition to collecting plant species hits at each 1-meter interval along the 25 meter tape, edaphic cover (i.e., litter, bare ground, deadfall) is also recorded, but in a separate column. Edaphic cover is summarized separately from live plant cover, but the divisor is also 100 for the 100 total points making up the plot. Deadfall is defined here as fallen limbs and/or attached stems and leaves in excess of approximately 3 centimeter (cm) diameter.

At each 1-meter interval along the 25-meter tape, a densitometer is used to estimate canopy cover within the plot. The canopy cover data are recorded in the same column of the spreadsheet as understory plants, as the species that is intersecting the cross-hairs of the densitometer. This is almost invariably coast live oak. Total percent cover can be over 100 percent, since there tends to be much overlap in aerial cover inside the woodland.

DBH

Starting at true north, each oak encountered first as one travels clockwise from the plot center point is measured using a dbh tape measure. If a dbh tape is not used, diameter can easily be converted from circumference measures using a standard tape measure. Trees not measuring 6 centimeters diameter or over do not get measured. If more than one trunk arises within one meter of another trunk, the trunk with the widest diameter is measured. Although this is not ideal, it cuts down on time considerably, and helps keep order in which tree gets measured next as one travels clockwise from the center point. Additionally, if more than one trunk arises from a common trunk below breast height, the widest diameter trunk is measured at breast height. Ensure to note whether the data collector is entering measures in fractions of a meter or in centimeters.

Species richness

Those species present inside each circular plot in addition to those incident with the transect line are recorded in a separate column. Species composition is expected to change over time considerably, especially if broad changes in canopy cover take place, and if changes in moisture availability take place.

Rational

It is expected that the data generated by this methodology will not need to be measured again until it is perceived that a change in density, canopy coverage, and/or species composition is apparent. The dual measures of tree dbh and canopy cover may be useful in elucidating a change in size class as more mature trees disappear due to any number or combination of causes. Two plots were measured in 2010, and two are expected to be measured in 2011.

We are considering changes in methodology such as using forestry prisms, or a cheaper hand-made alternative that can mostly remove the need for tape measures. The understory cover is

very dense, however, and thus a tape measure will still be needed for determining whether some trees are inside or outside of the plot. The clockwise measures beginning at true north, from the plot center point should simplify data collection, since trees don't need to be marked. We are considering whether to follow the direction and order regimen, since there will be variability among observers from one measuring instance to the next. The only conceivable reason we can devise for following an order in dbh collection such as this is so that double measuring is less likely within each stand.

Appendix 5

Unauthorized Impact to Thread-leaved Brodiaea

Description of Unauthorized Impact

In mid-March of 2009, while conducting herbicide treatment on a right-of-way along a public trail, the City of Carlsbad's trail cleaning crew inadvertently sprayed herbicide onto an adjacent preserve area (Carlsbad Oaks North). The impacted area includes approximately 10 x 30 feet of native grassland and up to 50 individuals of thread-leaved brodiaea (TLB, *Brodiaea filifolia*), a state endangered, federally listed, narrow endemic species (see attached map and photos). The TLB were observed (and reported on) by CNLM in 2008 and 2009 in the impact location. The site is owned and managed by Center for Natural Lands Management (CNLM).

In February of 2010, the City and CNLM staff met to determine the impact to the native grassland and TLB in this subsequent year, as TLB and other native species may have survived the impact. The conclusion was that the grassland was significantly impacted and most native species were lost. It was also determined that approximately 20-25 TLB were impacted.

City HMP staff have met on site with CNLM and City Parks staff. All parties are committed to establishing tighter controls and better communication for trail treatments through and adjacent to preserves. The City understands the seriousness of this accident and is committed to mitigating the impacts and taking the steps necessary to ensure that this type of incident doesn't happen again. The City would like to propose the mitigation measures discussed below.

Mitigation Recommendations

Determination of appropriate impact mitigation was based on the following factors:

- The duration, frequency, or recurrence of the violation
- The nature and seriousness of the violation
- Whether the offense impacted sensitive habitats or species
- The willfulness of responsible party's misconduct
- The good faith effort by the responsible party to remedy the situation

Based on the criteria above, the following mitigation measures are recommended for impacts to 300 ft^2 (0.0069 acre) of native grassland and an estimated 20-25 TLB plants:

1. Restore impacted area:

a. Re-plant affected area with appropriate perennial native grassland species, to include blue-eyed grass (*Sisyrinchium bellum*), rayless gumplant (*Grindelia campurum* var. *bracteosum*), foothill needlegrass (*Nassella lepida*), and common goldenstar (*Bloomeria crocea*). Container planting will occur in the winter of 2010-11. In addition, the site will be seeded with small flowered morning glory (*Convolvulus simulans*)..
b. Provide erosion control as necessary.
c. Provide weed control as necessary (hand pulling only).
d. Collect seed, propagate and transplant 250 thread-leaved brodiaea into the affected area. Water as necessary. Planting is estimated to occur in winter of 2010-11.

2. Monitor grassland restoration area for success. Success will include less than 15% cover of nonnative plant species (determined qualitatively using visual inspection), native plant cover equal or better than the adjacent, unimpacted grassland (determined qualitatively using visual inspection) and 25 individual brodiaea (counted vegetativel), or more, 5 years after planting.
3. If success criteria are not met by year 5, the City will finance continued maintenance and restoration activities until success criteria are met.
4. Provide a monitoring report to the City Planning Department and Preserve Manager (Center for Natural Lands Management) on the status of the restoration project and brodiaea at the end of each calendar year from 2010-2014.
5. Implement training program to educate City personnel about spraying herbicide in and adjacent to preserve areas.
    a. Trails Maintenance staff attended Native Plants Seminar (conducted on September 12, 2009)
    b. Trails and selective Parks Maintenance staff attended Sprayer Application Rules and Laws Training (conducted on November 11, 2009)
    c. Selective Parks Maintenance staff to attend Native Plants Seminar (conducted on April 10, 2010)

Thread-leaved Brodiaea Herbicide Overspray Area

Photo 1. Facing west.

Photo 2. Close-up of affected brodiaea

Thread-leaved Brodiaea Herbicide Overspray Area

Photo 3. Facing east

Photo 4. Facing east.

Transformed habitat, spring 2010