Questions and Answers

The Coastal Training Program continues to field questions to land managers and scientists to further clarify issues of concern for maritime chaparral conservation. The following text outlines a number of questions we have received and draft answers to those questions. In many cases, the answers have been peer reviewed by leading experts in maritime chaparral ecology and conservation. If you have additional questions or comments, or if you would like to borrow a video tape of the days' presentations, please contact Grey Hayes.

Identification of Maritime Chaparral

1. We understand that maritime chaparral (MC) consists primarily of manzanita varieties. What other native plants typically occur within the maritime chaparral habitat?

See the attached revised definition of Maritime Chaparral for clarification of the dominant species found in different types of Maritime Chaparral habitat. In the Monterey Bay area, maritime chaparral is dominated by (in approximate decreasing abundance): manzanitas, live oaks, chamise, toyon, ceanothus, coffeeberry, and coast silk tassel.

As maritime chaparral is a fire dependent ecosystem, the plant species found in a given area will vary depending on the length of time since the last fire. Most of the maritime chaparral in the central coast of California is dominated by a few shrub species because few fires have occurred in recent years. The following tables illustrate the typical dominant plant species in different seral stages of maritime chaparral (Tables 1-3).

Table 1: In mature maritime chaparral, a number of woody shrub species dominate this habitat type.

Scientific name	***Common name***
Adenostema fasciculata	Chamise
Arctostaphylos spp.	Manzanitas
Ceanothus spp.	Blue blossom; California lilac
Dendromecon rigida	Bush poppy
Garrya eleptica	Silk tassel bush
Gaultheria shallon	Salal
Heteromeles arbutifolia	Toyon
Marah fabaceus	People root
Pickeringia montana	Chaparral pea

Scientific name	***Common name***
Quercus agrifolia	Coast live oak
Rhamnus californicus	Coffeeberry
Toxicodendron diversilobum	Poison oak
Vaccinium ovatum	Huckleberry

Table 2: Adolescent chaparral, from 5-12 years following a fire, grasses and short-lived perennials are dominant species.

Scientific name	***Common name***
Ceanothus spp.	Blue blossom; California lilac
Elymus glaucus	Blue wild rye
Lotus scoparius	Deer brush
Melica spp.	Melic grass
Mimulus aurantiacus	Sticky monkeyflower
Nassella spp.	Needlegrasses
Salvia mellifera	Black sage

Table 3: Young chaparral, shortly after a fire, is dominated by a diverse assemblage of wildflowers.

Scientific name	***Common name***
Castilleja spp.	Paintbrushes, owl's clovers
Cryptantha spp.	Popcornflower
Eschscholzia californica	California poppy
Gilia spp.	Gilly flowers
Lotus spp.	Deer brush, etc.
Lupinus spp.	Lupines
Phacelia spp.	Phacelia

2. Are there special-status (i.e., federally/state listed, CNPS listed), that also typically occur in MC?

Appendices 1-6 contain comprehensive lists of special status species occurring in maritime chaparral. Appendix 1 is the list for Monterey County plants. Appendix 6 contains special status animal species found in the central coast's maritime chaparral.

3. Can an area containing a mix of chaparral and non-chaparral plants constitute "maritime chaparral"?

Plant communities are not discreet entities. No two species are distributed alike, and there are infinite levels of spatial and temporal intergradations in species composition in natural vegetation. Thus, the boundaries between what is clearly maritime chaparral and another vegetation type are difficult to precisely define. There is also difficulty in cases where maritime chaparral has been degraded and now supports some natural vegetation mixed with species that invaded with degradation. One approach planners can use is to identify and protect areas that have not been degraded by modern human activities and weed invasion. These areas will be relatively rare. Areas that are degraded, but that can be restored relatively easily should receive protection as well. Other circumstances, probably the bulk of the habitat in Monterey County are more difficult.

Plant community nomenclature is usually used to indicate the present, dominant species assemblage of a plant community. But, maritime chaparral, like many California plant communities, is a disturbance-dependent ecosystem. The California Environmental Quality Act mandates that botanical surveys be conducted as part of an environmental review process, and that those surveys are used for a biotic inventory as well as to document the presence of any sensitive species or habitats. The term "presence" here is tricky, as maritime chaparral largely regenerates from a dormant seed bank. Such chaparral seed banks are believed to be persistent and long-lived due to extreme dormancy. Dormant seeds of many plants have known longevities of at least several centuries (Baskin & Baskin 1998) . *Therefore, in a very real manner, maritime chaparral species may also be "present" in what otherwise resembles several other plant communities, including grassland (early successional), coastal scrub (mid successional), or coast live oak woodland and pine forest (late successional). In addition, the invasion of weeds can overrun the above-ground maritime chaparral community while maintaining the below ground seed bank. Weed communities can include: blue gum, pampas grass, acacia, and Monterey pine.*

Most maritime chaparral areas in the Monterey Bay area, exhibit dynamics whereby cover of coast live oak and manzanita continue to increase in the absence of fire. Research in maritime chaparral elsewhere has shown that fire greatly reduces the cover of these species, and provides an opportunity for a host of other shade intolerant species, which eventually decline again as stands age. The full spectrum of temporal dynamics must be used in a definition of maritime chaparral. It is not static, steady state vegetation. This is important to consider because, presently, most maritime chaparral in the Monterey Bay area, except parts of Fort Ord, have not experienced fire in many decades, and exhibit the old growth form of the vegetation. It is paramount to the recovery and conservation of the ecosystem and its rare species that we learn to recognize previous distributions and potential regeneration sites for the community. This might best be accomplished through historical ecology methods, soils and soil seed bank analysis, creation of very large buffers from existing habitat areas, or experimental manipulation of habitat types with clearing and/or burning.

The tenets of the science of conservation biology caution against narrowly defining the range of a species or community. All successional stages are important for conservation. Plants in the soil seed bank carry with them genes that may be critical to the long-term viability of species.

4. Does one Pajaro or Hooker's Manzanita constitute "maritime chaparral"? If not one, how many, or how many square feet of an isolated stand would constitute MC?

An individual manzanita that is maritime chaparral dependent may or may not indicate the presence of maritime chaparral. An individual or small group of manzanitas might be planted, for instance, outside of its natural habitat and so would not indicate maritime chaparral. In most cases, however, single or small groups of manzanitas or other maritime chaparral dependent species alone would indicate maritime chaparral because of the aforementioned potential for the existence of a persistent soil seed bank.

Of course, the tenets of conservation biology caution that larger patches of habitat types, especially if are well connected with other patches, more readily conserve the organisms that depend upon them. However, there is an increasing awareness that even very small, isolated patches of habitats are important for the conservation of native plant species. Of course, in order to maintain the viability of smaller patches of habitat, it is important to maintain them against impacts of exotic species.

Restoration of Maritime Chaparral

1. If restoration of MC habitat were to be required as a mitigation measure, would maximum benefit result from implementing restoration adjacent to an existing chaparral stand, or are isolated chaparral stands equally sustainable?

First, it should be noted that further loss of maritime chaparral in the Pajaro hills or on the series of terraces above Monterey severely threatens the viability of these types of maritime chaparral. These should be considered endangered ecosystems and should be avoided entirely. Large-scale conservation plans need to be implemented to assure that no further fragmentation occurs in these habitats and to plan for restoration of disturbance regimes that will maintain the maritime chaparral habitat and species.

Perhaps because of the lack of study, there is disagreement among experts as to the best strategy for restoration mitigation. There are strong reasons supporting mitigation that is conducted adjacent to existing chaparral. First, many chaparral plants, particularly some of the sensitive herbaceous species, do not have adaptations for long-distance dispersal. Therefore, it is essential that they be located near sources populations. Second, the more fragmented the chaparral the less likely will it be feasible to recreate

the mosaic of burn intensities and frequencies characteristic of chaparral. Third, maritime chaparral hosts a host of animal species that require larger patches of habitats and cannot disperse across unsuitable habitat. However, these areas should only be restored if they contain the correct soils and have merely been lost due to succession. Isolated stands should be preserved in some cases as stepping stones or corridors between larger, in tact, chaparral areas.

In consultation with leading experts, The California Native Plant Society has adopted a set of guidelines concerning mitigation measures that we endorse fully. See: http://www.cnps.org/archives/mitigation.pdf

2. Can MC be planted in any type of sandy soil, or is MC dependent on a special type of sandy soil with other constituents?

Most chaparral communities in California are found on well drained soils. But, there are no examples of maritime chaparral being effectively restored through planting. While it is possible to plant a few of the dominant plant species frequently found in maritime chaparral, replacement of the numbers of seeds and diversity plant species found in the soil seed bank is not possible, as far as we know. There are probably hundreds of taxa of fungi and insects that are dependent upon maritime chaparral; many of these species have yet to be described. The restoration of all of these life forms is beyond anything now possible.

Many maritime chaparral species are associated with specific substrate, moisture, and exposure types. Pajaro manzanita is restricted to xeric (drier) exposed sites on the Aromas red sands where it forms a tall canopy on deeper unconsolidated soils and a lower canopy on shallow sandstone. Similarly, Sandmat manzanita is found only on ancient dune soils. Toro manzanita is present at sites on Aromas sands as well as on nearby alluvial soils. Hooker's and shagbark manzanitas grow on a wider variety of well-drained soils, derived from sand- or mudstone. Research by Professors Dr. Laurel Fox and Karen Holl at UCSC suggest that sand gilia is highly sensitive to soil moisture both at the seed germination and seedling stage. Sand gilia requires sufficient moisture to germinate, but does not tolerate water-logged soils.

Beyond these coarse soil structural requirements, the specific soil requirements (pH, organic matter, nutrients, and fungal communities) of maritime chaparral are unknown.

3. Would eradication of invasive species within existing chaparral be as beneficial as creating additional habitat, in terms mitigation for impacts/ habitat loss?

Certainly, management of existing habitat is far superior to attempts to create additional habitat. See notes above about the impossibility of maritime chaparral creation. The only viable mitigation (e.g., compensating for the impact by replacing or providing substitute resources or environments) for destruction of existing chaparral is the outright purchase or purchase of conservation easements for ecological protection, along with

long-term funding for managing maritime chaparral areas that would otherwise have been destroyed. It should be noted that eradication of invasive species is a temporary measure with little assurance of long-term benefit without solid funding mechanisms (such as endowments) of mitigation banks.

4. How important is diversity of manzanita species within MC habitat?

The importance of manzanita species diversity depends upon the question about importance and the scale of inquiry. There may food webs or other interactions between organisms that depend on many differently diverse communities of manzanitas. For instance, a population of native bees may depend upon the staggered timing of mass blooming of one species of manzanita over many acres. Or, there may be leaf miner insects that depend upon two or three species of manzanitas in close proximity in different generations of offspring. What can be said with certainty is that it is important to maintain some areas of the extremes of species diversity that currently exist. The precautionary principle requires that we maintain the large patches of only Pajaro manzanita, brittle leaf manzanita, sand mat manzanita, etc., that we currently find. It also says that we should maintain areas where these species are well mixed and co-dominant.

It is essential that natural habitats contain sufficient and appropriate genetic diversity to enable them to adapt to changing conditions (e.g. wildfire suppression, groundwater depletion, exotic species, pathogens, climate change). Attention should be paid to maintaining the genetic integrity of local plants: manzanitas and ceanothus, in particular, hybridize readily and so landscape plantings of these genera should be avoided in areas with native stands. In restoration sites, genetic diversity and species diversity should be maintained by maintaining the full array of native species and gene pools of those species.

5. Should mitigation or restoration strategies include planting and growing all of the varieties of manzanita associated with MC , or should restoration aim to enhance the number of rare and less common manzanitas?

This question is informed by previous comments on the efficacy of planting and restoring maritime chaparral. It is important to remember that many mitigation requirements for maritime chaparral are aimed at species other than manzanitas – sand gilia, spineflower, etc. With these previous comments in mind, another important concept is that restoration plans identify a reference ecosystem that is appropriate to the area identified for mitigation/restoration. That is, a site should be identified that is in close proximity, very similar in slopes, position on slope, soil texture and chemistry, aspect, soil seed bank, position on landscape, and disturbance history, etc. Identification of a reference site will guide the restoration goals; all species that are present at the reference site should be restored to the mitigation site. In some cases, certain species appear to be in decline throughout their normal range; in the Monterey Bay area, Ceanothus species and

Ericameria fasciculate are disappearing and so might be particularly augmented in some cases.

6. What are appropriate buffers between development and maritime chaparral?

Buffers should be designed on a site-by-site basis (Kelly & Rotenberry 1993). Appropriate buffers depend on surrounding use, the design of buffers, the size of the maritime chaparral patch, the priority conservation values of within the patch, and the layout of the surrounding matrix. Buffers should be designed to allow prescribed fire to be used for the long-term conservation of maritime chaparral.

7. Developers have advocated development in "unhealthy areas of MC or areas in decline" as an option to consider when locating development. Is this a rational approach? Are unhealthy areas or areas that contain dead or dying MC typically in transition?

There is no point in the natural dynamics of this plant community at which it can be said to be unhealthy or in decline. The term "health" is being misused here. In natural vegetation there will always be processes of disease and mortality. Such processes are not unhealthy as long as they are natural. The two most likely explanations for "unhealthy" or "declining" maritime chaparral are the introduction of human-caused disturbance and gradual conversion to woodland resulting from fire suppression. Maritime chaparral species are very long-lived, as is their seed bank, so senescence (old age) is unlikely to be the cause. Moreover, scientific studies of chaparral have found that senescence and senescence risk do not occur. The dense, impenetrable mature vegetation is every bit as vigorous as the young vegetation, and it resists weed invasion. If disturbance (and the resulting introduction of exotic species or pathogens) is the cause, the habitat would likely recover if the source of disturbance was eliminated through management or restoration.

8. How can an established seed bank and/or root balls of apparently dead (maritime chaparral) plants be “revived,” and is it generally accepted that they are in transition and will ultimately regenerate?

Most species will regenerate from the dormant seedbank if there is a fire. Species like oaks will resprout, but not if they are dead. A number of studies have looked at seed bank dynamics and plant demography and found that there is no reason to be concerned with “senescence risk.” Therefore, at least among chaparral ecologists and others familiar with these studies and the dynamics of the vegetation it can be said that it is widely accepted that there are transitions in the form of natural dynamics as stands age, and that chaparral will regenerate particularly well after fire.

Maritime chaparral is not significantly different from montane or inland chaparral, in that some species are stimulated to germinate with light, and others require direct effects of fire (i.e., heat, charate, or smoke). Removal of canopy and plant litter will result in germination of some species but not all. Claudia Tyler and others (Swank & Oechel 1991; Tyler 1995, 1996)*, have found that addition of light, or removal of competing shrubs, can produce a flush of germination, but intense herbivory in small cleared patches can prevent those seedlings from surviving. Many of the species that do not require direct effects of fire to germinate, still benefit greatly, in terms of growth and survival, from indirect effects of fire such as higher soil nutrient levels, in addition to reduced herbivory.*

In most cases it is fair to say that older stands/seed banks will ultimately regenerate when they are burned. The exception may be stands that are so old (? hundreds of years?) that density of viable seed is too low to withstand the mortality rate that comes with any fire. There are probably very few stands where that is likely to be the case. Perhaps the other exception would be old stands that are burned in the wet season, or are exposed to other deleterious factors (intense weed invasion) that would ultimately reduce post fire regeneration.

9. What is the overall recommended goal when considering development in MC: avoiding the creation of pockets of development among MC and maintaining continuous expanses? Or are other goals to be considered?

The overall goal is avoidance of the in tact habitat or areas of habitat that may contain a diverse maritime chaparral seed bank. Conservation of larger blocks of maritime chaparral is the best strategy. Another, corollary goal is the reduction of edge effects. These include increased invasion by exotic grasses that compete with endangered plant species (e.g., sand gilia) and invasion of exotic animal species (e.g., argentine ants) that compete with rare native animals (e.g., coast horned lizard) or disrupt other ecosystem functions (e.g., seed dispersal by native harvester ants). .

Other goals include conservation of corridors between maritime chaparral areas, preservation of especially biologically rich patches of chaparral, intelligent landscape planning in developments, setting aside of funding for long-term management of chaparral reserve areas, and avoidance of impacts from development such as light and noise pollution, erosion, and irrigation. It is important to note that there are many indirect impacts of development that are more difficult to mitigate and perhaps more deleterious than direct impacts.

It is also important not to forget that maritime chaparral is a fire-adapted habitat. As the vegetation matures and the canopy increases in height, the volume of flammable material increases. Sooner or later, fire will occur. Development that is scattered throughout the chaparral is far more difficult to defend from fire. Therefore, clustered development adequately separated from large chaparral expanses is preferable from the perspective of safety as well as for preservation of habitat. Developed areas need to have clearance

zones around them to prevent catastrophic loss to fire, and leading to the loss of even more chaparral habitat.

10. What is known to be more valuable in terms of animal habitat, MC or Oak Woodland?

-n.b. there was a lot of trouble with answering this question because reviewers were unsure of what was being asked. The question could refer to value in terms of: 1) species richness 2) supporting rare species 3) support for given cohort of animals or 4) providing good corridors between core reserve areas.

Without further clarification on the question, it should be said that the habitats are equally valuable to animals: they both have their place in the landscape mosaic. Different animals use each type of habitat and many may depend on both, so it depends on the animal and the time of year. For instance, deer prefer chaparral over oak habitat for cover and browse, but rely heavily on acorns during certain times of the year. The diversity of animals that use each and the value of each of the habitats during different life stages, times of year, etc, make this a difficult question to answer.

Oak woodland is a habitat type that may be more widespread in extent while maritime chaparral is extremely rare and decreasing. The "sudden oak death" disease may change this dynamic, making oak woodland rarer, though this disease may also affect chaparral shrub species.

11. Is the crowding out of MC by Oak Woodland a natural process or is it induced by man?

The answer is both. Succession is a natural phenomenon and, at times during the evolution of many of the maritime chaparral species, there were fire free times and times where there was less browsing, so that oaks may have crowded out the habitat. However, humans have variously removed the Pleistocene megafauna and changed fire regimes such that most of the large-scale disturbance processes which maintained maritime chaparral are now gone, creating an environment that greatly facilitates the invasion of oaks. There is a large body of research from various locations on the central coast that demonstrates that maritime chaparral is successionally stable under cycles of occasional fire, but that oak woodland will eventually dominate most sites in the absence of fire.

12. Some biologists have suggested that MC is naturally on the way out altogether. What is your response to this theory?

Insofar as humans and their <u>actions</u> are considered natural, then those biologists are correct. The reasons that maritime chaparral is currently disappearing are human-induced: changes in disturbance regimes, introduction of exotic species, development,

and fragmentation. There is evidence that maritime chaparral species such as the manzanitas have been evolving quite readily to the changing coastal environment over the last 2 million years, creating new species, and maintaining a diverse assemblage of closely associated fungi and invertebrates. There is no evidence that this community was on the verge of extinction prior to very recent human activities.

APPENDIX 1: Sensitive plant species associated with maritime chaparral in Monterey County

Click on the species name for a full account, and usually a photo, of the species

Scientific name	Status	Common name
Arctostaphylos cruzensis	Fed S.O.C. CNPS 1B	Arroyo de la Cruz Manzanita
Arctostaphylos edmundsii	CNPS 1B	Little Sur manzanita
Arctostaphylos hookeri hookeri	CNPS 1B	Hooker's manzanita
Arctostaphylos montereyensis	CNPS 1B	Toro manzanita
Arctostaphylos pajaroensis	CNPS 1B	Pajaro manzanita
Arctostaphylos pumila	CNPS 1B	Sandmat manzanita
Ceanothus cuneatus var. rigidus	Fed S.O.C. CNPS 4	Monterey ceanothus
Chorizanthe douglasii	CNPS 4	Douglasí spineflower
Chorizanthe pungens pungens	Fed T CNPS 1B	Monterey spineflower
Cirsium occidentale var. compactum	CNPS 1B	Compact cobwebby thistle
Cordylanthus rigidus ssp. littoralis	State E CNPS 1B	Seaside bird's beak
Cupressus goveniana ssp. goveniana	Fed T CNPS 1B	Gowenís cypress
Eriastrum virgatum	CNPS 4	Virgate eriastrum
Ericameria fasciculata	CNPS 1B	Eastwood's goldenbush
Gilia tenuiflora ssp. arenaria	Fed E State T CNPS 1B	Sand gilia
Horkelia cuneata sericea	Fed S.O.C. CNPS 1B	Kelloggís horkelia
Lomatium parvifolium	CNPS 4	Coastal biscuit root
Mimulus rattanii ssp. decurtatus	CNPS 4	Santa Cruz County monkeyflower
Monardella undulata	Fed S.O.C. CNPS 4	curly leaved mondardella
Pinus radiata	CNPS 1B	Monterey pine
Piperia michaelii	CNPS 4	Michaelís rein orchid
Piperia yadonii	Fed E CNPS 1B	Yadon's rein orchid
Rosa pinetorum	CNPS 1B	Pine rose
Trifolium trichocalyx	State R CNPS 1B	Monterey clover

APPENDIX 2: Sensitive plant species associated with maritime chaparral in Santa Cruz County

Scientific name	Status	Common name
Arctostaphylos andersonii	Fed S.O.C. CNPS 1B	Santa Cruz mountains manzanita
Arctostaphylos glutinosa	CNPS 1B	Shreiber's manzanita
Arctostaphylos hookeri hookeri	CNPS 1B	Hooker's manzanita
Arctostaphylos ohlone pro. sp.	No listing, but very, very rare	An undescribed manzanita on Lockheed property in "the chalks"
Arctostaphylos silvicola	CNPS 1B	Silver leaf manzanita
Calandrinia breweri	CNPS 4	Brewer's calandrinia
Calyptridium parryi var. hesseae	CNPS 3	Santa Cruz Mountains pussypaws
Ceanothus cuneatus rigidus	Fed S.O.C. CNPS 4	Monterey ceanothus
Chorizanthe pungens pungens	Fed T CNPS 1B	Monterey spineflower
Cupressus abramsiana	Fed E State E CNPS 1B	Santa Cruz cypress
Ericameria fasciculata	CNPS 1B	Eastwood's goldenbush
Eriogonum nudum var. decurrens	Fed S.O.C. CNPS 1B	Ben Lomond buckwheat
Erysimum teretifolium	Fed E State E CNPS 1B	Santa Cruz wallflower
Gilia tenuiflora ssp. areneria	Fed E State T CNPS 1B	Sand gilia
Hoita strobilina	CNPS 1B	Loma prieta hoita
Horkelia cuneata sericea	Fed S.O.C. CNPS 1B	Kellogg's horkelia
Lomatium parvifolium	CNPS 4	Coastal biscuitroot
Malocothamnus arcuatus	CNPS 1B	Arcuate bush mallow
Micropus amphibolus	CNPS 3	Mt. Diablo cottonweed
Mimulus rattanii decurtatus	CNPS 4	Santa Cruz County monkeyflower
Monardella undulata	Fed S.O.C. CNPS 4	curly leaved mondardella
Penstemon rattanii kleei	Fed S.O.C. CNPS 1B	Santa Cruz Mtns. beardtongue
Piperia michaelii	CNPS 4	Michael's rein orchid

APPENDIX 3: Sensitive plant species associated with maritime chaparral in San Luis Obispo County

Scientific name	Status	Common name
Agrostis hooveri	CNPS 1B	Hoover's bentgrass
Arctostaphylos cruzensis	Fed S.O.C. CNPS 1B	Arroyo de la Cruz Manzanita
Arctostaphylos hookeri hearstiorum	Fed S.O.C. CNPS 1B	Hearst's manzanita
Arctostaphylos hooveri	CNPS 4	Hoover's manzanita
Arctostaphylos obispoensis	CNPS 4	Bishop's manzanita
Arctostaphylos pilosula	CNPS 1B	Santa Margarita manzanita
Aspidotis carlotta-halliae	CNPS 4	Carlotta Hall's lace fern
Bloomeria humilis	State R CNPS 1B	dwarf goldenstar
Calycadenia villosa	CNPS 1B	dwarf calycadenia
Ceanothus hearstiorum	Fed S.O.C. CNPS 1B	Hearst's ceanothus
Ceanothus maritimus	Fed S.O.C. CNPS 1B	Maritime ceanothus
Eriastrum luteum	CNPS 1B	yellow-flowered eriastrum
Lomatium parvifolium	CNPS 4	Coastal biscuitroot
Monardella undulata	Fed S.O.C. CNPS 4	curly leaved mondardella

APPENDIX 4: Sensitive plant species associated with maritime chaparral in San Mateo County

Scientific name	Status	Common name
Arctostaphylos andersonii	Fed S.O.C. CNPS 1B	Santa Cruz mountains manzanita
Arctostaphylos imbricata	Fed S.O.C. State E. CNPS 1B	San Bruno mountain manzanita
Arctostaphylos montaraensis	Fed S.O.C. CNPS 1B	Montara manzanita
Cupressus abramsiana	Fed E State E CNPS 1B	Santa Cruz cypress
Dirca occidentalis	CNPS 1B	western leatherwood
Horkelia cuneata sericea	Fed S.O.C. CNPS 1B	Kellogg's horkelia
Malocothamnus arcuatus	CNPS 1B	Arcuate bush mallow
Micropus amphibolus	CNPS 3	Mt. Diablo cottonweed
Monardella undulata	Fed S.O.C. CNPS 4	curly leaved mondardella

APPENDIX 5: Sensitive plant species associated with maritime chaparral in California's central coast region

The following are the abbreviations used for the counties: SLO = San Luis Obispo; MNT = Monterey; SCR = Santa Cruz; SMT = San Mateo

Scientific name	County	Status	Common name
Agrostis hooveri	SLO	CNPS 1B	Hoover's bentgrass
Arctostaphylos andersonii	SCR/SMT	Fed S.O.C. CNPS 1B	Santa Cruz mountains manzanita
Arctostaphylos cruzensis	MNT/SLO	Fed S.O.C. CNPS 1B	Arroyo de la Cruz Manzanita
Arctostaphylos edmundsii	MNT	CNPS 1B	little sur manzanita
Arctostaphylos glutinosa	SCR	CNPS 1B	Shreiber's manzanita
Arctostaphylos hookeri hearstiorum	MNT/SLO	Fed S.O.C. CNPS 1B	Hearst's manzanita
Arctostaphylos hookeri hookeri	MNT/SCR	CNPS 1B	Hooker's manzanita
Arctostaphylos imbricata	SMT	Fed S.O.C. State E. CNPS 1B	San Bruno mountain manzanita
Arctostaphylos montaraensis	SMT	Fed S.O.C. CNPS 1B	Montara manzanita
Arctostaphylos montereyensis	MNT/SCR	CNPS 1B	Torro manzanita
Arctostaphylos nova sp.	SCR	No listing, but very, very rare	An undescribed manzanita on Lockheed property in "the chalks"
Arctostaphylos pajaroensis	MNT/SCR	CNPS 1B	Pajaro manzanita
Arctostaphylos pumila	MNT	CNPS 1B	Sandmat manzanita
Arctostaphylos silvicola	SCR	CNPS 1B	Silver leaf manzanita
Ceanothus cuneatus var. fascicularis	SLO	CNPS 4	Lompoc ceanothus
Ceanothus cuneatus var. rigidus	MNT/SCR	Fed S.O.C. CNPS 4	Monterey ceanothus
Ceanothus ferissae	SCL	Fed E CNPS 1B	Coyote ceanothus
Ceanothus hearstiorum	SLO	Fed S.O.C. CNPS 1B	Hearst's ceanothus
Ceanothus maritimus	SLO	Fed S.O.C. CNPS 1B	Maritime ceanothus
Chorizanthe pungens hartwegiana	SCR	Fed E CNPS 1B	Ben Lomond spineflower
Chorizanthe pungens pungens	MNT/SCR	Fed T CNPS 1B	Monterey spineflower
Cirsium occidentale var. compactum	SMT/MNT/SLO	CNPS 1B	Compact cobwebby thistle

Scientific name	County	Status	Common name
Cordylanthus rigidus ssp. littoralis	SB/MNT	State E CNPS 1B	Seaside bird's beak
Cupressus abramsiana	SCR/SMT	Fed E State E CNPS 1B	Santa Cruz cypress
Cupressus goveniana ssp. goveniana	MNT	Fed T CNPS 1B	Gowen cypress
Dirca occidentalis	SMT	CNPS 1B	western leatherwood
Eriastrum virgatum	MNT	CNPS 4	Virgate eriastrum
Ericameria fasciculata	MNT/SCR	CNPS 1B	Eastwood's goldenbush
Eriogonum nudum var. decurrens	SCR	Fed S.O.C. CNPS 1B	Ben Lomond buckwheat
Erysimum teretifolium	SCR	Fed E State E CNPS 1B	Santa Cruz wallflower
Gilia tenuiflora ssp. areneria	MNT/SCR	Fed E State T CNPS 1B	Sand gilia
Horkelia cuneata sericea	MNT/SCR/ SLO/SMT	Fed S.O.C. CNPS 1B	Kellogg's horkelia
Lomatium parvifolium	SCR/MNT SLO	CNPS 4	Coastal biscuitroot
Malocothamnus arcuatus	SMT/SCR	CNPS 1B	Arcuate bush mallow
Mimulus rattanii decurtatus	SCR/MNT	CNPS 4	Santa Cruz County monkeyflower
Monardella undulata	MNT/SCR SMT/SLO	Fed S.O.C. CNPS 4	curly leaved mondardella
Penstemon rattanii kleei	SCR	Fed S.O.C. CNPS 1B	Santa Cruz Mtns. beardtongue
Pinus radiata	MNT	CNPS 1B	Monterey pine
Piperia michaelii	MNT/SCR	CNPS 4	Michael's rein orchid
Piperia yadonii	MNT	Fed E CNPS 1B	Yadon's rein orchid
Trifolium trichocalyx	MNT	State R CNPS 1B	Monterey clover

Appendix 6: Sensitive animal species associated with maritime chaparral in California's central coast region

Scientific name	County	Status	Common name
Ambystoma macrodactylum croceum	MNT/SCR	Endangered	Santa Cruz long-toed salamander
Anniella pulchra nigra	MNT/SCR	Rare	black legless lizard
Dipodomys venustus venustus	SCR	Rare	Santa Cruz kangaroo rat
Polyphylla barbata	SCR	Endangered	Mt. Hermon june beetle
Stennama sp.	MNT	?	undescribed ant species
Trimerotropis infantilis	SCR	Endangered	Zayante band-winged grasshopper

Appendix 7: Maritime Chaparral Mitigation/Restoration Projects

Site Name/ Nearest City	Size of Site	Success or Failure/Notes
North of Fairway/Seaside, CA	17 acres	Failure/native manzanitas and ceanothus not successfully transplanted, reestablished
UC MBEST/Marina	7 acres	Partial Success/weeds eradicated thus far in delineated areas

Appendix 8: Proposed Definition of Maritime Chaparral

The "Woolly leaf manzanita series" as described by Sawyer and Keeler-Wolf (Sawyer & Keeler-Wolf 1995), best describes many areas of maritime chaparral:

"forms of woolly leaf manzanita dominant or important shrub with one or more rare ceanothus or manzanita in canopy; black sage, California buckwheat, California coffeeberry, California sagebrush, chamise, coyote brush, poison oak, and/ or toyon may be present. Emergent birch leaf mountain-mahogany, and /or coast live oak may be present. Shrubs < 3 m; canopy continuous. Ground layer sparse."

However, there are several areas of maritime chaparral not dominated or even partially occupied by woolly leaf manzanita. The following manzanita species dominate large areas of maritime chaparral and qualify for designation as unique series in future updated versions of the Sawyer and Keeler-Wolf text:

- Arctostaphylos andersonii
- A. canescens
- A. crustacea
- A. edmundsii
- A. glutinosa
- A. hookeri hearstiorum
- A. hookeri hookeri
- A. montaraensis
- A. montereyensis
- A. morroensis
- A. nummularia sensitiva
- A. ohlone pro. sp.
- A. pajaroensis
- A. pumila
- A. purissima
- A. silvicola
- A. tomentosa (all subspecies and forms)
- Ceanothus cuneatus var. rigidus
- Ceanothus hearstiorum
- Ceanothus maritimus
- Ceanothus cuneatus var. fascicularis
- Ceanothus gloriosus var. gloriosus
- Ceanothus gloriosus var. exaltatus
- Ceanothus gloriosus var. porrectus

This new description combines, among other things, the following previous definitions:

Chaparral on ancient sand deposits at Ft. Ord, Nipomo, Vandenberg, Morro Bay
(Griffin 1978).

Northern Maritime Chaparral, Central Maritime Chaparral, Southern Maritime Chaparral: "within the zone of summer fog incursion" (Holland 1986).

Ecologically, maritime chaparral is separated from interior chaparral by having greater exposure to summer fog, humidity, and mild temperatures moderating drought pressures and, potentially leading to adaptations to different disturbance regimes (less frequent fire).

It is important to recognize that, imposing inappropriate disturbance regimes can result in maritime chaparral being replaced by other community types. Inappropriately frequent or out of season fire or some types of land clearing can convert maritime chaparral to grassland or species-poor coastal scrub (Stylinski & Allen 1999, Odion & Tyler 2002). Infrequent disturbance or invasion of non-native species can temporarily change maritime chaparral to woodland or coastal scrub communities, but in such cases, seed bank remains awaiting fire or clearing (Van Dyke & Holl 2001). Delineation of maritime chaparral, therefore, should include analysis of historical air photos to determine prior extent of the community.

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