Calavera Hills and Robertson Ranch
Habitat Conservation Area

(Dedicated natural areas set aside as part of the
Calavera Hills Phase II and Robertson Ranch developments)
(CNLM No. S031)
(USFWS: Calavera Hills Phase II 1597 & Robertson Ranch 2004B007)

Annual Work Plan

October 2010 - September 2011

Prepared for:

U.S. Fish and Wildlife Service
Attn: David Zoutendyk
6010 Hidden Valley Road
Carlsbad, CA 92009

California Department of Fish and Game
Attn: David Mayer
4949 Viewridge Avenue
San Diego, CA 92123

City of Carlsbad
Attn: Mike Grim
1635 Faraday Avenue
Carlsbad, CA 92008

Prepared by: Patrick McConnell, San Diego Preserve Manager
Reviewed by: Markus Spiegelberg, San Diego Area Manager

Center for Natural Lands Management
215 West Ash Street
Fallbrook, CA 92028
(760) 731-7790
www.cnlm.org

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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 Calavera Hills Phase II Final Habitat Management Plan (HMP)(Planning Systems 2002), the Robertson Ranch East Village Open Space Land Management Plan (Planning Systems 2006) and the Robertson Ranch West Village Open Space Preserve Land Management Plan (Planning Systems 2007). These Habitat Management Plans have been reviewed by and agreed upon by the City of Carlsbad, United States Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG).

The Center for Natural Lands Management (Center) holds conservation easements (since June 2006 for Calavera Hills Phase II, and February 2007 for Robertson Ranch East Village, and December 2007 for Robertson Ranch West Village Parcel 23C Phase I) on the Calavera Hills and Robertson Ranch Habitat Conservation Area (HCA) and performs or oversees the tasks identified in the three Habitat Management Plans (collectively HMP's).

The HCA is comprised of seven parcels, commonly referred to as Village H, R, U, W, and X, Robertson Ranch East Village, and Robertson Ranch West Village PA 23C Phase I, the first phase of a two phase parcel recordation process. The Center has merged the funding and reporting for these two areas as we provided the developer a financial discount for selecting the Center to manage both properties. In other words, the funding for the Robertson Ranch areas is less than what we would normally charge had we not already received funding for the Calavera Hills Phase II areas. This will also simplify future budgetary, reporting, and planning considerations.

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. Unless otherwise stated, all tasks will be performed by Center's Preserve Managers Patrick McConnell and Jessica Vinje and Rangers Justin Trujillo, Zadok Othniel and Roberto Bejar.

Summary of Tasks and Goals for the Management Year:

- Maintain signs and existing fences
- Install signage, smooth-wire fencing, and vegetation to limit pedestrian and vehicular access
- Census and conduct habitat assessments of thread-leaved brodiaea (*Brodiaea filifolia*), and San Diego thornmint (*Acanthomintha ilicifolia*)
- Continue to set up and monitor coastal sage scrub (css) long-term monitoring plots
- Conduct Village H grassland point-intercept and species richness transects
- Set up and conduct non-native plant control study
- Monitor and control nonnative, exotic plants
- Continue Village X exotic forb control
- Contract exotic forb control along Calavera Creek
- Contract exotic forb control in portions of West Village PA 23C

- Contract fennel (*Foeniculum vulgare*) and Bermuda buttercup (*Oxalis pes-caprae*) control at Village H
- Remove nonnative plants from the habitat restoration project at Village R
- Continue communications as needed with the Calavera Hills and Robertson Ranch HOA's and homeowners regarding landscaping issues
- Conduct weekly patrol visits, continue blocking unwanted trails
- Remove trash as necessary
- Conduct conservation easement (CE) compliance of HCA
- Prepare and provide to the wildlife agencies and City of Carlsbad 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 paper for Carlsbad Habitat Management Plan (HMP) covered sensitive plant species, Orcutt's hazardia (*Hazardia orcuttii*) and Del Mar Manzanita (*Arctostaphylos glandulosa* var. *glandulosa*)
- Draft an updated 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, Public Services, Reporting, Office Maintenance, and Operations. Each of these categories will be discussed below.

A. Capital Improvements

The installation of signs and fences will occur during this management year:

1. **Signing** Signs will be maintained at all of the major access points and along most of the perimeter to the HCA and a few other notable locations. Signage will be placed along the northern section of the eastern parcel of Village K. This was planned to take place during the 2009-2010 management year, but didn't take place. Each sign explains that the HCA is a dedicated as a habitat preserve, and that fire, off-road vehicles use, dumping, and shooting are prohibited.

2. **Fencing** We will continue to block unwanted trails in Village U and elsewhere with anchored vegetation where possible, and fencing where necessary. We may install short sections of fencing in combination with anchored vegetation along the eastern margins of Village U in order to dissuade mountain bikers.

B. Biological Surveys

Biological monitoring activities at the HCA will follow items listed in the HMPs. The Center has modified monitoring tasks outlined in the HMPs 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 habitat assessments for the two federally listed plant species that occur on the HCA; and the third year of a long-term css monitoring program. All data will be entered or stored in a Geographic Information System (GIS) database, or in MS Excel. Brief descriptions of monitoring activities outlined by taxa are provided below:

1. Animal Surveys

No protocol or otherwise purposeful animal surveys are scheduled this management year. We will map any sensitive animals observed while carrying out other duties.

2. Vegetation Surveys

a. Native grassland assessments The native grassland areas of the Village H parcel are of high quality, and support thread-leaved brodiaea populations. These grasslands are on a bi-annual sampling cycle, and were last sampled during the 2008-2009 management year. Therefore, we will again perform transect sampling during this 2010-2011 management year. For detail of cover by species, by origin, habit, and species richness over the past two sampling cycles see CNLM 2009.

b. Coastal sage scrub long-term monitoring A few more long-term vegetation monitoring plots may be installed 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.

3. Sensitive Plant Species Continued surveys will occur for thread-leaved brodiaea and San Diego thornmint in Village X parcel. Habitat assessments will take place among populations here, and in Village H. Habitat assessments will be performed by using point-intercept from quadrat sampling in stratified-random locations inside populations. Cover by species, species diversity, and edaphic information will be collected using the point-intercept estimates. The thornmint population does not occur inside the HCA, but rather occurs very close to the HCA. The close proximity to the HCA (within ten feet) of this occurrence necessitates we continue studying the population in the hopes that nearby conditions will be suitable for population expansion.

Table 1 Schedule of Biological Monitoring Tasks

Monitoring task	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015
Focused sensitive reptile surveys[1]		TBD	TBD	TBD	TBD
Native and non-native ant surveys		TBD	TBD	TBD	TBD
Coastal California gnatcatcher surveys (including observations of other sensitive avian species)		TBD	X	TBD	TBD
Native grassland vegetation community assessments	X		X		X
Coastal sage scrub quantitative monitoring[2]	X	X	TBD	TBD	TBD
San Diego thornmint surveys[3]	X	X	TBD	TBD	TBD
Thread-leaved brodiaea surveys[4]	X	X	TBD	TBD	TBD
San Diego thornmint and thread-leaved brodiaea habitat assessments	X	X	TBD	TBD	TBD

1. Focused reptile surveys will occur in lieu of installing and monitoring pitfall arrays. Pitfall arrays will not be installed because the HCA is heavily used by the public. Based on Center experience, these arrays would likely be vandalized.
2. The Center initiated coastal sage scrub quantitative monitoring during the 2008-2009 management year.
3. Two San Diego thornmint found May 2008 near northwestern boundary of Village X parcel. Four found Spring 2009, and two in 2010.
4. Additional thread-leaved brodiaea found in Village X parcel spring 2008, vegetation counted spring 2009, and again in spring 2010.

Palmer's grappling hook (*Harpagonella palmeri*), and small flowered microseris (*Microseris douglasii* var. *platycarpha*) will be censused where found. In cases where a population is too large to count, subplot sampling will also be used to generate population estimates and density.

If time and conditions permit, western dichondra (*Dichondra occidentalis*), small-flowered morning glory (*Convolvulus simulans*), and California adolphia (*Adolphia californica*) will be mapped where found throughout the HCA. Other sensitive plants will be censused and mapped, if located. See CNLM 2010 for results of activities carried out during 2009-2010 management year. Table 2 lists probable threats to sensitive plants known to occur in the HCA.

C. Habitat Restoration and Maintenance

Most of the HCA's habitat is good quality, with little disturbance from nonnative plant species. There are nonnative exotic plants scattered throughout the HCA, however. The Center has budgeted for continuing the eradication efforts in Village H, X, and Robertson Ranch parcels.

1. **Village H weeds** Fennel, crown daisy (*Chrysanthemum coronarium*), artichoke thistle (*Cynara cardunculus*), and Bermuda-buttercup patches will continue to be controlled in this area of the HCA. Since 2006, the southern end of Village H has been periodically mowed and skid-sprayed in order to reduce the seed production of persistent weeds. More mowings will occur during 2010 in order to continue the eradication effort. Fennel has again become common throughout Village H since the contracted treatments of 2006, and so we will obtain a crew for treating fennel during spring 2011.

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[4] CNPS List 4.2	Human disturbance Non-native grasses and forbs	Frequent patrol
Western dichondra[4] CNPS List 4.2	Human disturbance	Frequent patrol
Palmer's grapplinghook[4] CNPS List 4.2	Human disturbance Non-native grasses and forbs	Frequent patrol
Small flowered morning glory[4] CNPS List 4.2	Human disturbance Non-native grasses and forbs	Frequent patrol Yearly habitat assessments coincident with thornmint & brodiaea surveys
Nuttall's scrub oak (*Quercus dumosa*)	Human disturbance	Frequent patrol
California adolphia[4] CNPS List 2.1	Human disturbance[5] Non-native grasses and forbs	Frequent patrol CSS monitoring

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.
4. In many cases, Palmer's grapplinghook and small flowered morning glory co-occur with San Diego thornmint and/or thread-leaved brodiaea. In these cases, detailed cover data will reveal changes in cover values that may be detrimental. Since neither of these species, or other non-MHCP listed species are a priority for study, long-term css monitoring (Appendix 3), and coincidental information derived from thornmint and brodiaea studies will be relied upon for trend information.
5 Human disturbance includes fire and physical damage due to any number of activities. Fire is a threat since a fire may be vigorously controlled at the expense of the landscape, and because fire return intervals will more likely than not be shorter than that which the plant communities are adapted to. Finally, fire can open the landscape up to further encroachment as well as erosion processes that may be exceedingly difficult to manage.

2. **Robertson Ranch and Village X weeds** The Robertson Ranch West Village Planning Area 23-C (PA 23C) parcel has numerous saltcedar (*Tamarix* sp.) along a small drainage, and this will be the focus of one contractor day during fall 2010. Another contractor day will be continuing the removal of black mustard and other weeds along the western areas of Village X parcel. This area holds much promise, as soil conditions appear to be favorable to expansion of nearby thread-leaved brodiaea populations.

3. **Village R restoration** Village R is re-vegetating very well, mostly by way of natural recruitment of native shrubs and grasses. We plan on allowing more natural native plant recruitment of the area and will only be applying herbicide and manually weeding during the 2010-2011 management year. Appendix 4 contains a close-up of the restoration area.

4. **West Village and East Village re-vegetation** Brookfield homes and Robertson Family Trust are responsible for eventually re-vegetating approximately 3.2 and 20.5 acres of West Village parcel, respectively, as mitigation measures for development. The Center will continue to work with developers and assigned contractors to ensure that faithful compliance with re-vegetation plans is carried out. Brookfield has also assumed responsibility for the wetland restoration project in East Village parcel either side of Calavera Creek (Calavera Hills Phase II restoration obligation), and for the remaining 10.2 acres of upland re-vegetation in East Village parcels. D&D Wildlife Habitat Restoration, Inc. has been performing the installation and maintenance. The Center will stay involved with ensuring compliance with re-vegetation goals is met, and that pertinent documents are made available wherever possible.

5. **Grassland weed control experiment** We wish to try a non-systemic herbicide (Sygenta *Reward*®) among remnant native grassland habitat in East Village Parcel A, and in disturbed grassland at Village H. 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. Carlsbad Oaks North HCA is expected to be included in the overall design as well. 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 annual grasses and 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.

D. Public Services

Public services activities include the patrolling of the HCA; consulting with neighbors, HOA representatives, and landscapers about perimeter landscaping; and responding to emergencies. However, other opportunities for public service will undoubtedly be forthcoming during the year with local groups and individuals interested in volunteering labor for HCA projects, and class field trips from local schools. Whenever possible, management will try to accommodate these activities.

1. **Outreach** The landscaping bordering the HCA is typically high-water use. The result of this hydrophilic vegetation is excess water seepage into HCA edges, which will replace dry-adapted vegetation with wetland vegetation, and favors the establishment of weeds. The Center has worked with HOA representatives and landscapers regarding this matter, and there has been some improvement. See CNLM 2010 for comparison of 2009 with 2010 seepage area of Village X.

3. **Patrols** Patrols will be performed approximately four times per month, and also during biological surveys or other HCA activities. Patrols include the routine maintenance of fences, signs and trash removal. Observations of sensitive species, negative human effects, new weed infestations, and trash will be gathered during patrols as well.

4. **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 trespass issues.

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 HCA's.

2. **Photo-documentation Stations** Permanent photo documentation stations were established for the Calavera properties in 2006 and photographs were labeled and stored. Photographs at these stations will be updated in 2011, as necessary. Baseline photo points were established for Robertson Ranch West Village PA 23 C Phase I parcel along with Robertson Ranch East parcels during the summer 2008.

3. **Reports**

a. **Year-End/Agency Reports** A year-end report will be prepared by the HCA manager by December of 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 permit reporting conditions.

b. **Annual Work Plan** The annual work plan 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 and USFWS and CDFG.

c. **Conservation Easement (CE) Compliance** The HCA Manager will monitor compliance of all areas of the Conservation Easement 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 report. The next management year will encompass the fifth CE Compliance visit cycle for Calavera Hills parcels, and the third CE Compliance visit for Robertson Ranch parcels. All parcels are included in the same annual CE compliance since the 2008-2009 management year.

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

d. **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 classes or seminars during the upcoming year. Also included within this category of activity is the conduct of employee reviews.

III. WORKLOAD AND BUDGETS

1. **Supervision and Staffing:** The Area Manger will be supervised by the Center's Director of Conservation 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 Preserve Managers and Rangers.

2. **Budgeting**: A budget of $68,330 has been allocated for this management year. Every effort will be made by HCA Management to allocate time and expenses according to this estimated budget.

IV. REFERENCES

CNLM. 2010. Calavera Hills and Robertson Ranch Habitat Conservation Area Annual Report October 2009- September 2010.

Merkel & Associates. 2004. Biological Resources Report for the Robertson Ranch Project Carlsbad California. August 2004.

Planning Systems. 2002**.** Calavera Hills Phase II Final Habitat Management Plan. October 2002.

Planning Systems. 2006. Robertson Ranch East Village Open Space Land Management Plan. November 2006.

Planning Systems. 2007. Robertson Ranch West Village Open Space Preserve Land Management Plan. September 2007.

V. APPENDICES

Appendix 1

Task Schedule

Task	October-December 2010	January-March 2011	April to June 2011	July to September 2011
Sensitive Plant Habitat assessments			X	
Coastal Sage Scrub Monitoring			X	
Village H native grassland transects			X	
GIS/Database			X	
Exotic plant control study	X	X	X	
Village R Restoration	X	X	X	X
Nonnative Plant Removal (Including contractors)	X	X	X	X
Fencing/Signage/Trail Blocking	X			X
Patrolling	X	X	X	X
Reports & CE Compliance				X
Position Papers	X			X
Management Plan	X			X
HOA Outreach	X	X	X	

Appendix 2

HCA Location Maps

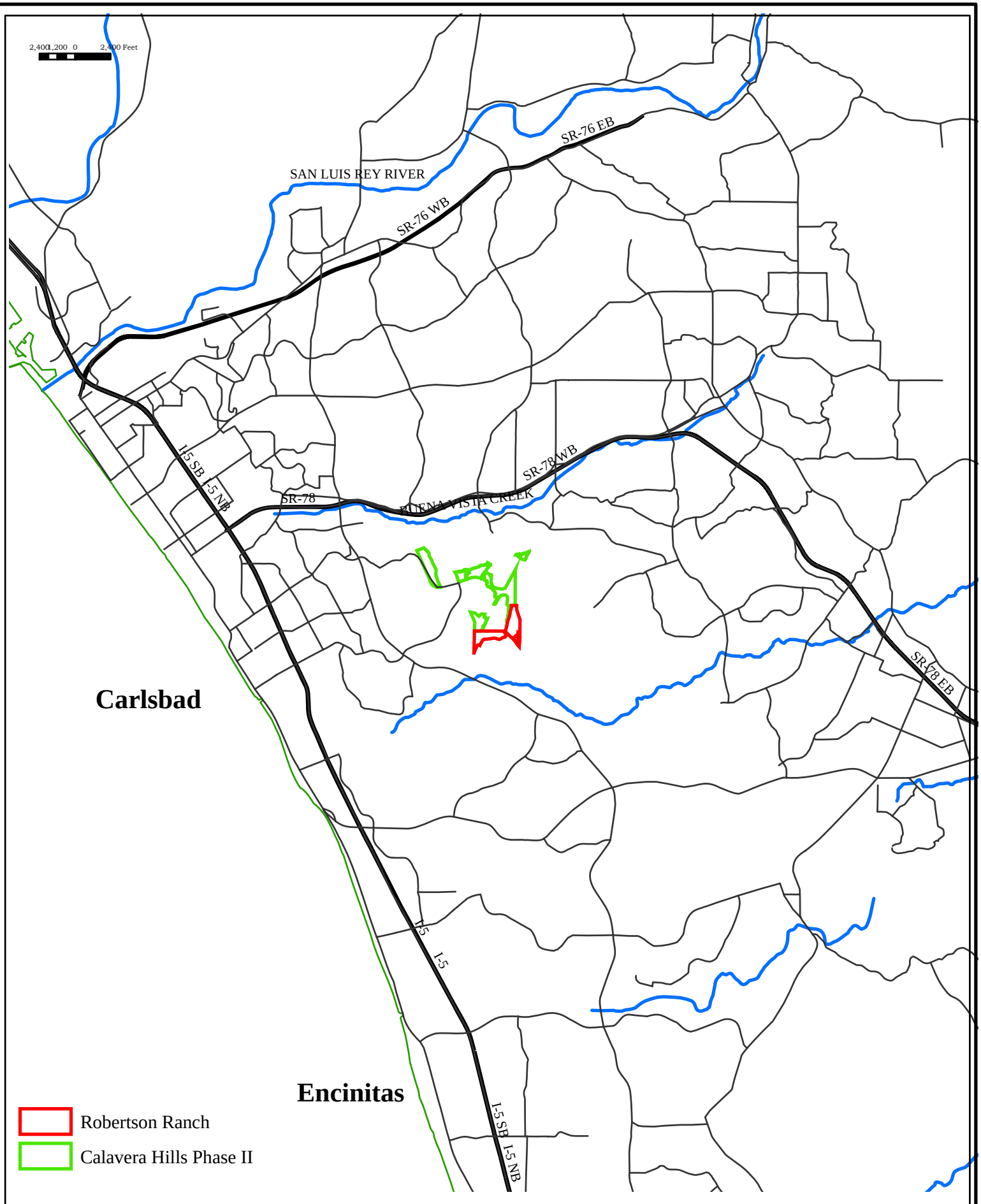

Figure 1
Preserve Vicinity
Roberstson Ranch and Calavera Hills Phase II Habitat Conservation Area - Carlsbad, CA

Center for Natural Lands Management

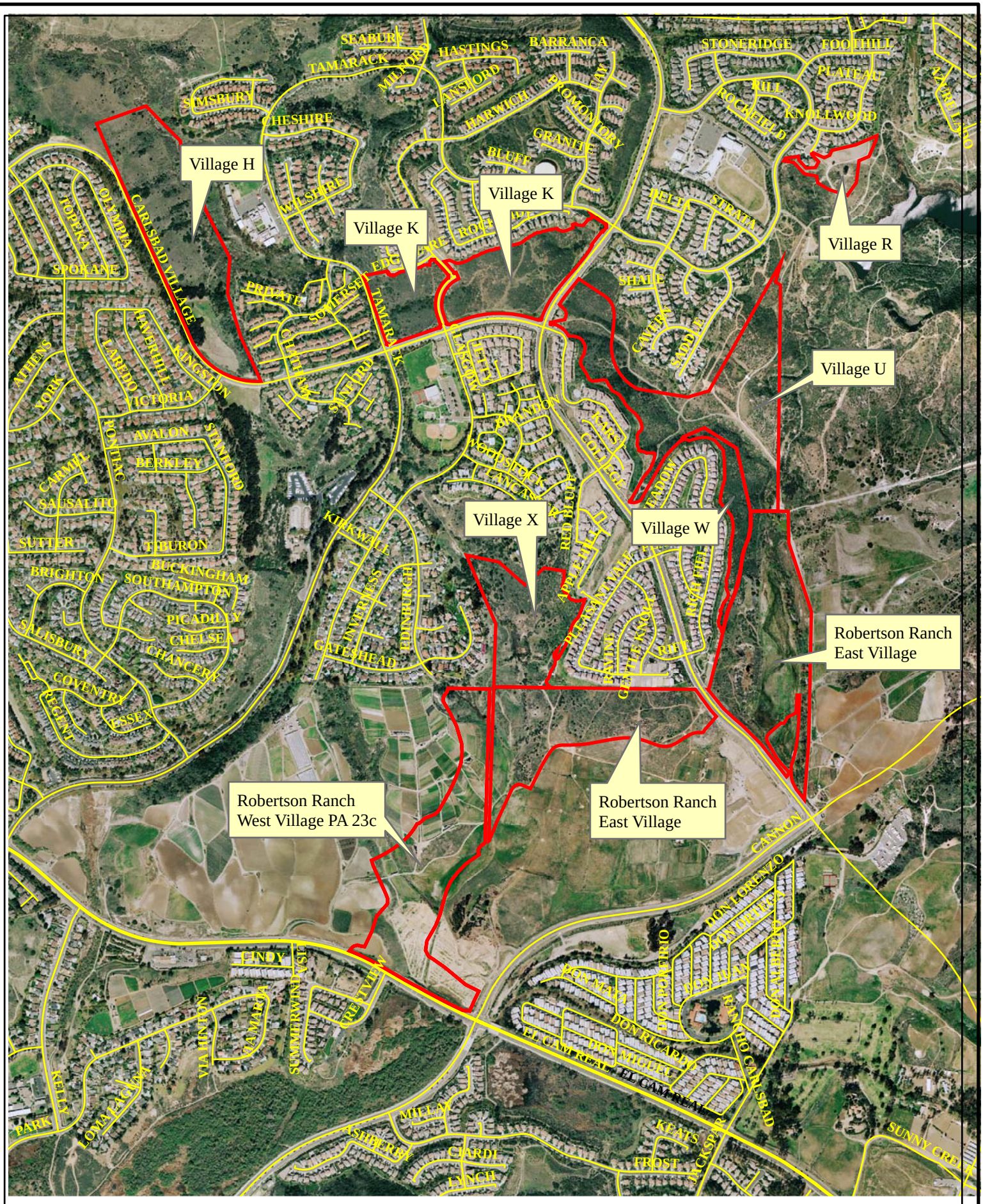

Figure 2. Preserve Location Map

Calavera and Robertson Ranch Habitat Conservation Area

380 190 0 380 Feet

Center for Natural Lands Management

Appendix 3

Coastal Sage Scrub Long-Term Monitoring Plan

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

Village R Restoration Area Photos