WEED MANAGEMENT PLAN

FOR THE

BALDWIN HILLS

LOS ANGELES COUNTY, CALIFORNIA

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October 5, 2012

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INTRODUCTION/OVERVIEW

As it is in most urban areas, habitat management in the Baldwin Hills is extremely challenging. The effects of long-term isolation have meant that many of the native species once present are now extirpated, and we're left with managing an environment that is not just impacted, but in many cases radically altered from its natural state. Of the two major habitats once present in the hills, coastal scrub and coastal prairie, the latter has been completely eliminated. Among various micro-habitats present in the hills, cactus scrub has been degraded, and vernal pool habitat (if it was present at all) has been eliminated, not just from the area around the Baldwin Hills, but from essentially the entire Los Angeles Basin. And, despite the widespread impression that oil drilling has been largely responsible for this loss, the opposite is probably more accurate – it is the oil operations that have largely preserved what little native habitat remains, even as park development and landscaping nearly finished off what little public open space was left as the city built up in and around the hills.

As a result, we are left with devising a restoration strategy that is largely a stop-gap approach – trying to keep what is still here around, trying to stave off further degradation, and trying to bring back at least elements of that which was lost. And, we're doing it on a fraction of the remaining habitat (i.e., that outside the oil fields), with only fragmentary information – few biologists have ever been allowed on oil field property (operations there have been largely exempt from CEQA, at least up until the late 2000s), and no public information exists on its natural resources.

Along with the local loss of diversity has been degradation at a more regional scale, as widespread, generally urban-adapted species have moved in to places once occupied by localized, unique natives once common in the Los Angeles Basin. The arid, treeless plains with willow stringers and scattered wetlands described by early naturalists have given way to an irrigated forest of non-native trees, lawns, and subtropical landscaping, which has led to the confusing situation where there may be many more species – in terms of sheer numbers – using the habitats of the hills than there were in its pristine state; the problem is that these species are generally common everywhere else as well (some, globally so), and their abundance is more a sign that the habitat has been altered from its original state than an indication that the ecosystem is functioning as it should.

To resist these effects completely is probably futile. Without, say, the complete removal of all trees, mammals like the eastern fox squirrel (*Sciurus niger*) and butterflies like the gulf fritillary (*Agraulis vanillae*) are probably here to stay, non-native animals reliant almost exclusively non-native food sources. Rather than trying to focus on ridding the landscape of these non-natives, a more manageable – and likely, ultimately more successful – approach would be to a) identify key natural reserve areas around the various protected parklands where the habitat and its wildlife are still relatively intact, and b) work to remove non-natives and repair past degradation in these areas specifically, before moving on to other areas of the park.

For example, there are discrete areas on the steep, west-facing ridge of Kenneth Hahn Park where footpaths (that otherwise crisscross the habitat) have not yet been established, and where the native-to-non-native ratio of plants is still very high (Figure 1). Many of these areas, however, have a number of weeds forming local infestations, such as Australian saltbush (*Atriplex semibaccata*) and freeway iceplant (*Carpobrotus edulis*) along the footpaths, German ivy (*Delairea odorata*) draped over Mexican elderberry (*Sambucus mexicana*), and orchard grass (*Dactylis glomerata*) and ornamental geranium (*Pelargonium horotum*) in what were apparently early restoration attempts. Thus, we would suggest that workers target *only* the Australian saltbush and ivy located on a specific portion of this ridge (perhaps marked with a small amount of flagging), and move outward from here as the non-natives of various species are removed.

For these ecologically intact areas, little to no planting would be necessary; if anything, old irrigation lines could be removed. Trails could be re-routed and blocked with brush piles and boulders, etc. Once these areas are secured, work could move on to the next-most-pristine areas, and so on.

Figure 1. Slope at Kenneth Hahn Park, showing intact, cactus-rich, Xeric Coastal Scrub on a south-facing slope (at left), and Mesic Coastal Scrub with larger shrubs on the opposite slope.

Otherwise, restoration, particularly of highly degraded areas such as entire hillsides of mustard and thistle, becomes effectively never-ending, and aside from ridding small sections of a select group of weeds (maybe), without a long-term financial commitment involving a team of people dedicated to weed control fulltime, complete conversion from non-natives to natives cannot be anything be a very long-term goal on a very small scale. And, even with this level of effort, there is little guarantee that the desired native species would respond as expected and help recover the vegetation. Instead, additional work, in the form of re-weeding, seeding and direct planting, would likely require more irrigation, and more time and effort.

This document sets a course for what is hopefully a more strategic approach to weed control in the Baldwin Hills, focusing on identifying and securing the most biologically significant areas and features, and, wherever possible, relying on "passive restoration" – weed-pulling without planting. In

the end though, this plan is less a directive on how to proceed, but is rather a review of ecological conditions and a set of guiding principles, based on the author's own observations and experience monitoring numerous habitat restoration projects throughout the region over the past 20 years.

Site Description

The Baldwin Hills are located just northeast of Los Angeles International Airport (LAX), on the western/coastal edge of the Los Angeles Basin. They are entirely surrounded by urban development, and are bisected north-south by two main thoroughfares, South La Brea Ave. and South La Cienega Blvd., and by Jefferson Blvd. to the north. Geologically, Ballona Creek (now Ballona Creek channel) forms the northern extent of the hills, an area that historically supported an extensive freshwater wetland complex of reedbeds and willow groves (none of which remains today). Neither part of the Santa Monica Mountains to the north, nor the El Segundo Dune formation along the coast, the hills are the northernmost and one of the largest zones of oil-rich uplift along the Newport-Inglewood Fault (also responsible for such features such as the Dominguez Hills and Signal Hill, Long Beach, as well as the San Joaquin Hills in south Orange County). They are characterized by steep slopes and deep arroyos, and divide the Ballona Creek watershed – which includes most of west Los Angeles and Hollywood – from the broad, low-lying coastal prairie that stretches through the South Bay to Palos Verdes.

With roughly 1,200 acres all under 500' elevation, the Baldwin Hills support some of the last native basin-floor habitats in urban Los Angeles, very little of which remains even in a degraded state, much less in anything resembling its pristine form. As such, their vegetation is significant as a relict of formerly more-extensive natural communities that covered the Los Angeles area, which included freshwater marshes and swamps, seasonal wetlands that formed after rain, forb-dominated annual grassland, and a variable scrub community that would have varied by soil type, slope, aspect, and distance from the coast.

Due to a history of isolation from other natural areas through road building and urbanization, as well as from direct impacts due to park development, oil drilling, and other activities, native communities of the hills have persisted for decades in isolation from natural areas to the west (Ballona Wetlands, El Segundo Dunes) and north (Santa Monica Mountains), and have also been internally fragmented, with patches of native vegetation scattered on steep hillsides within a sea of

non-native weeds and ornamental plantings. Because of both natural and anthropogenic impacts, many species that are common in the nearby Santa Monica Mountains are absent from the hills, despite the appearance of intact, native-dominated vegetation here. For example, common scrubland bird species such as California Thrasher (*Toxostoma redivivum*) and Wrentit (*Chamaea fasciata*) are essentially vagrants to the Baldwin Hills, probably due to a combination of these factors (assuming they were present originally; both were known from the Ballona Wetlands in the early 1900s, but are equally scarce here[1]. Certain species that occur (or recently occurred) here are/were clearly part of a historic scrubland community that is now highly degraded, such as the coastal Cactus Wren (*Campylorhynchus brunneicapillus*), which vanished in the mid-1990s and has not recolonized[2], and the California Quail (*Callipepla californica*), which may have been extirpated in the past 3-5 years[3].

Still, significant species populations persist in the hills, and are worthy of attention and preservation. Some of these were recognized by a recent all-taxa biological inventory[4] (hereafter referred to as the "Biota Report"), but as this effort involved little intensive fieldwork, none of which apparently took place on the vast oil field properties, and as a result, many natural features were apparently missed. Truly significant elements now known to occur (or to have occurred until very recently) in the hills were not mentioned; for example, Los Angeles County's sole representative of "true" scrub oak (*Quercus dumosa*), which is endemic to chaparral in sandy soil along the immediate coast of southern California, occurs as a small cluster of apparently very old (yet acorn-bearing, as of October 2012) plants near the Baldwin Hills Scenic Overlook, near one of the only individual of greenbark ceanothus (*Ceanothus spinosus*) along the coast south of the Santa Monica Mountains. What was probably the last population of San Diego black-tailed jackrabbit (*Lepus californicus bennettii*) in coastal Los Angeles County occurred here at least until around the year 2000 (roadkill found, but not discussed as significant). During later environmental documentation, while the 2004 Baldwin Hills Scenic Overlook EIR correctly identified and located the scrub oak, it was not noted as a sensitive

[1] Cooper, D.S. 2006. Annotated checklist of extirpated, reestablished and newly-colonized avian taxa of the Ballona Valley, Los Angeles County, California. Bulletin Southern California Academy of Sciences 105(3):91-112.
[2] Garrett, K.L. 2001. "Birds of the Baldwin Hills", pp. 77-126. *In*: Community Conservancy International/Natural History Museum of Los Angeles County Foundation, 2001. The Biota of the Baldwin Hills: An Ecological Assessment. K.C. Molina, ed., February 2001.
[3] D.S. Cooper, pers. obs.; D. Sterba, via email.
[4] Community Conservancy International/Natural History Museum of Los Angeles County Foundation, 2001. The Biota of the Baldwin Hills: An Ecological Assessment. K.C. Molina, ed., February 2001.

species (it is a CNPS Rank 1B.1 taxon), possibly assuming it was the more widespread foothill scrub oak (*Q. berberidifolia*)[5].

Biological Communities

The natural communities of the Baldwin Hills are difficult to categorize and describe, due to the history of degradation, the current degree of disturbance and dominance by non-native species, and the fact that many very common species, such as Mexican elderberry and coyotebush (*Baccharis pilularis*), are found in otherwise distinct habitat types. Today, non-native species are so pervasive that weed-free habitats are difficult to locate, much less describe properly. Still, broad categorizations can be made, and are useful to establish now and to refine later, as more information becomes available.

The 2001 Biota Report identified 12 distinct "plant associations", including several urban/modified types. Among these were two types of coastal scrub ("south-facing" and "north-facing"), as well as a coastal sage scrub defined in part by the presence of black sage (*Salvia mellifera*). The report also separated out the following as distinct communities: cactus scrub, "grassland/prairie" (that supporting native purple needlegrass *Nassella pulchra*), and "hardpan-standing seasonal water", which appears to be a type of vernal pool. Disturbed vegetation types identified include "urban riparian", and "drainage/runoff areas", the latter associated with culverts in landscaped areas. While useful, this classification does little to acknowledge the type and array of historical communities that would have present, and therefore makes the development of restoration priorities difficult.

The 2004 Baldwin Hills Scenic Overlook EIR identified 11 vegetation associations, three of which are principally disturbed/ornamental. It divides coastal scrub by disturbance history (including "degraded" and "revegetated" types), and identified several habitat types not recognized in the 2001 report, notably "degraded mixed chaparral", which includes laurel sumac (*Malosma laurina*) and toyon (*Heteromeles arbutifolia*), mapped near the northern base of the hills below the Scenic Overlook (a community that is almost certainly anthropomorphic; the 2001 Biota report considered toyon to be a component of coastal sage scrub, making things even more confusing). The 2004 EIR apparently followed the Biota Report in identifying "cactus scrub" as a distinct community, adding two single-species communities, "giant ryegrass" and "poison oak thicket". It must be noted, however, that the

[5] EDAW, Inc. 2004. Baldwin Hills Scenic Overlook. Final Environmental Impact Report. State Clearinghouse No. 2003111098. Prepared for California Department of Parks and Recreation by EDAW, Inc., March 2004.

2004 EIR did not extend its coverage to the southern slopes of the hills, which support a somewhat different array of scrub species, notably extensive cover by coyotebush.

The advantage of the 2004 classification scheme is that it acknowledges past disturbance, and hints at the actual former arrangement of the habitat types, namely that mixed chaparral (with or without toyon dominant) may have extended along at least the base of the northern slope of the hills[6], and that the varied scrub types present today may not have been radically different vegetation communities, but simply the result of differing degrees and types of disturbance over the years.

We propose a simplification of the vegetation associations, and based on our fieldwork in summer 2012 and from many casual visits over the past decade, we suggest that the hills have just a single primary, or dominant, naturally-occurring native community, "coastal scrub", which may be divided into two types, Xeric Coastal Scrub and Mesic Coastal Scrub (abbreviated simply "xeric scrub" and "mesic scrub"). This acknowledges that the scrub in the hills is by definition coastal, yet varies considerably by soil, aspect, and slope, as well as by its position relative to coastal moisture (the hills appear to create their own rain-shadow effect, where warm summer days lead to hot, "valley-like" afternoon temperatures in the central and eastern parts of the hills, while the western portions toward the coast remain cool and breezy during the same periods). We are reluctant to call the vegetation "coastal sage scrub", because this would imply that a sage species is dominant in at least some occurrences, which it is not (black sage Sal*via mellifera* is uncommon in a few areas of the hills, and does not appear to be naturally prevalent here, as observed in the Biota Report[7]).

We further recognize four secondary associations as occurring to a limited extent around and within these main habitat types: Seep Scrub, Cactus Scrub, Riparian Scrub and Vernal Pool, which are described in detail below.

[6] This view is supported by the recent discovery of two chaparral plant species here, greenbark ceanothus and Nuttall's scrub-oak, and others may await discovery, particularly if oil field areas are ever accessible; D.S. Cooper, unpubl. data.
[7] Anderson, V. 2001. "Vegetation of the Baldwin Hills", pp. 12-38. In: Community Conservancy International/Natural History Museum of Los Angeles County Foundation (*op. cit.*).

Primary Associations

Xeric Coastal Scrub

This habitat type occurs wherever soils are sandy enough to allow its distinctive flora to find purchase, including very steep sites such as roadcuts, where eroding soil discourages non-native grasses and allows natives to gain a foothold. It tends to be absent from deep, shady arroyos, but can thrive on north-facing slopes. Characteristic plant species include at least two buckwheats, coast buckwheat (*Eriogonum fasciculatum*), lance-leaf dudleya (*Dudleya lanceolata*) and Turkish rugging (*Chorizanthe staticoides*); three goldenbushes, including coast goldenbush (*Isocoma menziesii*), Palmer's goldenbush (*Ericameria palmeri*), and mock-heather (*Ericameria ericoides*), as well felt-leaved everlasting (*Gnaphalium canescens*), branching phacelia (*Phacelia ramossissima*) and bush-lupine (*Lupinus* cf. *latifolius*). Patches of prickly-pear cactus (*Opuntia* sp.) would have occurred locally; several of these are still present today, but many have been overtaken by non-native weeds and vines (discussed below).

Native forbs ("wildflowers") would likely have been prevalent in this habitat community, such as popcorn-flower (*Cryptantha* spp.) and goldfields (*Lasthenia* spp.), but these features have largely been lost. Today, spaces between shrubs are crowded by non-native weeds, particularly annual grasses, mustards, wild radish (*Raphanus sativa*), garland chrysanthemum (*Chrysanthemum coronarium*) and leafy spurge (*Euphorbia terracina*). The few native forbs that remain include the most persistent species, such as blue-eyed grass (*Sisyrhinchium bellum*), miniature lupine (*Lupinus bicolor*) and others found widely in habitat patches throughout the urban Los Angeles Basin.

Where this habitat type was dominated by these forbs (and where shrubs were sparse for whatever reason), it would have resembled more of a prairie than a scrubland; these include flat, more poorly-drained soils, including areas of sandy soil overlain with finer loam or even clay soils. In such places, the vegetation would have appeared as more a sparse grassland with scattered shrubs such as deerweed (*Lotus scoparius*) and California sagebrush (*Artemisia californica*), with dramatic spring wildflower blooms and a largely dormant carpet of brownish stems for most of the year. Certain persistent native species with broad soil tolerance such as fascicled tarweed (*Deinandra fasciculata*), California sand-aster (*Lessingia filaginifolia*) and gumplant (*Grindelia* cf. *camporum*) would probably have been common in this habitat and still occur locally in the hills today, providing a hint at where these habitats would have been present. This coastal prairie was only recently recognized as a distinct

habitat formation, and would have extended south from the southern slopes of the hills, once stretch south to the base of the Palos Verdes Peninsula[8].

The most intact remaining examples of the xeric scrub community in the hills appear to be located "over the fence" on oil field lands adjacent to West L.A. College (just east of Jefferson Blvd.) extending north to near the Culver City Park dog park (note: some of this habitat appears to have been planted/seeded recently on adjacent college property as part of recent construction at the northeastern corner of campus[9]). More degraded examples may be readily observed on steep slopes east of the main picnic area of Kenneth Hahn Park, in patches along the driveway up to the Baldwin Hills Scenic Overlook from Jefferson Blvd., and west of La Brea Ave. where it cuts through the park.

Mesic Coastal Scrub

This term is here assigned to the areas of the hills with a combination of consistently higher soil moisture, poorer drainage (i.e., less sand), as well as coast-facing slopes that would have been subject to summer fog and cooler temperatures. Unfortunately, early-historical photographs of the hills are few, and the true extent of this habitat is not known. However, relict species present near the Scenic Overlook, notably scrub oak and greenbark ceanothus, hint at its former presence, possibly extending up the north slope of the hills from the Ballona Creek floodplain. This habitat type persists in deep, shaded arroyos throughout the hills, and is characterized by moisture-loving species such as Mexican elderberry, two species of *Baccharis* (coyotebrush and mulefat *Baccharis salicifolia*), lemonadeberry (*Rhus integrifolia*), and Southern California black walnut (*Juglans californica*).

All of these species are present in drier Xeric Coastal Scrub, but in lower densities (conversely, many species typical of Xeric Scrub occur in Mesic Scrub as well, but are not dominant here, such as buckwheat and cactus). While not true chaparral, these environments support several chaparral animals, including birds (including Spotted Towhee *Pipilo maculatus*) and reptiles (including western fence-lizard *Scleroporus occidentalis*) which would not be as numerous in Xeric Scrub.

[8] Mattoni, R. and T. R. Longcore. 1997. The Los Angeles Coastal Prairie, a vanished community. Crossosoma 23(2):71–102.
[9] See West L.A. College Master Plan and supplemental materials, posted online at: http://www.wlac.edu/masterplan/college_masterplan2.html

While native grasses occur commonly in this habitat type (notably chaparral melic *Melica imperfecta*), native forb diversity is typically low, probably due to the dense ground-cover and shade that discourages all but the most persistent species, such as blue-eyed grass (*Sisyrhinchium bellum*). Non-native grasses and forbs can be scarce in mesic scrub, yet exotic vines and larger trees shrubs have become established in many areas, particularly around seeps, which now support dense thickets of German ivy (*Delairea odorata*), nasturtium (*Nasturtium officinale*), poison hemlock (*Conium maculatum*), and Catalina cherry (*Prunus lyonii*). It must be noted that elements of mesic scrub may occur within xeric scrub (and vice-versa) as conditions allow.

Secondary Associations

Seep Scrub

Several species associated with areas of very high year-round soil moisture frequently form thickets in the hills, and such microhabitats are probably best classified as seeps. Characteristic plant species of seeps in the area including California fuchsia (*Epilobium canum*), sticky monkey-flower (*Mimulus aurantiacus*), poison-oak (*Toxicodendron diversiloba*), and most obviously, giant wildrye (*Leymus condensatus*). These vegetation types rarely extend more than a few square meters in size, and so rarely form ecological communities themselves that are distinct from surrounding scrub, but appear common here and there across both scrub types (both xeric and mesic). For example, patches of giant wildrye may be frequently found next to patches of cactus, which requires dry soil and can't tolerate high soil moisture. Rather than making habitat maps endlessly detailed (and confusing), this variation must simply be recognized as inherent in the natural diversity of scrubland habitats here and more widely in southern California.

Cactus Scrub

Cactus Scrub was presumably much more extensive in the hills in recent years, as indicated by the long presence of the coastal cactus wren, which requires large (>1 acre) patches of tall (>1 meter high) cactus. Today, small patches are scattered throughout the hills on slopes with a variety of steepness and aspect, including in deep canyons otherwise dominated by mesic scrub species such as Mexican elderberry. Most occurrences appear to be in serious decline, with desiccated pads, and non-native shrubs, particularly tree-tobacco (*Nicotiana glauca*) and castor bean (*Ricinis communis*) overtaking the remaining patches. Still, interesting native vegetation is still associated with even small

cactus patches, particularly those that still maintain patches of open soil where non-natives can't gain a foothold. For example, one of the few local occurrences of golden currant (*Ribes aureum*) was found recently in a mature cactus patch just northeast of the main entrance to Kenneth Hahn Park (DSC, pers. obs.). As a note, cactus has been a target of re-vegetation efforts in recent years (by Los Angeles Audubon Soc.), so it is important to recognize naturally-occurring patches from those that might have been introduced or enhanced.

Riparian Scrub

Willows (*Salix* spp.) are probably the best indicator of this habitat type, since willows are infrequent in coastal scrub, and are typically associated with a suite of species that require very high soil moisture and, often, surface water for at least a portion of the year. Permanent streams were probably never a feature of the historical Baldwin Hills (vast riparian and wetland areas did occur nearby, associated with Ballona Creek and Centinela Creek). Today, riparian areas are mainly associated with urban runoff, and in these areas non-native species such as pampas-grass (*Cortaderia* spp.) often dominate the understory, due to the presence of year-round water and lack of flooding. As such, these areas are particularly susceptible to invasion by a range of non-native trees, shrubs, and vines, sometimes leaving only scattered willows as the only hint of a natural ecosystem.

Vernal Pool

Vernal pools form in small depressions of hard-packed soil where pools from winter rains persisting longer than in surrounding habitats. These features were once abundant throughout cismontane (coastal-slope) California, but have been nearly completely eliminated in southern California. Notable relicts of this community, albeit in degraded form, include those at Los Angeles International Airport (LAX)[10], Madrona Marsh Preserve in Torrance[11], and at Fairview Park in Costa Mesa, Orange County[12]. The history and identification of vernal pools in the Los Angeles area is complicated by the fact that most were lost by the 1960s, prior to the passage of landmark environmental laws in the 1970s. Therefore, essentially the only record of their presence (particularly

[10] While no vernal pools have been identified and delineated, a vernal pool obligate species, the Riverside fairy shrimp (*Streptocephalus woottoni*), occurs. See:
http://www.ourlax.org/docs/final_eir/part1/22_0411_EndangeredandThreatenedSpeciesofFloraandFauna.pdf
[11] Cooper, D.S. and E. Fiesler. 2012 Madrona Marsh Preserve Biological Inventory Final Report. Prepared for City of Torrance and Friends of Madrona Marsh, February 27, 2012.
[12] Hamilton, R.A. 1995. Biological constraints and opportunities analysis, Fairview Park, Costa Mesa. Prepared for City of Costa Mesa Community Services Department, October 9, 1995.

if a given landscape has been subjected to widespread earth-moving, road-building and other human-caused modification, as has been the case with the Baldwin Hills and surrounding area) comes from historical plant collections of vernal pool-obligate species. Complicating matters, plant collections generally have such vague location information that it is nearly impossible to pinpoint exact locations vernal pools. For example, many collections refer to a "sink near Inglewood", which could have been located within the Baldwin Hills, or several miles away.

Vernal pools in the area would have been of two main types, alkali and freshwater. Alkali pools would have been present as part of now-extinct alkali sink habitat along the floor of the Ballona Valley in Culver City (formerly known as "Mesmer"), part of the massive "Cienega" seasonal wetland complex that once stretched from the northern base of the hills to Hollywood, and that was essentially an eastward extension of the Ballona Wetlands ecosystem[13]. These habitats also occurred locally east of the Baldwin Hills in areas like Inglewood, where they would have been associated with the margins of alkali and brackish wetlands, or simply present as isolated depressions within the larger Los Angeles Basin[14]. As these habitats were present only at the base of the hills, they form an interesting ecological record, but probably contributed little to the flora and fauna of the actual hills.

A second type of pool would have been present on non-alkaline soils, including hard-packed sand, and would have supported species such as western spadefoot (*Spea hammondi*) and others that cannot tolerate alkaline conditions. As with the alkali pools and sinks, these habitats were presumably more widespread outside the hills, but may have occurred locally within small depressions in more level portions of the hills, including areas now covered with houses to the south and east of the current open space. Today, areas to be examined for the presence of "cryptic" vernal pools would be on mesa-tops and other flat areas throughout the hills, even those that were formed by grading many years ago, but which might now support conditions favorable for vernal pools.

Intriguingly, the 2001 Biota Report not only maps "seasonal standing water" as a habitat type (see "Map Area 6"), it lists as "present" a plant species strongly associated with historical (and current/relict) vernal pools, toadrush (*Juncus bufonius*). Troublingly, it also lists plant species clearly

[13] Dark, S., E. D. Stein, D. Bram, J. Osuna, J. Monteferante, T. Longcore, R. Grossinger, and E. Beller. 2011. Historical ecology of the Ballona Creek watershed. Southern California Coastal Water Research Project Technical Publication No. 671. 75 pp.

[14] The largest and most significant of these interior brackish marshes was probably "N---- Slough", now referred to as "Laguna Dominguez", near present-day Gardena. The only remnant of this vast wetland is the "Gardena Willows", owned by City of Gardena, near the intersection of Artesia Blvd. and the 91 Fwy.

not associated with standing water as also occurring in this microhabitat, such as coastal lotus (*Lotus salsuginosus*), and at least one that was clearly misidentified (blow-wives *Achyrachaena mollis*, likely extirpated in the Los Angeles area). While this habitat type was not treated in the 2004 EIR, that report only covered the northern flank of the hills, which support little flat land that would support seasonal standing water. Today (and as mapped in 2001), small pools are known to form in heavy soils on a graded mesa-top in the northern portion of Holy Cross Cemetery, and on similar substrate east of and overlooking the main picnic areas of Kenneth Hahn Park.

In addition, the central portion of the hills, including much of the oil field area, supports numerous low pockets with seasonal water. Unfortunately, many of these have been used as oil storage and runoff areas, and in any case are not accessible for surveys. Still, as has been the case elsewhere in the region (notably at Madrona Marsh in Torrance), oil production and oil storage is not necessarily incompatible with the presence of vernal pools (or other rare habitats), and in certain cases may actually support their persistence by making the soil more impermeable[15].

Reference Sites

Although these basin-floor habitats have been all but lost to development, important intact remnants do exist, mainly at the periphery of the Los Angeles area. One area of potential comparison is at the southwestern edge of the Simi Hills (east of Thousand Oaks, Ventura Co.), which also features steep, rolling hills of marine sediments at low elevation and hot, arid summers (while coastal, much of the Baldwin Hills is not subject to coastal fog as are sites up the coast). These hills show a strikingly similar zonation of plant communities to the Baldwin Hills, with xeric coastal scrub on south- and west-facing slopes, mesic scrub dominated by sumac, elderberry and walnut on north-facing slopes (oaks are relatively rare), seeps with poison-oak and giant wildrye, and even patches of prickly-pear cactus. Of course, the Simi Hills are missing the sandy soils that characterize portions of the hills, but they at least can provide an contemporary example of what the habitat may have been like in the Baldwin Hills more than 100 years ago (historical photographs confirm this[16]). Images from the southwestern Simi Hills are provided in Appendix D.

[15] Cooper and Fiesler, *Ibid.*
[16] Dark et al., *op. cit.*

Keystone and Indicator Species

Ecologists have developed many systems for describing species' roles in the ecosystem, from the early days of the "food chain", where everything ate, and was in turn eaten by, something else, to energy cycles, to the determination of surrogate species, wherein the conservation of one conspicuous, easily-managed species presumably serves to conserve a great many, more cryptic species. This plan will discuss just two categories we feel are most applicable to habitat management at the scale of the Baldwin Hills, "Keystone Species", which hold a particularly important place in the ecosystem in providing food for a diverse array of other taxa (or supporting a particularly rare species) which wouldn't ordinarily occur; and "Indicator Species", which are easily-detected plants and animals that are characteristic of a particular native habitat.

Keystone Species

For the Baldwin Hills, Keystone Species could include abundant, berry-producing plants whose fruit are eaten by a number of birds throughout the year, including Mexican elderberry, prickly-pear cactus and toyon. They could also include nectar-producing species that are particularly attractive to a range of native insects (= pollinators), such as coast buckwheat and bush sunflower (*Encelia californica*). They might also include small mammals and macro-invertebrates that are taken by raptors, including California vole (*Microtus californicus*), food for the white-tailed kite and northern harrier (both now rare), and Jerusalem-crickets (*Stenopalmatus* spp.), food for both the American kestrel (*Falco sparverius*) as well as the loggerhead shrike (*Lanius ludovicianus*)[17]. Some may be plants that are particularly important for rare species for which the Baldwin Hills represents important relictual habitat, such as California sagebrush (required by the California gnatcatcher *Polioptila californica*[18]), and still others may be extirpated from the site at the moment, but formerly occurred, and probably played an important role in the ecosystem, such as San Diego black-tailed jackrabbit

[17] A historical breeding record for the loggerhead shrike includes a nest set collected in the Baldwin Hills on 1 June 1934 "in a willow" (WFVZ); In addition, surveyors during the Los Angeles County Breeding Bird Atlas in the late 1990s recorded American kestrel as nesting in numbers, with the white-tailed kite "possibly" nesting. Today, all three are apparently extirpated as local nesters, and only the kestrel remains as a (rare) breeding species in the Ballona/South Bay region.

[18] No certain record exists for the California gnatcatcher in the Baldwin Hills. A single report from the Baldwin Hills, now permanently in the California Natural Diversity Database, was based on a mistaken identification from Dr. Jon A Atwood (J. Atwood, via email, quoted by R.A. Hamilton in a memorandum to Paul McCarthy, Los Angeles Co. Dept. of Regional Planning, regarding Baldwin Hills CSD, April 14, 2008). Despite considerable coverage by birders in recent years, the species is unrecorded here (though several recent records, including photographs, exist for the nearby Ballona Wetlands; D.S. Cooper, unpubl. data).

(*Lepus californicus bennettii*), which formerly would have opened up scrub for native forbs and grazed non-native grasslands, at least abating somewhat the lifeless thatch of weeds present across the hills today. Of course, any list of indicator species is really a guess – it is our interpretation of nature, rather than what the local species might actually require biologically – but it is at least an educated guess.

Indicator Species

Taxa that are both characteristic of a particular (and generally native) ecosystem or habitat type – regardless of their importance to other species in the system – are considered indicators of that habitat; for management purposes, these are typically easy-to-identify, fairly common animals and plants that could be readily monitored by future researchers trying to study or restore a particular site. For more xeric coastal scrub, animal species that require sandy, more open areas would be the side-blotched lizard (*Uta stansburiana*), acmon blue butterfly (*Plebejus acmon*), and California ground-squirrel (*Spermophilus beecheyi*). Rufous-crowned sparrow (*Aimophila ruficeps*), if it still occurs, would also be a suitable indicator species for Xeric Coastal Scrub, as would several wildland-dependent butterfly species, a group that has never been surveyed here. The American kestrel and the western meadowlark (*Sturnella neglecta*) are excellent indicators of grassy, open scrub, as (was) black-tailed jackrabbit, which is almost certainly extirpated, but which could be re-introduced. Indicator species for Mesic Coastal Scrub would include the two remaining scrub-requiring bird species, the Bewick's wren and the spotted towhee, as well as perhaps slender-salamander (*Batrachoseps* sp.) and, if still extant, California quail (*Callipepla californica*); most of the other birds, mammals, and herptiles that occur in this habitat also occur widely in other habitats, including urban situations.

Indicators of the secondary habitats of the hills would be those not also found in the primary habitat types or in other secondary habitat types (e.g., the spotted towhee is closely associated with riparian habitat, but it is also found widely in mesic scrub, in seep scrub, and even locally in xeric scrub). For seep and riparian habitats, birds such as Orange-crowned Warbler (*Vermivora celata*), Common Yellowthroat (*Geothlypis trichas*) and Song Sparrow (*Melospiza melodia*) are good indicators, as are Lorquin's admiral butterfly (*Limenitis lorquini*), and two amphibians, Pacific chorus-frog (*Pseudacris regilla*) and western toad (*Anaxyrus boreus*), assuming it is still extant at the site. The desert woodrat (*Neotoma lepida*), if it occurs, would be a good indicator for cactus scrub, as its nests are conspicuous and it was still present during the late 1990s (Biota report).

The lists of both keystone as well as indicator species are probably shrinking each decade; cactus wren, for example, was a near-perfect indicator of cactus scrub, but has been extirpated here since the mid-1990s. And, until extant local vernal pools are located and better-described, it is difficult to determine which species might be associated with them.

Conservation Targets: Goals and Strategy

What does successful restoration look like? For some projects, including those tied to most state and federal standards, simply planting the right plants, at high densities, and keeping them alive for at least a few years, is enough. But, despite considerable effort devoted to developing standardized targets for restoration, these are generally unsatisfactory for more holistic ecosystem restoration, since each site has a different history of disturbance, and different array of species dependent on it (or extirpated from it, and waiting to re-establish). Thus, restoration is not a one-size-fits-all process, but must be careful planned in light of current, former, and future ecological conditions and constraints.

At its root, restoration must start with history as a guide, looking at what plant and animal communities would have occurred in the Baldwin Hills, and attempting to re-create them as faithfully as possible. This imperative is reflected in a recent "international primer" on restoration from the Society for Ecological Restoration, which succinctly lays out guiding principles that apply to any ecological sound restoration attempt[19]:

> Restoration attempts to return an ecosystem to its historic trajectory. Historic conditions are therefore the ideal starting point for restoration design. The restored ecosystem will not necessarily recover its former state, since contemporary constraints and conditions may cause it to develop along an altered trajectory. The historic trajectory of a severely impacted ecosystem may be difficult or impossible to determine with accuracy. Nevertheless, the general direction and boundaries of that trajectory can be established through a combination of knowledge of the damaged ecosystem's pre-existing structure, composition and functioning, studies on comparable intact ecosystems, information about regional environmental conditions, and analysis of other ecological, cultural and historical reference information. These combined sources allow the historic trajectory or reference conditions to be charted from baseline ecological data and predictive models, and its emulation in the restoration process should aid in piloting the ecosystem towards improved health and integrity.

[19] SER 2004. SER International Primer on Ecological Restoration, Society of Ecological Restoration International Science and Policy Working Group. Version 2, October 2004 (1). Available online at: http://www.ser.org/resources/resources-detail-view/ser-international-primer-on-ecological-restoration

Unfortunately, the make-up of the current natural communities of Baldwin Hills are very poorly known, even more so than its historical conditions. The site has never seen a formal botanical survey, has never been subject to a butterfly survey, nor pitfall trapping for reptiles, the main groups that might inform restoration at a small, urban-surrounded site. The last formal bird survey was summarized in the 2001 Biota Report, but the status and distribution of the resident species of the hills since then is not known.

Therefore, we cannot conclude that the natural areas of the hills are understood well enough to justify active restoration, since without a baseline there is little way of know what we're "restoring to" and measuring success. For this reason, we suggest using **planting as a last resort**. Instead, the main goal must be preservation, concurrent with study, rather than re-creation of natural communities, since only through protection and inventorying of existing native areas will we be sure we're restoring the habitat to its proper function. Simply planting out a hillside may succeed in covering a hillside with plants (as has occurred at the Westchester Bluffs) at least for a while, but unless the new community resembles an earlier one *ecologically*, this is not a restoration, but a gardening exercise. Planting, either through container plants or seeding, is fraught with unintended consequences[20], especially in urban areas with a near-limitless array of weeds, and particularly in arid areas where any water (i.e., through irrigation) acts as a magnet for non-native plants and animals (such as Argentine ant *Linepithema humile*). Too often, planting is simply not monitored for anything other than the growth of the planted plants; if they are doing well, the community is assumed to also be doing well.

However, this simplistic view fails to address ecological integrity of the natural system – is it sustainable on its own, are native species dominant, etc. Lack of monitoring can also miss major developments that could inform the restoration. To take a local example, the Ballona Wetlands backdune relict in Playa del Rey has been the site of weed-pulling and native plantings (most recently, of *Eriogonum parvi*folium the foodplant of the rare El Segundo blue butterfly *Euphilotes battoides allyni*) for several decades, but it wasn't until 2011 that anyone ever checked to see if it was achieving the desired function (nor did anyone agree on what this function was, other than to remove non-natives). In fact, the butterflies are present (pers. obs.), along with a second, equally rare

[20] Longcore, T., R. Mattoni, G. Pratt, and C. Rich. 2000. On the perils of ecological restoration: lessons from the El Segundo Blue Butterfly. Pp. 281-286 in J. Keeley, M. Baer-Keeley, and C.J. Fotheringham, eds., 2nd Interface Between Ecology and Land Development in California. Open-File Report 00-62, U.S. Geological Survey, Sacramento, Calif.

(but un-listed) dune endemic butterfly, the dune metalmark (*Apodemia virgulti arenaria*). Only a tiny portion of the backdune has been planted with the favored buckwheat; much of the remainder is a mix of (native) dune bush-lupine (*Lupinus chamissonis*) and willow (*Salix* spp.)[21]; unfortunately, no further surveys are planned to determine whether these plants are attracting rare obligate species back to the site.

Obviously, it is impossible to do restoration perfectly; for one thing nature is dynamic, so a suite of species present, say, 100 years ago might have been quite different than one 500 years ago, etc. However, through historical collections and notes of botanists, enough is known about the original natural communities of the Los Angeles Basin looked like more than a century ago to make a decent guess at what a "pre-invaded" habitat would have looked like. Ideally, what's supposed to be here will be at least somewhat suited to the site's soil and climate, and therefore is more likely to be sustainable into the future than a guess[22].

Conservation targets must involve both Goals and Strategies; one without the other wastes everyone's time. You can have lofty goals – a restored native prairie covering the east side of Hahn Park – but unless the participants in this goal adopt the strategies to get there, it will never happen. Similarly, stand-alone strategies, such as spraying castor bean and cutting pampas-grass, without clear goals as to why it's being done, is likely to lead to confusion over the vision for the land.

Long-term, large-scale (>100-acre) restoration projects in the South Bay area (i.e., which have soils and climate most similar to the Baldwin Hills) are few, but have been attempted on the Westchester Bluffs as well as at multiple sites on the Palos Verdes peninsula. The Westchester Bluffs saw a massive (professional) planting effort in the late 1990s and early 2000s, which has resulted in the establishment of a coastal scrub community there across several dozen acres of what had been largely annual grassland and other non-native forbs, dominated by a handful of very common local scrub species, including California sagebrush, sages *Salvia* spp., coyotebush, toyon, etc. The entire site continues to be irrigated, but otherwise sees little management now that the plants have been established. On the Palos Verdes Peninsula, one of the largest restoration attempts has occurred at

[21] Discussed in training manual for Ballona Wetlands docents. See: http://www.cooperecological.com/ballonatrainingmanualnew.pdf

[22] However, simply planting "whatever will grow", even if native to southern California, does not constitute restoration; weeds will readily grow too. This is the problem – the species that are native are often outcompeted by those that aren't, meaning that success cannot be based on simply getting plants to thrive, but on what kind of ecosystem is being re-established, and for what species.

the Navy Fuel Depot in San Pedro, where the approach focuses on a) removing non-native plants "in areas where they could expand their range into high quality habitat", and b) attacking smaller populations of non-native species "that are new to (the) area and removing them immediately (to) avoid their spreading"[23].

This has resulted in a focus on the most invasive species, as identified in a prior Biological Opinion regarding the Endangered Palos Verdes blue butterfly, including "pepper tree, ice plant, and arundo, and secondarily, euphorbia [*E. terracina*], castor bean and pampas grass." Their approach has been to focus on the species that are established within the rare butterfly habitat, then to move out to target areas nearest this habitat. As is the case with many restoration attempts, particularly those that involve "novel weeds" like *Euphorbia terracina*, they are working out techniques for removal as they go.[24]

This measured, deliberate approach is reflected in recent review of recommendations for restoration by IUCN, which identified three "core principles" of best practices, suggesting that to be successful, restoration must be[25]:

1. Effective in re-establishing and maintaining protected area values
2. Efficient in maximizing beneficial outcomes while minimizing costs in time, resources and effort;
3. Engaging through collaboration with partners and stakeholders, promoting participation and enhancing visitor experience.

Under Principle 1 (Chapter 4), the study included guidelines such as "'Do no harm' by first identifying when active restoration is the best option", as a warning against rushing to restore an area that might be functional on its own (Guideline 1.1); and highlighted the need to restore ecosystem structure and function, ecosystem resilience, and connectivity "within and beyond the boundaries of protected areas".

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[23] Danielle LeFer, Conservation Director, Palos Verdes Peninsula Land Conservancy, via email 9/27/12.
[24] D. LeFer, *Ibid.*
[25] Keenleyside, K.A., N. Dudley, S. Cairns, C.M. Hall, and S. Stolton. 2012. Ecological Restoration for Protected Areas: Principles, Guidelines and Best Practices. Gland, Switzerland: IUCN. x + 120pp.; available online at: http://data.iucn.org/dbtw-wpd/edocs/PAG-018.pdf

We suggest a similar approach for the Baldwin Hills, and outline the goals and strategies to meet those goals below.

Goal 1. Protect the best remaining examples of native-rich habitat.

Strategy: Inventory and map existing areas of parkland dominated by native species, and devise plans for their protection.

Native-rich habitats are found scattered around the parklands of the Baldwin Hills, but have not been mapped in more than 10 years. Vegetation changes rapidly, and current maps showing the hotspots where native-rich scrub and other habitats remain are urgently needed. Once these are known, an assessment of the major weeds in these areas can be made (we provide an educated guess here, based on several site visits), and these weeds can be targeted for removal. Additional management actions, including fencing, signage, outreach, and other techniques may be installed around these key areas, and may be as effective, if not more, than weeding or planting natives. Surveys to locate indicator/keystone species may be done concurrently to this mapping effort.

Goal 2. Identify and protect the rarest/relictual plant and animal occurrences, such as the single stand of scrub oak (*Quercus dumosa*), lance-leaf dudleya (*Dudleya lanceolata*), patches of native wildflowers, and potential vernal pools.

Strategy: Invite knowledgeable botanists – perhaps from local California Native Plant Society chapters, to explore the parklands and submit their findings.

Parks and reserves around the world plan annual Bioblitz events that bring together scientists and interested citizens to document as many species – of everything – as possible in a single 24-hour period. Baldwin Hills would be ideal for this due to its location, the many groups involved in its protection, and the potential to contribute meaningfully to long-term conservation here. Once these locations are known, work with park management to better protect these occurrences, or least become aware of them.

Goal 3. Use staff and volunteer time more effectively for habitat restoration activities.

Strategy: Prioritize easy-to-kill, non-native trees and shrubs *that are currently threatening* patches of native-rich habitat for immediate removal, attacking the less disruptive (often herbaceous) non-natives in these same areas, as time and labor allow.

The eradication of non-native grasses and other herbaceous weeds may be an impossible task; yet, there are many "low-hanging fruit" – large, woody species that are seriously impacting the structure of the scrubland habitat – that could effectively be removed, or at least contained, using volunteer labor. Once this has been done, more landscape-scale approaches could be made to address the more extensive areas of herbaceous weeds, including solarization (covering slopes with large tarps), mowing (including weed-whipping) and, with extreme caution, limited grazing.

Goal 4. Increase the size of native-dominated habitat patches, and connect isolated ones.

Strategy: Use targeted weeding and seeding/planting to grow/connect smaller habitat patches, once non-natives have been satisfactorily eliminated from the patches themselves. Experiment with non-traditional techniques such as "roadcut creation".

Areas such as the slope north of/below the Scenic Overlook support several small, isolated patches of native scrub, some of which are surprisingly un-invaded by weeds. Rather than trying to attack entire hillsides, which is draining on labor and time, a better approach may be to expanding these patches outward (even slightly), or to create weed-free corridors (i.e., lanes of native species through the weeds) through aggressive weeding and planting.

In some areas that are especially invaded by non-natives and seemingly hopeless, we would encourage small-scale experimentation using a variety of non-traditional techniques based on local observations on where natives are persisting in the area. One possibility would be "roadcut creation", or intentionally digging into weed-infested slopes to reveal looser, more eroding soil and even hard-packed dirt. These substrates can be relatively more resistant to invasion by non-native grasses and forbs than ordinary hillsides; local examples of this roadcut effect is readily observed

along Stocker Ave. east of So. La Brea Blvd., where the roadcut provides habitat for several natives, including white everlasting (*Gnaphalium canescens*), gumplant (*Grindelia* sp.), and sand-aster (*Corethrogyne filaginifolia*), while the undisturbed slopes above the cut remain weed-covered. Irrigation should not be used on these roadcuts (which would encourage more non-natives to invade).

Any planting in or near wildland habitat should use locally-sourced material (i.e., from the Baldwin Hills), and should not rely on general habitat guidelines from nationwide programs such as the "Native Seed Network" (e.g., "Coastal Sage Scrub[26]") or simply figuring out where a plant "can" grow (e.g., USFS guidelines[27]) which are intended more for gardening projects. Unless a plant can be located in life or as a herbarium voucher from the coastal Los Angeles Plain (EPA's "Ecoregion 85d")[28], it should be not be intentionally introduced to the Baldwin Hills.

Goal 5. Decrease opportunities for weeds to establish.

Strategy: Reduce the amount of irrigation, particularly near native habitat patches; limit planting/seeding to areas where non-natives have been recently removed, and only if no natives *of any kind* are returning on their own.

Often with restoration efforts, we think that if we could just get enough plants in the ground, and pull enough weeds as they grow, we can repair an ecosystem. Unfortunately, this approach can only succeed through a massive commitment of time, resources, and labor, typically lasting at least 3-5 years. Places where this commitment hasn't occurred are easy to spot – often as scattered native plants dotted across a weedy hillside, doing little to transform habitat. For now, at least in the short-term, we recommend avoiding these piecemeal efforts and instead, and instead recommend a prioritizing approaches that reduce not only potential sources of weeds, such as ornamentals and invasives at the edge of the park, but also fertile ground for their establishment, such as irrigation through otherwise arid open space (and at the edges of open space). Footpaths present an interesting challenge; in areas of loose, sandy soil, cuts in the earth can actually encourage natives to establish, as along eroding portions of the Stocker Corridor and the western slope of Hahn Park;

[26] http://www.nativeseednetwork.org/ecomap?state=CA
[27] http://www.fs.fed.us/wwetac/threat_map/SeedZones_Intro.html
[28] http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm#Level%20IV

however, in loamy soils, such as the eastern slope of Hahn Park, they can serve as conduits for weeds.

We recommend identifying areas that would be candidates for seeding and planting, based on 1) their potential for connecting larger but isolated patches of native vegetation; or 2) their being located along illicit footpaths that need to be "retired". Larger areas where the seed bank appears depauperate, such as weedy slopes, should be avoided as seeding/planting sites unless weeding alone has failed to produce natives of any kind for at least two years. Best candidates for species to be used would be those that are early-successional, quick to establish, and not prone to forming monocultures themselves (see Table 1 for a list of local natives).

Review and discussion of best management practices ("BMPs") involving weed prevention during restoration/planting are essential for successful projects, and to avoid making a bad situation worse. National Park Service guidelines review planting techniques for natural areas[29], and Cal-IPC has produced a manual for BMPs for land managers interested in minimizing weed spread during projects[30]. Basic tenets include taking time to plan, stopping movement of invasive plant materials and seeds, reducing soil and (native) vegetation disturbance, maintaining "desired" plant communities, and practicing "early detection and response" for new invasives. These guidelines also reference the need to prioritize areas, and spell-out factors necessary for this prioritization based on site characteristics as well as those of the weeds themselves, including focusing on locations where fire risk is high, where work may be done in a cost-effective manner, where habitat is still little-invaded, where endangered/rare species habitat may benefit, and other factors. Cal-IPC is also an excellent source for general information about the biology of the weeds themselves (see http://www.cal-ipc.org/ip/management/index.php). For more local information, Bell et al.[31] have produced a guide to planning an executing weed abatement plans in Los Angeles County specifically.

[29] http://www.nps.gov/plants/restore/pubs/intronatplant/toc.htm
[30] http://www.cal-ipc.org/ip/prevention/landmanagers.php
[31] Bell, C. and D. Lehman. 2005. Best Management Practices for Vegetation Management. Ellen Mackey, editor. Los Angeles County Weed Management Area. Los Angeles, California. http://acwm.co.la.ca.us/scripts/wma_2.htm

Goal 6. Convert unused "ornamental landscapes" back into functional native ecosystems, while maintaining existing plantings associated with designated picnic areas, major roads, and other human-usage areas.

Strategy: Use professional crews to begin to retire older plantations of non-native ornamental trees and shrubs in areas where they are not visited by park-goers, and are serving no ecological or aesthetic purpose.

Non-native pine trees planted in non-native grassland function as weeds if the grassland could otherwise be used by native species that are indigenous to the hills, particularly given the ongoing decline of these native species in the hills. An example of one of these non-native landscapes is the eucalyptus, juniper and pine grove above the Olympic Forest section of Hahn Park. These trees extend up from the parking area to near a powerline right-of-way atop a ridge that is virtually inaccessible to people, but that nonetheless supports scattered native plants that could be used by species indigenous to the Baldwin Hills.

Comprehensive Weed Management in the Baldwin Hills

Any strategy to remove or control non-native vegetation must first begin with a knowledge of native vegetation; after all, the goal in conservation isn't simply to remove weeds, it's to promote the return of native, natural vegetation. Otherwise, one could just remove lawn, shade trees, community gardens, and any other hotspot of non-native – and often, invasive – vegetation. The first step is determining where pockets of high-quality native habitat remain; the next step is determining which non-natives, or weeds, are degrading this habitat, both from within (infesting the native vegetation itself), and in the spaces between patches of native vegetation, precluding their spread and re-establishment. Once these patterns are understood, a comprehensive strategy may be developed which targets the most detrimental weeds affecting the most valuable habitat.

Inventory of significant native stands of vegetation in the Baldwin Hills

The Baldwin Hills – including the oil field area – has apparently never seen a comprehensive plant survey by a qualified botanist[32], and the last effort to map native vegetation of the Baldwin Hills happened more than ten years ago, during the preparation of the 2001 Biota Report. While a good start, this map failed to recognize many significant areas of native vegetation as native vegetation. It also frequently conflated a given area's *purpose* with its *vegetation*; for example, it labeled some riparian areas "Drainage/Runoff areas" (= purpose) and others "Urban Riparian" (= vegetation), sowing confusion as to which areas might be important reserves of native habitat, and which might be too far degraded.

Though apparently missed in prior mapping, what is likely the most intact, robust area of coastal scrub in the entire range occurs on oil property at the far northwestern corner of the hills, adjacent to West L.A. College (Figure 1) and Culver City Park (Figure 2); this area was mostly labeled "Disturbed Vegetation" in 2001. While certainly correct to a degree, this designation does little to capture its considerable importance. Of course, not having access to many of these areas, the surveyors could only peer through the fence (as is the case today). And, in the 11 years that have passed since the land was surveyed, vegetation that was disturbed at the time could have rebounded substantially. Today, many native species are readily visible, and provide vital information as to what the "natural" native vegetation would look like if it were restored throughout the hills.

[32] The plant list of the Biota Report (2001) is full of misidentifications, and should not be consulted as a source of accurate information on species presence. Various EIRs have largely recycled this information. Very few modern collections of plants are known from the Baldwin Hills [(*per* Consortium of California Herbaria, Calflora (www.calflora.org)].

Figure 2. Native vegetation ("xeric scrub") near the border of West L.A. College.

Most species were dormant when this photograph was taken (September 2012), but shrubs including coyotebush, linear-leaved goldenbush, branching phacelia, deerweed, and white everlasting. Though not visible in the photograph, several lance-leaf dudleya are present on this slope.

Figure 3. Native vegetation ("mesic scrub") near the border of Culver City Park.

Visible species including Mexican elderberry, southern California black walnut, California sagebrush, and poison-oak.

Elsewhere, significant native vegetation is found essentially throughout the entire range, including (based on aerial photos and views through fences) on lands heavily-used by oil production. Coastal scrub-dependent species cling to small roadcuts, and seep or riparian vegetation develops wherever a consistent source of freshwater water meets soil. The significance of each area is more difficult to determine, particularly without recent biological surveys as would be required for any assessment. However, a basic ecological truth probably applies: that patch size often connotes significance when assessing areas of relict vegetation. Today, the largest contiguous patches of habitat – exclusive of oil lands – are found in two main areas of parkland, both in Kenneth Hahn Park, and are described below.

Tier 1 Natural Areas

- **Hahn West**; the steep slope west of the large, flat lawn that extends down to the main picnic areas at Kenneth Hahn Park (Los Angeles County, Dept. of Parks and Recreation)

    - Extensive Xeric Coastal Scrub east of picnic areas with abundant native grass; Mesic Coastal Scrub in drainages (Figure 4) and Xeric Coastal Scrub on slopes (Figure 5); scattered areas of seep scrub and cactus scrub and potential vernal pool habitat on mesa-top (near powerline right-of-way); riparian scrub in drainages on oil lands just west and south of park entrance road (Figure 6).

    - Major wildland weeds of Hahn West include: Australian saltbush, smilo, tree tobacco, leafy spurge, and castor bean, with local infestations of pampas-grass (along drainages), freeway iceplant, Aleppo pine, and orchard grass.

- **Hahn East**; the eastern flank of the park along the west side of South La Brea Ave. in (Los Angeles County, Dept. of Parks and Recreation)

    - Extensive mesic scrub on north facing slopes and in drainages; smaller stands of xeric scrub with abundant native grasses (Figure 7); extensive areas of seep scrub and smaller stands of cactus scrub.

    - Major wildland weeds of Hahn East include: leafy spurge, fennel, castor bean, mustards, prickly ox-tongue and smilo, with local infestations of poison hemlock, freeway iceplant, Russian thistle, German ivy, tree-tobacco, and pampas-grass.

A third area, within Holy Cross Cemetery, supports high-quality native habitat, mainly mesic scrub on slopes north of ("behind") the cemetery property. Here one finds scattered areas of cactus scrub, as well as two drainages with riparian scrub, and vernal pool-like features on graded (flattened) ridgetops. A large portion of this habitat is contiguous with oil company property to the north (Figure 8).

Tier 2 Natural Areas

A second tier of open spaces would include the following public areas:

- **(Baldwin Hills) Scenic Overlook** (California State Parks)

    - This property extends up to the south from Jefferson Blvd. to the overlook, west to Culver City Park and east toward South La Cienega Blvd. (a small trail east of the upper parking lot provides access). At one time it would have been a significant habitat area given its size, but due to past fire and other degradation, it no longer supports much contiguous native habitat, just small patches. Recent "restoration" efforts involving seeding and planting natives have had mixed success, but pockets of intact mesic and xeric scrub and seep scrub persist, particularly south of the visitors center (Figure 9). Clearly, some very significant natural habitat and features are present, such as the sole Los Angeles County occurrence of the coastal-bluff-restricted Nuttall's scrub-oak and the only individual greenbark ceanothus known from the Baldwin Hills, both on the slope just below the Scenic Overlook (Figure 10). Immediate surveys should be undertaken to locate and mark existing patches of naturally-occurring native vegetation and to protect these areas from further disturbance, including planting of non-natives.

    - Major wildland weeds of the Scenic Overlook area include: various annuals (radish, prickly ox-tongue, mustards, etc.), leafy spurge, tree tobacco, and Russian thistle, with local infestations of Catalina cherry, jade tree, Algerian ivy, wattle, and giant yucca.

- **Cloverdale Ave**.; north slope of Hahn Park, east of powerline corridor

    - This somewhat isolated patch of habitat is accessible via South Cloverdale Ave./Terraza Dr., and supports a surprisingly intact patch of Xeric Coastal Scrub, with dense cactus and native needlegrass (*Stipa* sp.) stands. It appears to be the "original" canyon that was filled for the creation of the now-filled reservoir that now occupies the upper part of Hahn Park. While the base of the canyon is heavily impacted by past plantings, in particular toyon, the upper slopes are not (Figure 11).

- **Stocker Corridor**; south side of Stocker Ave., east of La Brea Ave.

    - This narrow band of open space persists along a broad, north-facing slope between houses at the top of a bluff ("View Heights") and the roadbed of Stocker Ave. It supports mainly non-native, herbaceous vegetation (including wild radish *Raphanus* sp.), with pockets of mesic scrub in low spots, and very small patches with a limited number of xeric scrub species.

- **La Brea East**; slope along the east side of La Brea Ave.

    - Similar vegetation to above area (Stocker), the east side of La Brea is characterized by large areas of non-native herbaceous vegetation, with pockets of riparian scrub (willows) in two larger side drainages running downslope to La Brea (Figure 12).

Both Xeric and Mesic Coastal Scrub habitats are present in most of these areas, as are limited secondary communities. All the first-tier sites are contiguous with more extensive habitat, as is the Scenic Overlook property; the second-tier sites are more isolated, by major roads (including La Brea Ave.) and residential development.

Cut/fill Slopes

We refer to large areas where earth has been excavated, contoured, or otherwise manipulated with heavy machinery as "cut/fill slopes", since this practice, done to control erosion and failure of slopes during rain, involves re-shaping a slope and re-directing the path of water into concrete aprons that lead to storm drains. Areas of cut-fill slopes are found widely, but are particularly conspicuous along the eastern edge of South La Cienega Blvd. adjacent to Kenneth Hahn Park and at the Cloverdale Ave. open space patches. Vegetation on these slopes is particularly difficult to address, since it tends to resist reverting back to native habitat (presumably since the top soil is lost in this process). Non-native species find fertile substrate here, owing to the past disturbance history, and thus these areas effectively provide a vector for non-native species to become established throughout the park (especially pampas-grass). It is also likely that native species like coyotebush and toyon, have become super-abundant since they both thrive on these manufactured slopes.

In the interest of limited staff/volunteer time and labor, these areas would have to be lower priority than, say, native and naturally-occurring habitat somewhere else in the parkland, since it is nearly impossible to contain the non-natives here (some may continue to be planted, such as fountain-grass, which is often seeded for slope-stabilization, leading to serious and probably permanent infestations). In any case, unless it is done as part of an overall strategy, such as – to use a hypothetical example –the elimination of pampas-grass along South La Cienega Blvd. and in the riparian sump at the entrance to Kenneth Hahn Park, we recommend not considering these slopes as priorities for restoration, now or in the near future.

The images below show some of these important refugia for native flora (and fauna).

Figure 4. Coastal scrub best described as mesic (despite the presence of cactus) along a drainage in the southern portion of Hahn West.

Visible species include mature native *Opuntia* cactus that would have been used by coastal cactus wren until the late 1990s (when extirpated), California sagebrush, and Mexican elderberry. The dried branches in the center of the image are tree-tobacco, which has extensively invaded and altered the structure of remaining cactus patches throughout the hills, probably rendering them unusable for cactus wrens.

Figure 5. Xeric Coastal Scrub, Hahn West, showing informal footpath and infestation by non-native freeway iceplant.

Figure 6. Riparian sump area near entrance to Hahn West off So. La Cienega Blvd.

Figure 7. Xeric Coastal Scrub at Hahn East near upper lawn.

Green plant in foreground is (non-native) "treasureflower" (*Gazania linearis*), which may have been mistaken for (native) blow-wives (*Achyrachaena mollis*) in the 2001 Biota Repot, which was noted as occurring near pooled water on mesa-tops, a description fitting this site. This species would be fairly easy to completely eradicate from intact habitat such as this.

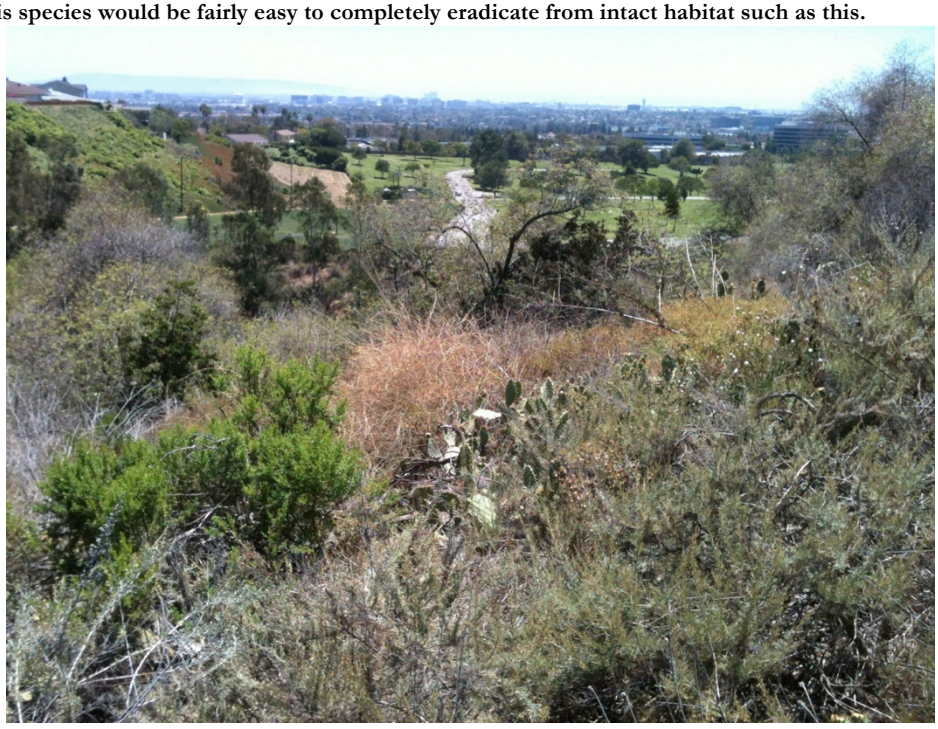

Figure 8. Coastal scrub at Holy Cross Cemetery on the southern flank of the Baldwin Hills.

Figure 9. Xeric scrub just south of Scenic Overlook.

Green shrubs in background are a non-native wattle (*Acacia* cf. *retinoides*). Native shrubs in the foreground are mainly dormant, but include bush sunflower, deerweed, and telegraph weed. Note large areas of bare, sandy soil, vital habitat for side-blotched lizard and other native scrub species.

Figure 10. Nuttall's scrub-oak just below the Scenic Overlook visitor's center (view north).

Figure 11. Xeric scrub (in foreground) at Cloverdale Ave., just north of the upper lawn at Kenneth Hahn Park.

Native cactus is visible, as is California sagebrush, wire-lettuce (probably *Stephanomeria virgata*) and giant wildrye. Large shrubs in distance, on cut/fill slope, are mainly toyon, native to the area but likely seeded here for slope stabilization in the 1970s if not earlier (M. Long, Los Angeles County Parks and Recreation, retired).

Figure 12. View of La Brea East slope, showing wide band of "fuel modification" (mowing for brush clearance below houses), below which is another band comprised almost entirely of non-native weeds.

The "fuel mod zone" has enabled numerous ornamental weeds to gain a toehold and expand greatly, including iceplant, giant yucca, Algerian ivy, and wattle. Many of these species are left intact during brush-clearance, enabling further spread, as shown here.

Native Plants of the Baldwin Hills

One of the major challenges to restoration in the Baldwin Hills has been agreement on what should actually be planted here. Well-meaning restoration attempts by multiple parties have used a variety of techniques and plant material in and around the park, with mixed success. There still appears to be confusion as to what constitutes a native plant, how and where natives should be introduced (or re-introduced), and the uses of non-native plantings in a park setting. To address this, we have assembled (Table 1) what appear to be extant, naturally-occurring native plant species documented recently in the Baldwin Hills. Following these is a list of species, recently introduced, that are probably native to the vicinity of the Baldwin Hills, though not documented as naturally-occurring here during recent surveys (Table 2). These may be thought of as "introduced local natives", for example, as distinguished from introduced species that are native to some other part of California.

Table 1. Native extant plants of the Baldwin Hills (2012). Included are species seen on recent surveys ("P"; D.S. Cooper, pers. obs.), as well as those reported (e.g., 2001 Biota report) that are deemed likely to still occur based on their persistence elsewhere in the region (e.g., Ballona Wetlands, Madrona Marsh). The latter are listed as "P?"; we also note whether a species is represented by both naturally-occurring ("N") and both naturally-occurring and planted/introduced individuals ("N/I").

Latin name	Common name	P/P?	N/I	Specimen	Abundance/habitat
FERNS					
DRYOPTERIDACEAE					
Dryoteris arguta	Coastal wood fern	P?	N	No specimen	Rare/mesic
DICOTS					
ANACARDIACEAE					
Malosma laurina	Laurel sumac	P	N/I	No specimen	Uncommon/various
Rhus integrifolia	Lemonadeberry	P	N/I	No specimen	Uncommon/various
Rhus ovata	Sugarbush	P	N	No specimen	Uncommon/various
Toxicodendtron diversiloba	Poison oak	P	N	No specimen	Common/seeps
ASCLEPIACEAE					
Asclepias fascicularis	Narrow-leaf milkweed	P	N	No specimen	Rare/xeric
ASTERACEAE					
Ambrosia acanthicarpa	sand-bur	P	N	No specimen	Uncommon/xeric
Ambrosia confertiflora		P	N	No specimen	Common/various
Artemisia californica	California sagebrush	P	N/I	UCR143127	Abundant/various
Artemisia douglasii	Mugwort	P	N	No specimen	Rare/mesic
Artemisia dracunculus	Wild tarragon	P	N	No specimen	Rare/xeric
Aster subulatus var. ligulatus	Slim aster	P	N	POM158116	Rare/irrigated zones
Baccharis pilularis	Coyotebush	P	N/I	No specimen	Abundant/various

Latin name	Common name	P/P?	N/I	Specimen	Abundance/habitat
Baccharis salicifolia	Mulefat	P	N/I?	No specimen	Common/seep
Cirsium sp. (native)	Thistle	P	N	No specimen	[needs confirmation]
Corethrogyne filaginifolia (FKA Lessingia filaginifolia)	California sand-aster	P	N/I	POM356124	Common/xeric scrub
Encelia californica	Bush sunflower	P	N/I	RSA348071	Abundant/xeric
Ericameria linearis	Linear-leaf goldenbush	P	N	No specimen	Uncommon/xeric
Ericameria palmeri var. pachylepis	Palmer's goldenbush	P	N	POM359435	Rare/xeric
Gnaphalium bicolor	Two-toned everlasting	P	N/I	No specimen	Uncommon/xeric
Gnaphalium californicum	California everlasting	P	N/I	No specimen	Common/various
Gnaphalium canescens ssp. beneolens	White everlasting	P	N	No specimen	Uncommon/xeric
Grindelia sp.	Gumplant	P	N	RSA80716	Uncommon/various
Hemizonia fasciculata	Fascicled tarplant	P	N/I	UCR209156	Common/various
Heterotheca grandiflora	Telegraph-weed	P	N	UC897765	Abundant/disturbed
Isocoma menziesii	Coast goldenbush	P	N/I	POM359490	Uncommon/xeric
Malacothrix saxatilis var. tunuifolia	Cliff-aster	P	N	No specimen	Common/xeric
Stephanomeria exigua subsp. coronaria	Small wire-lettuce	P	N	RSA474199	Common/xeric
Xanthium strumarium	Cocklebur	P	N	No specimen	Rare/riparian
BORAGINACEAE					
Amsinckia intermedia	Fiddleneck	P?	N	RSA499954	Uncommon/xeric
Phacelia ramosissima	Branching phacelia	P	N/I	No specimen	Uncommon/various
CACTACEAE					
Opuntia X occidentalis	Coast prickly-pear	P	N/I	No specimen	Common/xeric
CAPRIFOLIACEAE					
Sambucus mexicana	Mexican elderberry	P	N	UCR215157	Common/various
CONVOLVULACEAE					
Calystegia macrostegia	Morning-glory	P?	N/I	RSA394868	Common/various
CRASSULACEAE					
Dudleya lanceolata	Lanceleaf dudleya	P	N	RSA348069	Rare/hard-packed soil
EUPHORBIACEAE					
Croton californicus	California croton	P	N/I	UCR215155	Uncommon/xeric
Croton setiger	Doveweed	P	N	SD52713	Common/disturbed
FABACEAE					
Lotus purshianus	Spanish clover	P	N/I	UCR209046	Uncommon/xeric
Lotus scorparius	Deerweed	P	N/I	No specimen	Common/various
Lupinus bicolor	Miniature lupine	P	N/I	UCR209286	Uncommon/xeric
Lupinus cf. longiflorus	Bush-lupine	P	N/I?	No specimen	Uncommon/xeric
Lupinus succulentus	Arroyo lupine	P	N	RSA414315	Uncommon/disturbed
Lupinus truncatus	Collar lupine	P?	N	RSA414858	[needs confirmation]

Latin name	Common name	P/P?	N/I	Specimen	Abundance/habitat
Trifolium willdenovii	Tomcat clover	P?	N	POM156663	[needs confirmation]
Quercus dumosa	Nuttall's scrub oak	P	N	UCR209681	Single plant
GROSSULARIACEAE					
Ribes aureum	Golden currant	P	N	No specimen	Rare/xeric
JUGLANDACEAE					
Juglans californica	Southern California black walnut	P	N/I	No specimen	Uncommon/various
JUNCACEAE					
Juncus bufonius	Toadrush	P?	N	UC520009	[needs confirmation]
LINACEAE					
Linaria canadensis var. texana	Blue toadflax	P?	N	RSA400306	[needs confirmation]
NYCTAGINACEAE					
Mirabilis laevis var. crassifolia	Wishbone-bush	P?	N	RSA464651	[needs confirmation]
ONAGRACEAE					
Camissonia bistorta	Southern suncups	P	N	RSA465680	Rare/xeric
Epilobium brachycarpum	Fire-herb	P	N	No specimen	Rare/xeric
Epilobium canum subsp. canum	California fuchsia	P	N/I	RSA588397	Uncommon/seep
Epilobium ciliatum	Willow-herb	P	N	No specimen	Uncommon/seep
Oenothera elata	Hooker's evening-primrose	P?	N	UCR215154	[needs confirmation]
Plantago ovata var. fastigiata	Desert plantain	P?	N/I	SBBG68776	[needs confirmation]
POLEMONIACEAE					
Gilia angelensis	Angeles gilia	P	N	UCR209282	Rare/xeric
POLYGONIACEAE					
Chorizanthe staticoides	Turkish rugging	P	N	No specimen	Rare/xeric
Eriogonum fasciculatum	California buckwheat	P	N/I	No specimen	Uncommon/xeric
RHAMNACEAE					
Ceanothus spinosus	Greenbark ceanothus	P	N	UCR209680	Single plant
ROSACEAE					
Heteromeles arbutifolia	Toyon	P	N/I	RSA86824	Abundant/mesic (planted widely)
RUBIACEAE					
Galium angustifolium	Narrow-leaf bedstraw	P	N/I	No specimen	Uncommon/xeric
SALICAEAE					
Populus fremontii	Fremont cottonwood	P	N	No specimen	Single plant
Salix exigua	Sandbar willow	P	N	DS140205	Rare/riparian
Salix laevigata	Red willow	P?	N	UC506443	Rare/riparian
Salix lasiolepis	Arroyo willow	P	N	UC506442	Uncommon/riparian
SCROPHULARIACEAE					
Mimulus aurantiicus	Sticky monkeyflower	P	N/I	No specimen	Common/mesic
Orthocarpus purpurascens	Purple owl's-clover	P?	N/I	RSA402085	[needs confirmation]
SOLANACEAE					

Latin name	Common name	P/P?	N/I	Specimen	Abundance/habitat
Datura wrightii	Jimson-weed	P	N	RSA652014	Common/disturbed
Solanum douglasii	White nightshade	P?	N	POM156342	[needs confirmation]
VERBENACEAE					
Verbena lasiostachys var. lasiostachys	Chaparral verbena	P	N	RSA348073	Uncommon/disturbed
MONOCOTS					
CYPERACEAE					
Cyperus sp.	Nutsedge	P	N	No specimen	[needs confirmation]
IRIDACEAE					
Sisyrinchium bellum	Blue-eyed grass	P	N/I	RSA366927	Uncommon/various
LILIACEAE					
Dichelostemma capitatum	Blue dicks	P?	N	No specimen	[needs confirmation]
POACEAE					
Bromus carinatus	California brome	P?	N/I	POM156341	[needs confirmation]
Leymus condensatus	Giant wildrye	P	N/I	RSA483173	Abundant/seep
Melica imperfecta	Chaparral melic	P	N/I	UCD87919	Uncommon/various
Stipa sp.	Needlegrass	P	N/I?	No specimen	Uncommon/various
TYPHACEAE					
Typha latifolia	Cattail	P	N	No specimen	Rare/riparian

Table 2. List of introduced, extant species that are probably native to vicinity of Baldwin Hills. These could continue to be planted as restoration material.

Family	Latin name	Common name	Habitat
Asteraceae	Eriophyllum confertiflorum	Golden yarrow	Xeric scrub
Asteraceae	Lasthenia californica	California goldfields	Xeric scrub
Caprifoliaceae	Isomeris arborea	Bladderpod	Xeric scrub
Lamiaceae	Salvia leucophylla	Purple sage	Xeric scrub
Lamiaceae	Salvia mellifera	Black sage	Xeric scrub
Onagraceae	Clarkia pupuria	Purple clarkia	Xeric scrub
Papaveraceae	Eschscholzia californica	California poppy	Xeric scrub
Platanacea	Platanus racemosa	Western sycamore	Riparian
Poaceae	Vulpia microstachys	Small fescue	Xeric scrub
Rosaceae	Rosa californica	California rose	Riparian/seep
Scrophulariaceae	Keckiella cordifolia	Heart-leaf penstemon	Mesic scrub

Major weeds of the Baldwin Hills and their impact on native habitat

Weeds have been around in California for centuries, and some species are so entrenched that experts debate on their true native status. Adobe bricks excavated at early Spanish settlements show a

remarkable diversity of non-native grasses and forbs, many of which are still our most common field weeds, strongly associated with agriculture and livestock grazing. Another, newer category of weeds may be considered garden escapees – showy, often with bright-colored blooms. Many of these do just fine without garden sprinklers, which makes them so invasive. A few weeds, a small minority, were actually intentionally introduced, for various aesthetic or functional reasons, including fountain-grass, ryegrass and iceplant seeded or planted for slope-stabilization, or pines to provide year-round greenery or to provide work for youth corps, Boy Scouts and similar groups. Regardless of the origin, each weed requires a slightly different strategy in dealing with its removal, or in the case of the most abundant ones, their containment.

Because of the dazzling array of weeds and escaped ornamental species, the number of potential weeds of the Baldwin Hills is simply too high to manage individually. Taking one family alone, Asteraceae (sunflowers), at least 21 non-native species are known from the hills, representing about half the site's known sunflower taxa (n=43). Some are truly noxious pests, such as milk thistle (*Silybum marianum*) which form thick infestations that radically alter the structure of a given habitat, and are very difficult to eradicate in terms of time, labor, and safety (of volunteers, often students). Others are rather rare, appearing in small discrete areas that could be targeted and quickly eliminated. Some are annual herbs, meaning they die back to dead stalks each summer, but not after dropping millions of seeds which germinate again in winter, making total eradication nearly impossible.

Rather than a laundry-list of species, we felt the most useful approach would be to first divide the entire list by treatment – basically, grouping weeds by approach – and within these categories, prioritize the list based on how damaging each species is to the native ecosystem where it is currently invading. To this end, we consider large trees, which require drilling with herbicide (or otherwise professional removal), to be in a completely different league than iceplant, for example, which could be hand-pulled by middle school students during workdays. Similarly, annual plants, which are probably unlikely to controlled without the dedication of hundreds of thousands of dollars of labor over several years, would have to be a lower priority than perennials, which can respond to site-treatment.

This listing may be further subdivided by abundance; certain weeds are rare in the park, or have only very local infestations that could be relatively easily contained with concerted effort. Finally, the

ecology of the weed species itself should be taken into account with any weed strategy. Many invasive non-native species are ephemeral, appearing immediately after anthropomorphic disturbance such as road grading, and do not persist if the soil is allowed to recover. Some of these, such as Russian thistle (*Salsola tragus*) are essentially limited to the most disturbed habitats, and make only weak inroads into native habitat, appearing along trails or eventually being subsumed by native species (or more persistent weed species).

As an important note, human-modified areas are not always bad for natives – certain created features can actually encourage natives by eliminating habitat for non-native grasses and weeds, such as along steep roadcuts[33] or even where water flow has eroded sandy slopes. It is very difficult to predict which disturbances encourage vs. discourage native flora, without direct field observation of a particular site. This ecology must be considered when prioritizing which species, and areas, to address, since one could spend years pulling weeds and seeding a cut/fill slope and never produce a native-dominated system. (Graded slopes along the entrance driveway to the Scenic Overlook provide an example of this extremely challenging substrate). Instead, effort might be better spent targeting weeds in areas of most intact/pristine native vegetation, since they would presumably have the best chance of fending off future invasions in the long run.

Inventory of Weeds, 2012

Thanks to mapping work of Generation Water (Rebecca Shields Moose, unpubl. data), we have a reasonably good knowledge of the distribution of major weed infestations of the Baldwin Hills open space, including both State and County parklands. Appendix C presents a series of maps of selected weed species infestations deemed most damaging to native vegetation.

Tables 3-6 present lists of weeds of the Baldwin Hills divided by recommended treatment type[34] (List A, List B, etc.), including those that should only be removed by professionals using heavy equipment, down to herbs that children could recognize and pull on a workday event. For each treatment type, weeds are ranked in terms of their observed invasiveness, or tenacity, *in native vegetation* within the open space of the Baldwin Hills.

[33] Most of the natives at the Stocker Corridor appear to be along the roadcut just above the roadbed, including gumplant (*Grindelia* sp.), white everlasting (*Gnaphalium canescens*) and California sand-aster (*Corethrogyne filaginifolia*).
[34] These divisions were made following several conversations with Rebecca Shields Moose of Generation Water.

This distinction is important, since many are highly-invasive, but only in already disturbed areas (e.g., Russian thistle), near irrigation lines (e.g., prickly ox-tongue), or in other special circumstances. Likewise, abundance is also determined by abundance *within patches of native vegetation* throughout the open space, rather than in the hills overall, or how dense a given infestation is, or by other traits. So, a species like pampas-grass is highly invasive in native habitat, and also very common and widespread in native habitats (Figure 13). Algerian ivy may be conspicuous along a particular edge of open space adjacent to yards from which it has escaped (Figure 14), but it has shown itself to be poor at making inroads into native habitat in the hills overall, and only occurs in a handful of areas.

Figure 13. Pampas-grass invades a drainage, likely a seep, in Hahn West.

Figure 14. Algerian ivy invades a weedy hillside just east of Scenic Overlook.

Table 3 includes particularly large trees and shrubs that normally require professional treatment to control (or contain), such as a licensed applier of pesticides, and would typically not be appropriate for volunteers or even most work crews.

Important note: we are not suggesting that ALL occurrences of these species be removed – only the ones that are clearly impacting natural habitat areas, either directly or indirectly, and those that are not serving as ornamental/shade trees for other park uses.

Table 3. List A; Large/difficult-to-remove trees and shrubs targeted for professional treatment/removal, typically using mechanical tools or herbicide. Species are listed most-invasive (in native habitats) to least.

Species	Invasive-ness (1 = least invasive)	Abundance (A = least common)
Castor bean (*Ricinis communis*)	3	C
Poison hemlock (*Conium maculatum*)	3	B
Fan palm (*Washingtonia* spp.)	2	B
Brazilian pepper (*Schinus terebinthifolius*)	2	A
Shamel ash (*Fraxinus udhei*)	2	A
Aleppo pine (*Pinus halappensis*)	1	C
Cypress/juniper (*Cupressus*/*Juniperus* spp.)	1	B
California pepper (*Schinus molle*)	1	A
Date palm (*Phoenix* spp.)	1	A
Eucalyptus (*Eucalyptus* spp.)	1	A
Holm oak (*Quercus ilex*)	1	A
English walnut *(Juglans* cf. *regia*)	1	A

From Table 3, one can see that the most invasive, most common species, such as castor bean and poison hemlock, will probably require a longer-term strategy for removal; other less common species, such as holm oak, might be successfully be eradicated more quickly if targeted and prioritized for park-wide removal from natural/native habitats. For certain ornamental species, such as eucalyptus, as noted above, only those individuals making inroads into natural areas (or poised to), would be targeted for removal; in the case of eucalyptus, it is relatively infrequent in natural habitat, though planted widely.

Table 4 presents species that are difficult to remove, but would not normally require professional assistance where they occur in the park. These would simply take more time and energy to attack (per-plant), and would be most appropriate for more specialized, highly-trained work crews (such as conservation corps) rather than students or citizen-volunteers without considerable experience in their removal.

Table 4. List B; Large/difficult-to-remove trees and shrubs targeted for trained work crews; these are possible to remove with hand tools (non-mechanized). Species are listed most invasive (in native habitats) to least.

Species	Invasive-ness (1 = least invasive)	Abundance (A = least common)
Pampas-grass (*Cortaderia* spp.)	3	C
Wattle (*Acacia* spp.)	3	B
Chinese tree-of-heaven (*Ailanthus altissima*)	3	A
Giant cane (*Arundo donax*)	3	A
Salt-cedar (*Tamarix ramosissima*/*T. aphylla*/*T. chinensis*)	3	A
Tumbleweed (*Salsola tragus*)	2	C
Catalina cherry (*Prunus lyonii*)	2	B
Spanish broom (*Spartium juncaeum*)	2	A
Myoporum (*Myoporum laevis*)	2	A
Giant yucca (*Yucca elephantipes*)	1	B
European olive (*Olea europea*)	1	A
"Euphorbia tree" (*Euphorbia* cf. *tirucalli*)	1	A
"Unknown cherry" (*Prunus* sp.)	1	A
Edible fig (*Ficus carica*)	1	A
Indian laurel (*Ficus microcarpa*)	1	A
Cotoneaster (*Cotoneaster* sp.)	1	A
Firethorn (*Pyracantha* sp.)	1	A
Pride-of-Madeira (*Echium candicans*)	1	A

Obviously, any of the species above could be removed by professional crews, and, if warranted, with herbicides (typically painted on cut stumps). However, at least the less-widespread ones, such as Chinese tree-of-heaven, could make ideal targets for groups such as the L.A. Conservation Corps.

Table 5 lists species that, while potentially highly-invasive, are also appropriate for removal by even untrained volunteers such as during weekend workdays.

Table 5. List C; Volunteer targets.

Species	Invasive-ness (1 = least invasive)	Abundance (A = least common)
Carnation spurge (*Euphorbia terracina*)*	3	C
Fennel (*Foeniculum vulgare*)*	3	C
Smilo grass (*Piptatherum miliaceum*)*	3	C
Annual grasses (various, including *Avena* spp., *Bromus* spp., *Hordeum* spp.)	3[35]	C
Australian saltbush (*Atriplex semibaccata*)*	3	B
Dove's-foot geranium (*Geranium molle*)	3[36]	B
Garland chrysanthemum (*Chrysanthemum coronarium*)*	3	B
Large thistles (esp. *Silybum marianum*)*	3	B
Tree-tobacco (*Nicotiana glauca*)*	3	B
Fountain-grass (*Pennisetum* cf. *setaceum*)*	3	A
Sticky eupatory (*Ageratina adenophora*)	3	A
Mustards (incl. *Brassica* spp., *Hirschfeldia incana*)*	2	C
Wild radish (*Raphanus sativus*)*	2	C
Bristly ox-tongue (*Picris echioides*)*	2	C
Cheeseweed (*Malva parviflora*)*	2	C
Italian thistle (*Carduus tenuiflorus/C. pycnocephalus*)	2[37]	B
Horehound (*Marrubium vulgare*)	2	B
Tocalote (*Centarea melitensis*)	2[38]	B
Veldt grass (*Eherharta* spp.)	2	B
Freeway iceplant (*Carpobrotus edulis*)	2	B
African daisy (*Dimorphotheca fruticosa*) (FKA *Osteospermum fructosum*)	2	B
Curly dock (*Rumex crispus*)	2	B
Scarlet pimpernel (*Anagallis arvensis*)	2	B
Sweet alyssum (*Lobularia maritima*)	2	B
Wooly mullein (*Verbascum blatteria/V. virgatum*)	2	B
Horseweed (non-native) (*Conyza bonariensis/floribundus*)	2	B
Plantain (non-native) (*Plantago lanceolata/major*)	2	B
Bur-clover (*Medicago lupulina/polycarpa*)	2	B
German ivy (*Delairea odorata*)* (FKA *Senecio mikanioides*)	2	B
Sow thistle (*Sonchus oleraceus*)	2	A
Algerian ivy (*Hedera canariensis*)	2	A
Orchard grass (*Dactylis glomerata*)	2	A
Nasturtium (*Trapaeolum majus*)	2	A

[35] While ubiquitous, annual grasses and grass-like weeds are ranked "2" for invasiveness since their abundance varies from year to year depending on rainfall. They are generally not targeted for removal by local restoration projects, due to their sheer abundance.
[36] See note for annual grasses
[37] See note for annual grasses
[38] See note for annual grasses

Passion-vine (*Passiflora caerulea*)	2	A
Umbrella sedge (*Cyperus involucratus*)	2	A
Treasureflower (*Gazania linearis*)	2	A
Sweet-clover (*Melilotus* spp.)	1	B
Prickly lettuce (*Lactuca serriola*)	1	B
Lamb's quarters (*Chenopodium album*)	1	B
(no common name) (*Filago gallica*)	1	A
Bassia (*Bassia hysssopifolia*)	1	A
Knotweed (*Polygonum* cf. *arenastrum*)	1	A
Sand-spurrey (*Spergularia* spp.)	1	A
"Red apple" iceplant (*Aptenia cordifolia*)	1	A
Crystalline iceplant (*Mesembryanthemum crystallinum*)	1	A
Windmill pink (*Silene gallica*)	1	A
Beggar-ticks (*Bidens pilosa*)	1	A
Cape honeysuckle (*Tecoma capensis*)	1	A
Cape plumbago (*Plumbago auriculata*)	1	A
English ivy (*Hedera helix*)	1	A
Jade plant (*Crassula argentea*)	1	A
Ornamental geranium (*Pelargonium horotum*)	1	A
Sea lavender (*Limonium* sp.)	1	A
Silverleaf nightshade (*Solanum elaeagnifolium*)	1	A

As with the other lists, these especially will need to be further prioritized depending on the time and labor available. Those that are especially common, such as carnation spurge (*Euphorbia terracina*) cannot be effectively contained or controlled in a year or even several, but will require a long-term commitment and a restoration strategy involving discrete areas targeted for removal (ideally, in the most sensitive habitats, as discussed above). Others that are more local will require great attention to ensure that seemingly easy eradications don't result in re-invasion (such as pulling out sticky eupatory *Ageratina adenophora* at a seep, only to find it reappearing in greater abundance the next year).

By contrast, those species that are only weakly invasive and rare, but nonetheless damaging where they occur, could make for ideal workday projects, since their eradication would be straightforward and likely effective if planned and executed properly. These could include species like cape plumbago and German ivy, which primarily occurs at the edge of native habitat and tends to not make inroads deep into native scrub; the eradication of either could be characterized as an easy win in terms of restoration.

The last category (List D) are weeds that are best considered "quasi-natives" – species that are native to southern California, but for which there is no clear evidence through specimens, notes, or current distribution that they are native to either the Baldwin Hills, the interior Ballona area, or the Los Angeles Coastal Prairie region, of which the Baldwin Hills is part. We fully recognize that the historical flora of the Baldwin Hills has been extensively lost, and that large areas, particularly the north slope, might have had affinities with the Santa Monica Mountains that have since vanished (e.g., greenbark ceanothus may have been a dominant shrub in a former chaparral community here, as it is in places like lower Topanga Canyon and elsewhere in the central-coastal Santa Monica Mountains). These species are known locally only from plantings, including those done by park staff and volunteers over decades. Others arrived in seed mixes or as container plants during the construction of the Scenic Overlook state park (see Appendix B). Regardless of their provenance, they should be considered for removal from natural areas throughout the park, if it is determined a) that they are truly not native in recent geological time to the Baldwin Hills; b) they are not serving a purpose in support of some park use; and/or c) they are likely to become invasive and further disrupt the native habitats of the hills.

As a note, we have not confirmed that each is extant in the park; some were merely listed as being included in plantings and seed mixes, so are potentially present, but given their ability to grow in a variety of habitats, we include them here. And, new species are appearing which each planting; California coffeeberry (*Rhamnus californica*) and holly-leaved cherry (*Prunus ilicifolia*) have both been recently introduced as plantings at Hahn East near South La Brea Ave.; neither appears to be native locally, though both are common in the nearby Santa Monica Mountains.

We recognize that this list will be controversial since it includes several species that are well-loved by the public; for this reason, we provide some clarifying detail on why they are included here.

Of particular note, coast live oak (*Quercus agrifolia*) has been planted widely in the Baldwin Hills area, yet there is no evidence to support that it ever occurred in recorded history (T. Longcore, via email). In the Los Angeles area, oaks appear to be native south only to the southern flank of the Santa Monica Mountains (down roughly to Sunset Blvd.), east through the Repetto Hills (including Elysian Park and the low hills around downtown Los Angeles), and east and south through the Puente Hills into Orange County. There are no historical records or accounts from the Palos Verdes peninsula, or anywhere along the immediate coast south of the Santa Monicas. However, all oaks are very

important culturally, and it is not surprising they continue to be planted; but like any other tree (most of which are non-native), oaks too have the potential to displace native scrubland species by their mere presence, as well as by the species they attract.

Table 6. List D; Quasi-natives; not naturally-occurring in the Baldwin Hills but planted anyway. This list is preliminary; new species continue to be planted each year. See Appendix B for species list from Scenic Overlook revegetation.

Common name	Latin name	Justification
Dune evening-primrose	*Camissonia cheiranthifolia*	A dune species unlikely to have been present away from the active dunes of the El Segundo Dune formation to the west, and in very sandy soils of the Ballona Wetlands/Westchester Bluffs. Used in the revegetation of the Scenic Overlook property, and still (2012) extant.
Sawtooth goldenbush	*Hazardia squarrosa*	Unknown from historical specimens south of Santa Monica Mountains (e.g. Palos Verdes Peninsula), essentially a foothill species typical of the Santa Monica Mountains, and unlikely to have been found in the Coastal Prairie region. Included in the seed mix for the Scenic Overlook. NOT CONFIRMED IN BALDWIN HILLS.
Caterpillar phacelia	*Phacelia cicutaria*	Unknown from historical specimens south of Santa Monica Mountains (e.g. Palos Verdes Peninsula), essentially a foothill species typical of the Santa Monica Mountains, and unlikely to have been found in the Coastal Prairie region. Two other Phacelia are known locally, P. *distans*, known only from historical collections, and *P. ramosissima*, which is still locally common in the hills. The 2001 Biota report listed *P. cicutaria* as the only species present, apparently based on a mis-identification, and the seed mix listed for the Scenic Overlook plantings apparently included it (as well as *P. ramosissima*), perhaps continuing the error. NOT CONFIRMED IN BALDWIN HILLS.
Ashy-leaved buckwheat	*Eriogonum cinereum*[39]	Found in the western Santa Monica Mountains and on the Palos Verdes Peninsula, this species is unknown, historically or currently, from the intervening area, including El Segundo Dunes. It has been planted recently along the lower slopes of the Scenic Overlook.
Holly-leaved cherry	*Prunus ilicifolia*	Unknown from historical specimens south of Santa Monica Mountains (e.g. Palos Verdes Peninsula), essentially a foothill species typical of the Santa Monica Mountains, and unlikely to have been found in the Coastal Prairie region.
Coast live oak	*Quercus agrifolia*	Unknown from historical specimens south of Santa Monica Mountains (e.g. Palos Verdes Peninsula), essentially a foothill species typical of the Santa Monica Mountains, and unlikely to have been found in the Coastal Prairie region. See text for additional

[39] Yet another species of buckwheat, *E. giganteum*, is restricted/endemic to the Channel Islands, and has been extensively planted at Culver City Park, along with more local natives such as California sagebrush. Because it has not naturalized and does not occur in native habitat, we do not include it here, but instead treat it as an ornamental (and therefore do not include it in various lists).

		discussion.
Valley oak	*Quercus lobata*	Unknown from historical specimens south of Santa Monica Mountains (e.g. Palos Verdes Peninsula), essentially a Coast Range/Central Valley species that would not have occurred away from the state's interior valleys. Several have been recently planted in Hahn East.
California coffeeberry	*Rhamnus californica*	Unknown from historical specimens south of Santa Monica Mountains (e.g. Palos Verdes Peninsula), essentially a foothill species typical of the Santa Monica Mountains, and unlikely to have been found in the Coastal Prairie region.
White sage	*Salvia apiana*	Unknown from historical specimens south of Santa Monica Mountains (e.g. Palos Verdes Peninsula), essentially a foothill species typical of the Santa Monica Mountains, and unlikely to have been found in the Coastal Prairie region. This species is common vic. West L.A. College, presumably from a seed mix used for "restoration".

Specific Habitat Enhancement Areas

As noted above, rather than attempting to restore habitat based on weed occurrence (i.e., attacking various weed species wherever they occur), it is probably easier to use multiple approaches in specific treatment areas, based on access, available labor, and target species involved. Habitats of the hills naturally occur as a matrix, with multiple secondary and even primary associations nearly overlapping each other across a relatively small area. Thus, we recommend designing a management plan based not on habitat type, but on geography – identifying specific, accessible regions of the park where limited restoration effort can have the biggest impact in native habitats. Based on our observations, and on conversations with individuals involved in the restoration of the Baldwin Hills, we list the recommended highest-priority areas below, realizing that more analysis may be necessary to determine which specific locations within these areas have the most intact native vegetation, and which are the most pernicious weed species within them (this will determine the approach needed).

Within these large areas, smaller sites may be identified by observing the configuration of native vegetation, degree of invasion, access (i.e., is the slope too steep to safely walk on? Is the brush too thick?), and other factors. Once these smaller sites are identified, they can be mapped and prioritized for action. For example, at Hahn West, several of the canyon slopes are far too steep for people to walk along, but the canyon bottoms are fairly level, albeit choked with non-native plants. A plan may then be developed that identifies one or two high-priority canyons here, lists the non-natives

targeted for removal in them, and calculates the amount and type of effort needed (hand-pulling using volunteers, professional removal over time, etc.).

Table 7 provides a summary of management strategies (discussed above), by subarea, to better direct appropriate future attention to these important sites. We used maps provided by Generation Water in determining the major weeds of each subarea.

Table 7. Recommended management strategy for each subarea, based on mapped non-natives. Less common species in parentheses.

Subarea	Professional (Targeted removal of weed trees/shrubs)	Volunteer (Hand-weeding) *In native habitat only*	Replanting (Large/small scale)
Hahn West	Aleppo pine, eucalyptus, (holm oak), *Schinus*, Castor bean, pampas-grass, (palms), (Catalina cherry), (giant yucca)	Australian saltbush, Russian thistle, (poison hemlock), German ivy, tree-tobacco, fountain grass, milk thistle, smilo, ice plant, (wild radish), fennel, carnation spurge, garland chrysanthemum, (Catalina cherry),	**None recommended**. Native seedbank appears relatively robust, as many annuals, such as fascicled tarplant, persist within non-native weedy areas.
Hahn East	*Schinus*, Castor bean, pampas-grass, (palms), (holm oak), Catalina cherry, (giant yucca)	acacia, Australian saltbush, Russian thistle, poison hemlock, German ivy, tree-tobacco, fountain grass, milk thistle, smilo, ice plant, wild radish, fennel, carnation spurge, garland chrysanthemum, sweet alyssum, horehound, wooly mullein	**Small scale**: Recommend connecting smaller patches of native scrub through limited planting/seeding of tenacious natives (e.g., deerweed).
Scenic Overlook	(*Schinus*), Catalina cherry, (palms), (giant yucca)	acacia, Australian saltbush, Russian thistle, *Melilotus*, tree-tobacco, fountain grass, smilo, (ice plant), wild radish, fennel, carnation spurge, garland chrysanthemum,	**Small scale**: Recommend connecting smaller patches of native scrub through limited planting/seeding of tenacious natives (e.g., deerweed).
Cloverdale Ave.[40]	TBD	TBD	**Not recommended.** Habitat currently in good shape and

[40] Access for this site needs clarification. For now, it is reached via walking across a vacant lot, but actual ownership unknown.

			includes many native shrubs and grasses, cactus patches.
Stocker Corridor	Pampas-grass, (palms), (giant yucca)	(German ivy), tree-tobacco, fountain grass, smilo, ice plant, wild radish, fennel, carnation spurge, garland chrysanthemum,	**Large scale:** Recommend employing slope treatments such as solarization to contain extensive infestations. Native seedbank appears extremely limited, except on roadcuts. Recommend expanding roadcuts to provide toe-hold habitat for Coastal Scrub species already present.
La Brea East	Pampas-grass, (palms), (giant yucca)	tree-tobacco, fountain grass, milk thistle, smilo, ice plant, wild radish, fennel, carnation spurge, garland chrysanthemum,	**Not recommended**. Poor access to slope precludes regular work here. Small size and isolation will be persistent problems, at least given current staff/volunteer levels.

Summary of Strategy

To summarize the above information, along with that presented in the various target species lists, one could divide a weed control strategy into short term and long term, with the short term approach targeting the least common (but most invasive) species, and the long term approach targeting increasingly more common taxa. Note that as explained above, we are here concerned primarily with species in intact habitat only.

To that end, the following species are the most invasive and the least common, yet would be the best candidates for a short-term approach, such as a large group of volunteers on a workday (List C, rank 3-A or 3-B): Garland chrysanthemum (*Chrysanthemum coronarium*), large thistles (esp. *Silybum marianum*), tree-tobacco (*Nicotiana glauca*), fountain-grass (*Pennisetum* cf. *setaceum*), and sticky eupatory (*Ageratina adenophora*), Australian saltbush (*Atriplex semibaccata*) and dove's-foot cranesbill (*Geranium molle*). A returning group of people, such as a volunteer conservation club from a local school, could target areas of more widespread species (List C, rank 3-C), such as Carnation spurge (*Euphorbia terracina*), Fennel (*Foeniculum vulgare*), and smilo (*Piptatherum miliaceum*).

We should note that weed-pulling need not always be followed by planting, so just because both are mentioned for an area in Table 7, this doesn't mean that both need to be employed. The need for planting should be determined on a site-by-site basis, and used only as a last resort; where, after intensive and repeated weed-pulling, no natives are gaining a foothold. Often, natives will appear after pulling but will not be recognized as such (Figure 12), and planting will follow which results in adding non-natives to the recently-cleared site (Figure 13).

Figure 15. "Cryptic natives" fill-in an area of Hahn East where weeds have been (presumably) hand-pulled.

Two rapidly-colonizing natives, doveweed (*Croton setiger*) and horseweed (*Conyza canadensis*) are often the first to appear, with others to follow in subsequent months (often deerweed or California sagebrush). Note mounds of pocket-gophers (*Thomomys bottae*), which help work the topsoil and can spread additional native seed. Side-blotched lizard and California kingsnake would likely use this area, as would native harvester ants.

Figure 16. "Exotics upon exotics": Holly-leaved cherry, a foothill species, planted in Hahn East, being crowded-out by non-native castor bean thanks to the installation of irrigation.

Unless dedicated staff can devote hundreds of hours a year to weed-pulling, such wildland plantings are unlikely to succeed.

A more professional work crew in the hills for just one or two days (i.e., short-term) could target certain uncommon but invasive and large species (List B, rank 3-A and 3-B), such as wattle (*Acacia* spp.), Chinese tree-of-heaven (*Ailanthus altissima*), giant cane (*Arundo donax*) and salt-cedar (*Tamarix* sp.).

Obviously, species like castor bean and pampas-grass deserve their own special strategy, one that recognizes the long-term commitment necessary to start to contain, much less eliminate them from the hills.

As for planting and other re-vegetation methods, we recommend none whatsoever at Hahn West, Cloverdale Ave. or La Brea East sites, for various reasons. For Hahn West, the seedbank is still fairly robust, with natives appearing even on weedy slopes, helped possibly by higher sand content in the soil. Access is an issue at Cloverdale Ave., and until it is negotiated, this site will probably have to wait for restoration. La Brea East appears to be too narrow, isolated, loud (traffic noise) and confined, with extremely poor access (no parking, for example), and any restoration attempt there would probably largely be cosmetic.

Small-scale planting would be appropriate at Hahn East as well as the Scenic Overlook site. Hahn East clearly has more intact habitat overall, but at both areas, discrete habitat patches could be connected through directed planting (either seeding or container plants). We would not recommend prioritizing simply planting anywhere at either area – there is simply too much area, and years could be spent planting in various small areas with little impact (and while probably exacerbating the weed problem).

Finally, large-scale planting/seeding might be appropriate for a place like the Stocker Corridor, which probably has enough land area to support a reasonably diverse wildlife community, such as Audubon's cottontail (*Sylvilagus audubonii*), California kingsnake (*Lampropeltis gentilis*), and spotted towhee (*Pipilo maculatus*). Very few habitat patches are present here, suggesting that the native seed bank is probably very low. Experiments such as solarization of large areas of slopes using tarps, or even cutting into the earth to simulate roadcuts (to attract more natives to colonize) could result in the re-establishment of a native-dominated vegetation community here.

APPENDICES

Appendix A. Extirpated native plant species

Below is a complete list of native species that are known to have occurred in a natural state in the Baldwin Hills, including those known historically (for these, we describe the habitat type they would have been found in). Some of these could be considered candidates for re-introduction (or, preferably, re-discovery), but many were likely collected in habitats no longer present (such as alkali flats, or along then-natural riparian habitat along Ballona Creek). Known extirpated species are listed in Table A1; the rediscovery of any would be a very high conservation priority.

Table A1. Known and presumed extirpated plant species of the Baldwin Hills and vicinity (including Inglewood and Culver City), based on specimen data[41].

Family	Latin name	Notes
Apiaceae	Oenanthe sarmentosa	Probably collected along Ballona Creek; may not have occurred in BH.
Apiaceae	Sanicula arguta	Clay soils in openings in a variety of upland habitats (incl. mesic scrub, chaparral)
Asteraceae	Centromadia parryi subsp. australis	Flat, alkali grassland vernally-wet areas on floor of Los Angeles Basin, so may not have occurred in BH. Extant occurrences known from vic. Athens and Torrance.
Asteraceae	Gnaphalium palustre	Vernal pools; may not have occurred in BH.
Asteraceae	Lasthenia glabrata subsp. coulteri	Flat, alkali grassland vernally-wet areas on floor of Los Angeles Basin; possibly extinct in region; known from vic. Oxnard.
Asteraceae	Lasthenia gracilis	Arid grassland; probably extirpated along coast, but extant vic. Santa Clarita and in western Antelope Valley.
Asteraceae	Senecio californicus	Arid scrub; possibly extinct in Los Angeles Basin (persists vic. Santa Clarita).
Asteraceae	Silene laciniata subsp. major	Widespread in scrub, particularly on rocky slopes.
Boraginaceae	Cryptantha intermedia	Widespread and locally common on sandy soil.
Boraginaceae	Pectocarya linearis subsp. ferocula	Widespread and locally common on sandy soil.
Boraginaceae	Phacelia distans	Widespread and locally common on sandstone/shale.
Brassicaceae	Caulanthus lasiophyllus	Arid scrub; many coastal-slope populations lost.
Brassicaceae	Lepidium dictyotum var. acutidens	Flat, alkali grassland vernally-wet areas on floor of Los Angeles Basin; possibly extinct in region.
Brassicaceae	Lepidium nitidum	Uncommon in gravelly and sandy habitat in arid scrub.
Brassicaceae	Lepidium virginicum var. menziesii	Uncommon in gravelly and sandy habitat in arid scrub.
Brassicaceae	Planodes virginicum (FKA Sibara virginica)	Vernal pools; may not have occurred in BH.
Caryophyllaceae	Spergularia macrotheca var. leucantha	Vernal pools?
Chenopodiaceae	Atriplex serenana var. serenana	Various lowland habitats; possibly extirpated from L.A. Basin (persists Santa Clarita).
Chenopodiaceae	Chenopodium californicum	Scrub; possibly extirpated from L.A. Basin
Convolvulaceae	Cressa truxillensis	Widespread and common on sandy soil that pools water.
Cyperaceae	Carex praegracilis	Uncommon in moist areas.
Cyperaceae	Scirpus californicus	Probably collected along Ballona Creek; may not have occurred in BH.
Cyperaceae	Scirpus maritimus	Probably collected along Ballona Creek; may not have occurred in BH.
Elatinaceae	Elatine brachysperma	Vernal pools; may not have occurred in BH.
Euphorbiaceae	Chamaesyce albomarginata	May persist; found at edge of puddled/pooled water in grassy scrub and prairie-like habitat.

[41] Data provided by the participants of the Consortium of California Herbaria (ucjeps.berkeley.edu/consortium/).

Fabaceae	Astragalus trichopodus var. lonchus	Open, grassy areas of coastal scrub and prairie (local on Palos Verdes peninsula)
Fabaceae	Lotus heermannii	Sandy flats, often on gravelly soil in alluvial fans.
Fabaceae	Lotus salsuginosus	Open scrub near coast; often appears after burns (abundant on Palos Verdes peninsula).
Fabaceae	Lotus strigosus	Sandy soil; widespread even within urban areas (e.g., Madrona Marsh, Torrance).
Fabaceae	Trifolium ciliolatum	Sandstone/shale-derived soil; occurs in a variety of habitats.
Fabaceae	Trifolium gracilentum	Clay soils in scrub.
Juncaceae	Eleocharis acicularis var. acicularis	Vernal pools; may not have occurred in BH.
Juncaceae	Eleocharis macrostachya	Vernal pools; may not have occurred in BH.
Lamiaceae	Salvia columbariae	Sandy patches within scrub; locally common on Palos Verdes peninsula.
Lamiaceae	Stachys bullata	Common in mesic scrub and woodland understory in Santa Monica Mtns.
Lamiaceae	Stachys rigida subsp. rigida	Rare on clay soil near coast, various habitats.
Liliaceae	Bloomeria crocea var. crocea	Clay soil within grassland and open scrub.
Malvaceae	Sidalcea malviflora subsp. sparsifolia	Seasonally wet clay soil; possibly extinct in region.
Montiaceae	Calandrinia ciliata var. menziesii	Open vegetation on sandy soil, often following burns.
Oleaceae	Fraxinus latifolia	Probably collected along Ballona Creek; may not have occurred in BH.
Onagraceae	Boisduvalia glabella	Vernal pools; may not have occurred in BH.
Onagraceae	Camissonia lewisii	Local on sandy soil along coast (e.g., Ballona Wetlands)
Onagraceae	Camissonia strigulosa	Local on sandy, hard-packed soil, including urban areas (Torrance)
Papaveraceae	Platystemon californicus	Scrub, often after burns; possibly extirpated L.A. Basin.
Plantaginaceae	Plantago bigelovii subsp. californica	Arid scrub and prairie; now uncommon L.A. Basin
Poaceae	Alopecurus carolinianus	Assuming identification is correct, almost certain extirpated from L.A. Basin.
Poaceae	Leymus triticoides	Widespread elsewhere in alkali meadows; possibly collected along Ballona Creek/Cienega (not in hills)
Poaceae	Phalaris lemmonii	See *Alopecurus caolinianus*
Poaceae	Poa secunda	Widespread north/away from L.A. Basin, but probably extirpated from vicinity of hills.
Polemoniaceae	Gilia splendens subsp. splendens	Widespread in San Gabriel Mountains; probably extirpated at lower elevations.
Polemoniaceae	Linanthus dianthiflorus	Now rare in open scrub on sandy/gravelly soil.
Polemoniaceae	Navarretia fossalis	Vernal pools; may not have occurred in BH.
Polemoniaceae	Navarretia prostrata	Vernal pools; may not have occurred in BH.
Polemoniaceae	Nemophila menziesii	Widespread but uncommon on clay soil, various habitats.
Polygonaceae	Polygonum lapathifolium	May persist – can act like a weed.
Ranunculaceae	Ranunculus californicus var. californicus	Local on heavy clay soil in shady habitats, including mesic scrub.
Scrophulariaceae	Mimulus guttatus	Probably collected along Ballona Creek; may not have

		occurred in BH.
Scrophulariaceae	Orthocarpus purpurascens	Now rare in grassy openings within low scrub.
Solanaceae	Solanum umbelliferum	Probably conspecific with S. xantii, which is widespread and common in mesic scrub and woodland.
Verbenaceae	Verbena bracteata	Vernal pools; may not have occurred in BH.
Violacae	Viola pedunculata	Clay patches within mesic scrub and woodland.

Appendix B. Plant Palette of the Baldwin Hills Scenic Overlook

The following species were among those used in the re-vegetation of the Scenic Overlook property, primarily along the new access road south of Jefferson Blvd. Not all the species have survived; many are persisting only near irrigation. In patches of naturally-occurring vegetation on the site, it is probably now impossible to separate natural/native species from these introduced ones, a situation further complicated by the fact that some of the introduced species were cultivated from plants *in situ*. Lists provided by Generation Water.

Table B1. Species used in seed mix for landscaping Baldwin Hills Scenic Overlook. Data courtesy of Generation Water.

Species	Common name
Artemisia californica	California Sagebush
Baccharis pilularis	Coyote Bush
Bromus carinatus	California brome
Camissonia cherianthifolia	Dune Primrose
Calystegia macrostegia	Wild Morning Glory
Castilleja purpurascens	Owl's Clover
Clarkia purpurea	Purple clarkia
Encelia californica	California encelia
Eriogonum fasiculatum	California buckwheat
Epilobium canum	California fuchsia
Galium angustifolium	Narrow leaf bedstraw
Gnaphalium bicolor	two tone everlasting
Gnaphalium californica	Californica everlasting
Hazardia squarrosa	sawtooth goldenbush
Hemizonia fasciculata	tarweed
Isomeris arborea	bladderpod
Isocoma menziesii	Coast Goldenbush
Lotus purshianus	Spanish lotus
Lotus scoparius	deerweed
Lupinus bicolor	miniature lupine
Melica imperfecta	melic grass
Mimulus aurantiacus	monkey bush
Phacelia cicutaria	caterpillar phacelia
Phacelia ramosissima	Branching phacelia
Plantago ovata	wooly plantain
Vulpia microstachys	small fescue

Table B2. Species planted from containers at Baldwin Hills Scenic Overlook

Species	Common name
Croton californica	California croton
Eriophyllum confertiflorum	Golden yarrow
Heteromeles arbutifolia	Toyon
Junglans californica	California walnut
Keckiella cordifolia	Heart-leaved penstemon
Lasthenia californica	Goldfields
Lessingia (AKA Corethrogyne) filaginifolia	California sand-aster
Leymus condensatus	Giant wildrye
Lupinus albifrons	Bush lupine
Malosma laurina	Laurel sumac
Nassella cernua	Nodding needlegrass
Nassella (AKA Stipa) lepida	Foothill needlegrass
Nassella pulchra	Purple needlegrass
Opuntia littoralis	Coastal prickly pear
Plantanus racemosa	California Sycamore
Quercus agrifolia	Coast live oak
Rhus integrifolia	Lemonadeberry
Salvia apiana	White sage
Salvia leucophylla	Purple sage
Sisyrinchium bellum	Blue-eyed grass

Appendix C. Maps of some common (mapped) weeds.

(Images courtesy of Generation Water)

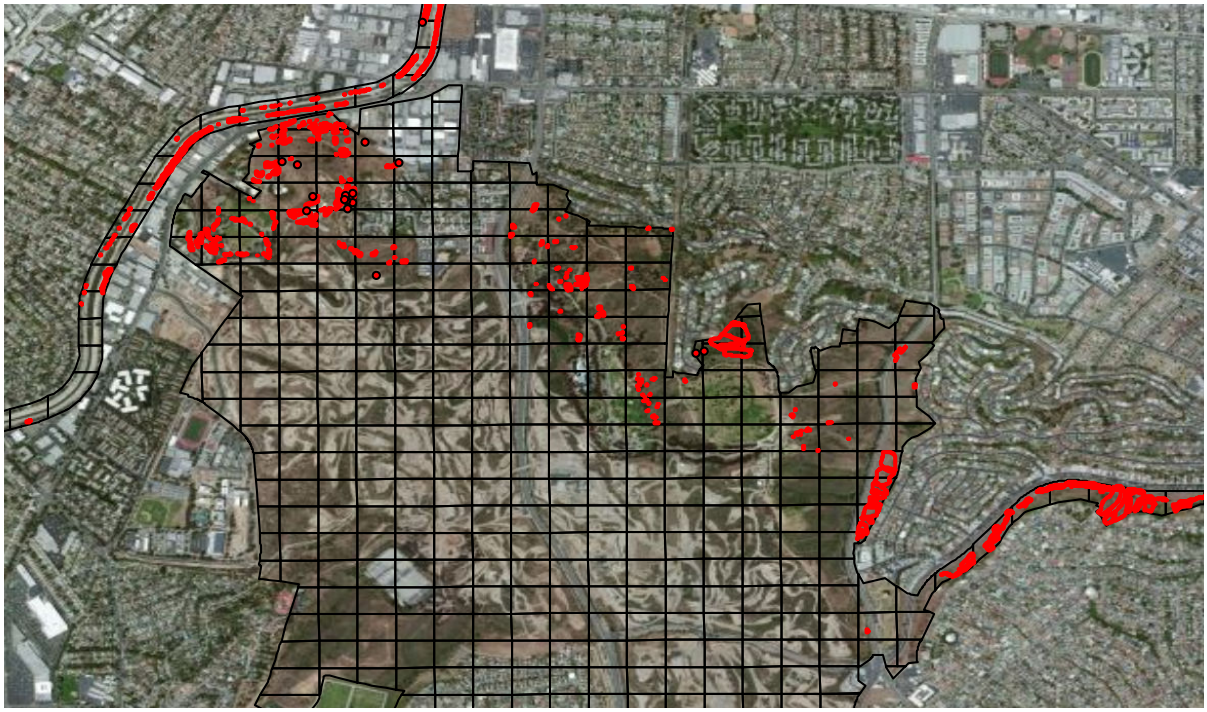

Figure C-1. Smilo (*Piptatherum miliaceum*).

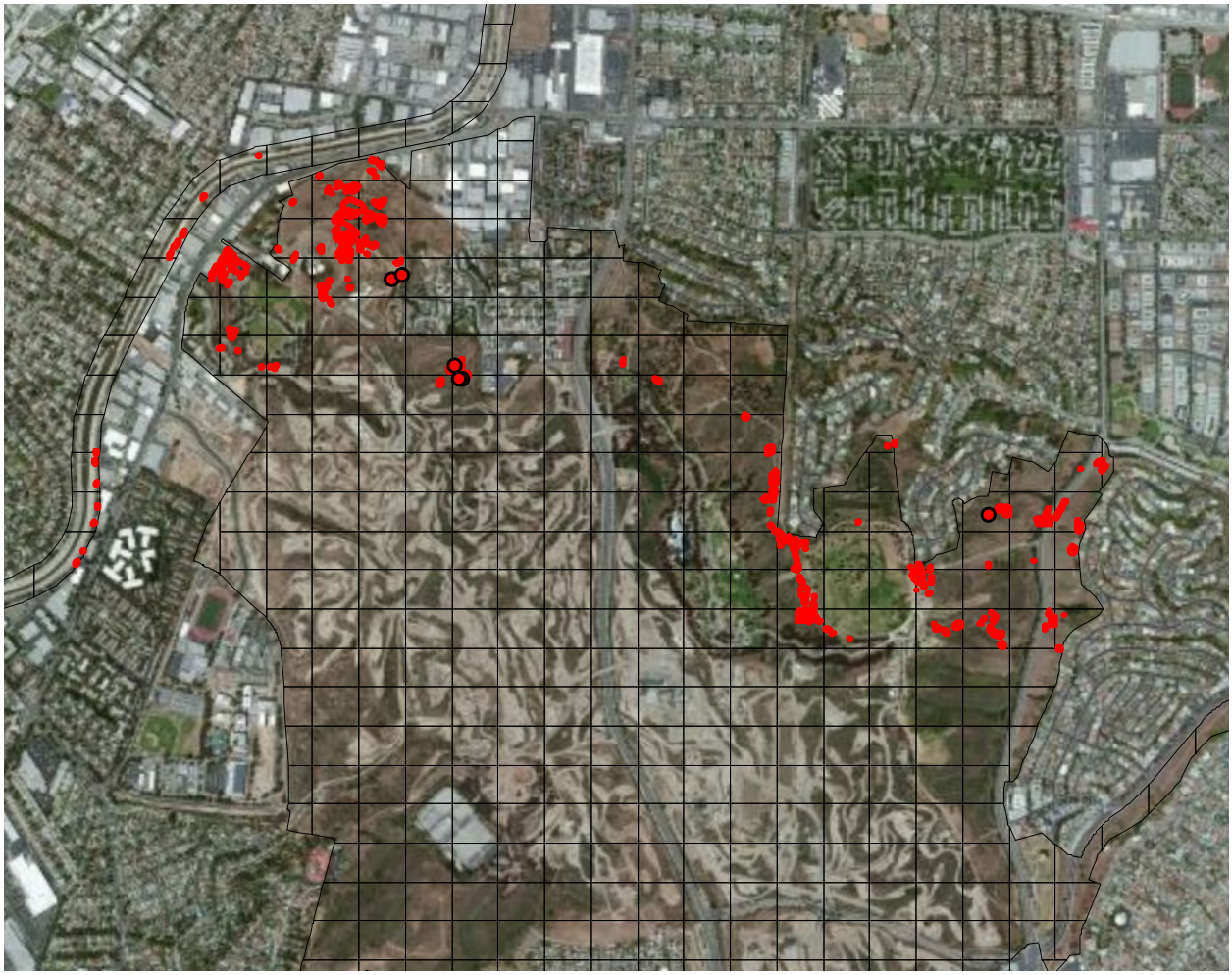

Figure C-2. Mustards (e.g., *Brassica* sp.)

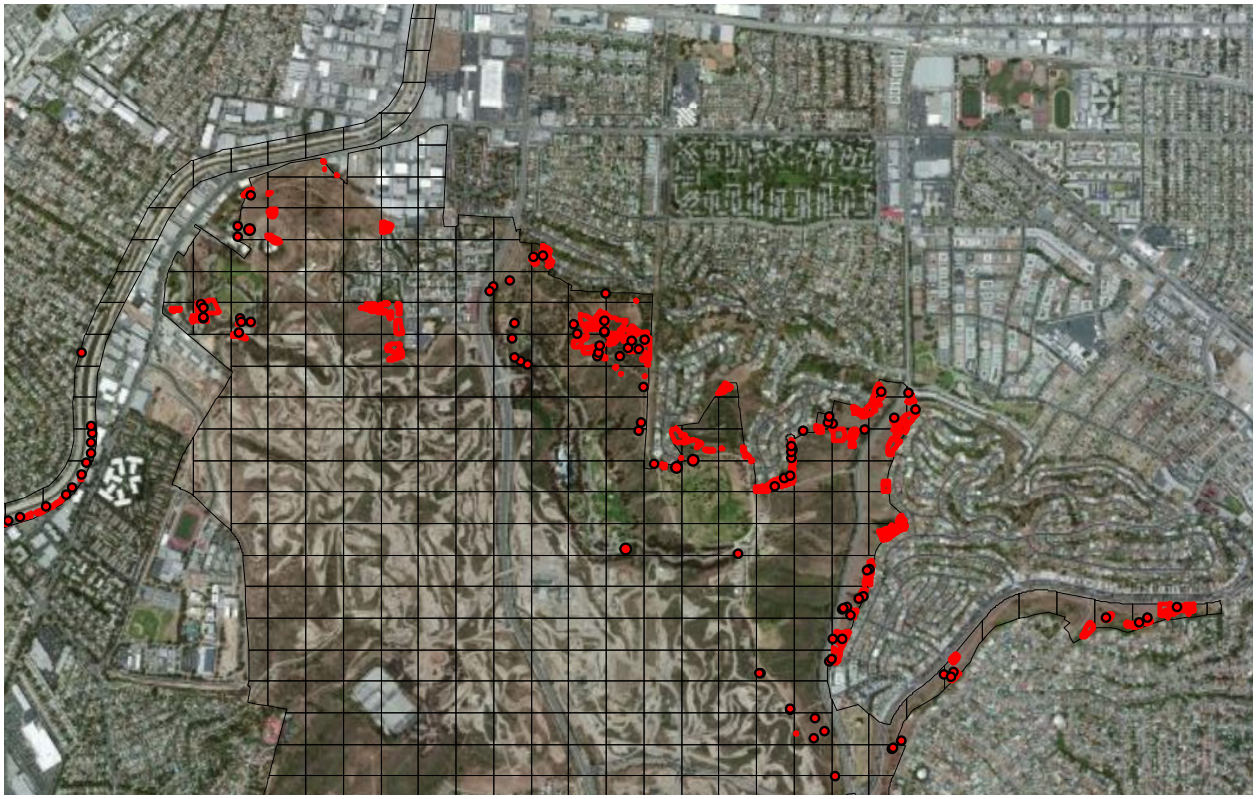

Figure C-3. Iceplant (*Carpobrotus* sp.)

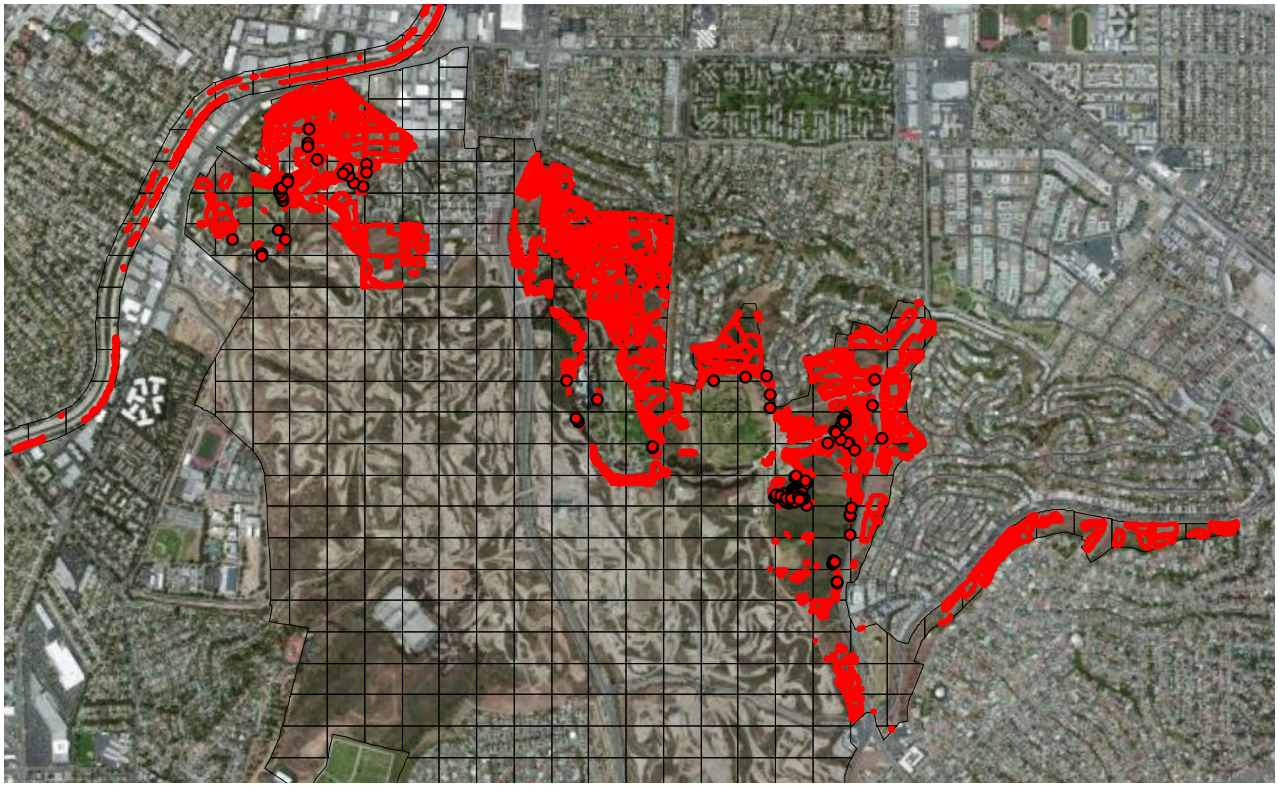

Figure C-4. Leafy spurge (*Euphorbia terracina*)

Figure C-5. Radish (*Raphanus* sp.)

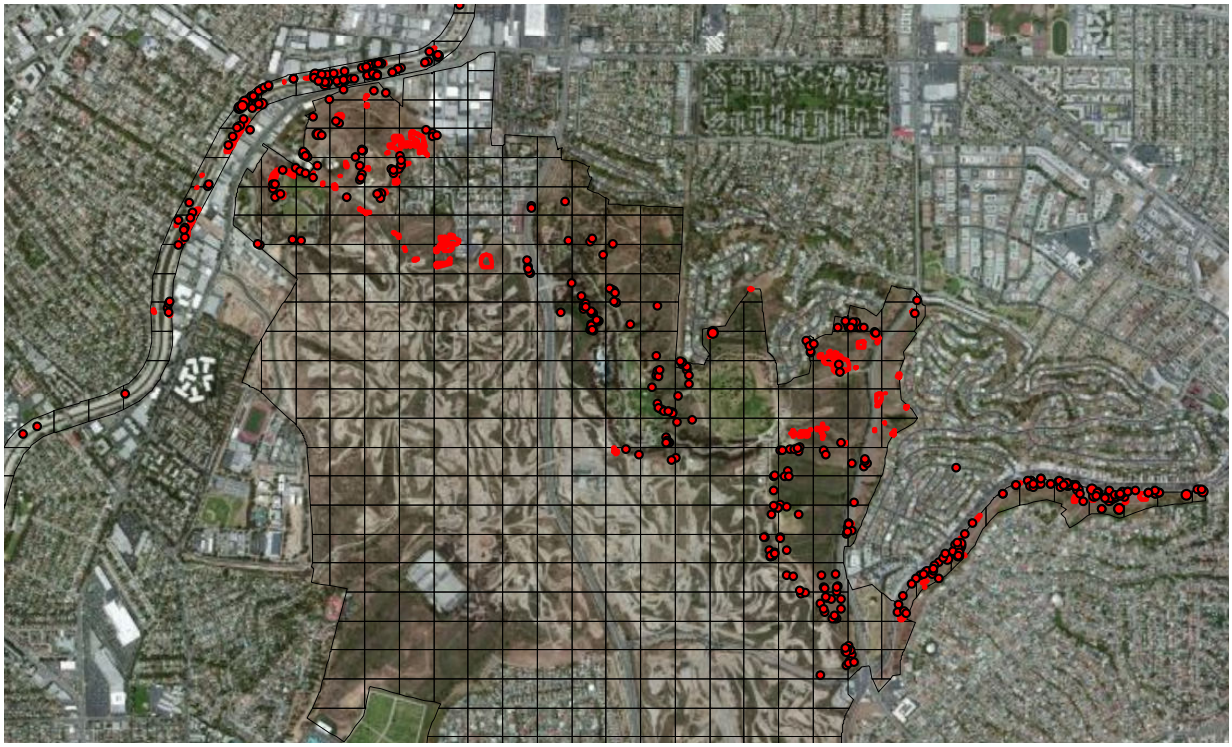

Figure C-6. Castor bean (*Ricinis communis*)

Appendix D. Images of potential reference sites.

(southwestern Simi Hills, Ventura Co.)

Figure D-1. Typical soil of southwestern Simi Hills. Note blocky white sedimentary rock (shoe for scale)

Figure D-2. Typical Xeric Scrub habitat of southwestern Simi Hills, here dominated by California sagebrush (dull olive), purple sage (gray), and black sage (whitish). Non-native mustard in foreground. This landscape is almost identical in outward appearance to historical photographs of other coastal hills in region (e.g., Palos Verdes Peninsula, Pt. Dume) and probably approximates their natural historical condition.

Figure D-3. Seep Scrub habitat, showing poison-oak (reddish) and giant wildrye (beige; at left).

Figure D-4. Typical Mesic Scrub of southwestern Simi Hills, showing southern California black walnut (yellow-green), laurel sumac (light green) and toyon (dark green).