APPENDIX C

2008 Vegetation Monitoring Report for the Interim Action Ranges Munitions Response Area

2008 Vegetation Monitoring Report for the Interim Action Ranges Munitions Response Area

Former Fort Ord
Monterey County, California

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Prepared for:

FORT ORD REUSE AUTHORITY

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ACRONYMS AND ABBREVIATIONS

Army	U.S. Department of the Army
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
dm	decimeter
DTSC	Department of Toxic Substances Control
ENSO	El Niño Southern Oscillation
EPA	U.S. Environmental Protection Agency
ESCA	Environmental Services Cooperative Agreement
FORA	Fort Ord Reuse Authority
GIS	Geographic Information System
GPS	Global Positioning System
HMP	Habitat Management Plan
IAR	Interim Action Ranges
LFR	LFR Inc.
m	meter
MEC	munitions and explosives of concern
mm	millimeter
MRA	Munitions Response Area
MRS	Munitions Response Site
RP	Remediation Program
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance

1.0 INTRODUCTION

This 2008 vegetation monitoring report was prepared by LFR Inc. (LFR) on behalf of the Fort Ord Reuse Authority (FORA) under the Environmental Services Cooperative Agreement (ESCA). This report documents vegetation monitoring conducted in 2008 to satisfy a requirement of the Installation-Wide Multispecies Habitat Management Plan (HMP; USACE 1997).

1.1 Purpose

Vegetation monitoring is required in habitat reserve parcels to document recovery following munitions and explosives of concern (MEC) clearance. “Baseline” condition is established by an initial vegetation survey conducted prior to disturbance of the area for the purpose of MEC clearance. After disturbance, vegetation surveys are repeated at intervals prescribed in the applicable monitoring protocol. If the results of the post-MEC-clearance surveys reveal that recovery is proceeding satisfactorily (i.e., temporal changes generally coincide with an anticipated “recovery trajectory” toward the “baseline” condition), no additional mitigation measures (such as active restoration) may be required. If recovery is deemed not to be proceeding satisfactorily, additional monitoring and/or mitigation measures may be proposed.

This report presents the results of a post-MEC-clearance vegetation survey conducted in 2008 in the Interim Action Ranges Munitions Response Area (IAR MRA). In addition, this report reviews and evaluates previously collected monitoring data for the area (see Section 1.3) and provides findings regarding trends in the status of plant communities. The potential influences on the communities of rainfall and plant community succession are also discussed.

1.2 Site Description

This survey was conducted at the former Fort Ord, which is located about 8 miles north of the city of Monterey, California, within the IAR MRA (Figure 1). The IAR MRA is approximately 231 acres in size located at the northern end of the former “Impact Area.” Prior to 2008, vegetation surveys were conducted within the Ranges 43-48 Munitions Response Site (MRS), part of which included the area currently referred to as the IAR MRA. The IAR MRA is designated for use as development (parcel E40) and habitat reserve (parcels E38, E39, E41, and E42; Figure 2). The portion of the IAR MRA covered in this survey (“the survey area”) encompasses the habitat reserve parcels, which comprise approximately 206 acres. An aerial photograph of the IAR MRA taken in 2007 is shown on Figure 2.

The survey area is within the “Northwest Pacific Coast” climate class which is characterized by variable precipitation, cool summer temperatures, and mild winter temperatures (Major 1988). In the Monterey area, local climate is influenced by summer fog and predominant cool northwest winds. There is a sharp gradient in climate from the coast to inland areas, where summer temperatures may be much higher, especially during calm periods and/or in areas sheltered from the prevailing winds (Major 1988). The IAR MRA, just over 2 miles from the Monterey Bay coastline, is closer to the coastal portion of this gradient.

Terrain over most of the IAR MRA consists of rolling hills (2 to 15% slopes) with elevations ranging from 370 to 530 feet. The surface soils are characterized as eolian (sand dune) and terrace (river deposits), which consist of unconsolidated materials of the Aromas and Old Dune Sand formations. The soils in the IAR MRA are predominantly weathered dune sand: primarily Arnold-Santa Ynez Complex with Baywood Sand in the northwestern portion of the MRA.

The vegetation in the IAR MRA is primarily maritime chaparral with patches of annual grasslands (Figure 3). Maritime chaparral is a vegetation type of particular concern in the HMP because of its association with a number of rare, threatened, and endangered species populations (i.e., "HMP species," including HMP annuals).

1.3 Relevant Site History

A "baseline" or existing condition flora and fauna survey of the Fort Ord Military Reservation (i.e., former Fort Ord, including the IAR MRA) was conducted and reported in 1992 (USACE 1992). However, this baseline was not obtained pursuant to the vegetation monitoring protocol established to evaluate post-MEC-clearance vegetation recovery, and the data obtained in the 1992 survey are not discussed further in this report.

Baseline and subsequent vegetation surveys of the IAR MRA obtained pursuant to the vegetation monitoring protocol established to evaluate post-MEC-clearance vegetation recovery were conducted prior to 2008. As indicated above, vegetation surveys conducted prior to 2008 ranged across the Ranges 43-48 MRS, which included the IAR MRA. Therefore, only a portion of the results presented in monitoring reports for the Ranges 43-48 MRS are directly relevant to the IAR MRA. The vegetation surveys performed during the period from 1999 to 2005 that are relevant to the 2008 IAR MRA survey and which are summarized below were conducted in accordance with the "Protocol for Conducting Vegetation Sampling at Former Fort Ord in Compliance with the Installation-Wide Multispecies Habitat Management Plan" (Jones & Stokes Associates, Inc. 1995).

A summary of events from 1999 through 2005 that are relevant to the IAR MRA 2008 vegetation survey is presented below.

- 1999 and 2000: Baseline shrub transects were established and sampled within the Ranges 43-48 MRS, including 12 in 1999 and 67 in 2000, to document baseline conditions (HLA 2001). In this report, the survey reported by HLA (2001) is referred to as the "2000 survey" even though some of the data were collected in late 1999. Of the 79 transects established, 33 were placed within what is now the IAR MRA.

  Transects were placed by HLA into one of three chaparral stand groups based on examination of aerial photographs and fieldwork: disturbed, intermediate-age, or mature (HLA 2001, p. 2). They indicated that they perceived these groups as associations or successional stages (i.e., seral stages) that could be separated by fire or disturbance history. Disturbed habitat included areas that had been subjected to regular disturbance and was generally located in range fans with cleared rows along firing lines that were interspersed with patches of chaparral species. Intermediate-age stands were estimated to be 5-15 years old and ranged from 3-6 feet in height. Mature stands were composed of fully mature to senescent stands of shrubs that were estimated to be greater than 15 years old and from 6-15 feet in height. HLA stated that disturbed stands were transitional in species composition and cover between intermediate-age and mature chaparral.

- 2000 (April-May): Baseline surveys were completed for three HMP annuals (sand gilia, Monterey spineflower, and seaside bird's-beak; Parsons 2005).
- 2001 to 2003: No surveys were conducted because no U.S. Department of the Army (Army) remedial actions had occurred.
- 2003 (October): Prescribed burn was conducted.
- 2004 (April-May): In the first spring following the burn, a survey was conducted by MACTEC for three HMP annuals: Monterey spineflower, sand gilia, and seaside bird's-beak (MACTEC 2005). No shrub (i.e., transect) sampling was conducted, because only a few months had elapsed since the burn, and there was insufficient regeneration of shrubs to provide adequate assessment of shrub recovery. Munitions removal work on the Ranges 43-48 MRS had barely begun at this time.
- 2005 (April-September): Surveys were conducted for three HMP annuals: Monterey spineflower (unspecified time frame), sand gilia (April-May), and seaside bird's-beak (June-July; Parsons 2005). Per the protocol, quantitative data were collected for sand gilia and seaside bird's-beak; however, for Monterey spineflower, only presence/absence data (within 100- by 100-foot grid blocks) were collected, owing to lack of time. The first post-baseline shrub transect survey was also conducted (August-September). Transects were evaluated based on the three groupings employed by HLA (2001). Two of the transects occupied in 2005 were not among those occupied in the 1999-2000 baseline survey. Because there are no baseline data for these two transects, they are not discussed further in this report.

2.0 2008 SURVEY OVERVIEW

The 2008 vegetation survey effort in the IAR MRA habitat reserve parcels represented a continuation of a series of surveys that was begun with the 1999-2000 baseline survey. Two types of vegetation surveys were conducted in 2008 per the then-applicable monitoring protocol (Burleson 2006; see Section 3.0 for more details): HMP annual species and shrub community surveys.

2.1 Scope of Surveys

The HMP annual species survey involved resampling or subsampling of the grid blocks within which the species had been recorded in the baseline surveys. The 2008 survey included plant counts of three HMP annual species: Monterey spineflower (*Chorizanthe pungens* var. *pungens*), sand gilia (*Gilia tenuiflora* ssp. *arenaria*), and seaside bird's-beak (*Cordylanthus rigidus* ssp. *littoralis*).

A shrub community survey (line-intercept data) was performed on the 33 baseline transects that occurred within the IAR MRA. The protocol also calls for quadrat sampling along the transects to obtain percentage cover data of herbaceous species if the abundance of that vegetation type along the transects meets certain criteria; in 2008 the criteria were not met on any transects and therefore no quadrat data were collected.

2.2 HMP Annual Species Accounts

HMP annual species are relatively rare and some are difficult to detect in the field; therefore, accurate field identification is critical to obtaining robust data for these species. The following species account information documents the basis for field identification of the HMP annual species that was employed in the 2008 survey.

2.2.1 Monterey Spineflower

Monterey spineflower *(Chorizanthe pungens* var. *pungens)* is an annual plant currently classified in the buckwheat family Polygonaceae (Figure 4, Page 1 and bottom of Page 3).

2.2.1.1 Flowering Period

The flowering period for the species generally extends from April through June (USFWS 1998). Experience in the former Fort Ord area indicates that the peak flowering period (i.e., the period during which focused surveys should be conducted) is somewhat longer than 30 days and the onset of this period varies somewhat from year to year.

2.2.1.2 Habitat

Monterey spineflower grows in loose (not compacted) dune sands and open sandy washes, such as those at the base of erosion scores of paleosol (compacted Pleistocene marine) sands (see Figure 4, bottom of Page 1). It is somewhat tolerant of sands with higher silt content, and can be found in more silty sand alluvium.

This species often can be found in gaps in low growing maritime chaparral (approximately <1 meter in height) and coastal dune scrub (Hayes and Taylor 2006b). Sand gilia may co-occur with Monterey spineflower in certain microhabitats (see Figure 4, bottom of Page 3), but because it is cryptic, sand gilia does not serve as a conspicuous field indicator of Monterey spineflower. However, populations of *Croton californicus* may be a field indicator of such microhabitats as it co-occurs with sand gilia (Figure 4, Pages 2-3).

Monterey spineflower prefers areas low in cover of exotic annual grasses and non-native herbaceous species (e.g., *Erodium* spp.) but is more tolerant of such species than sand gilia, having been recorded in areas with >60% cover of non-native herbaceous vegetation. Monterey spineflower also occurs in areas containing high percentage cover of native annual species.

At the former Fort Ord, this species has been found in firebreaks, along roadsides, in sandy openings between shrubs, in the central portion of the firing range (i.e., "the impact area") and in areas where military activities resulted in frequent habitat disturbances (USFWS 1998).

2.2.1.3 Appearance

Monterey spineflower is a prostrate annual herb <2.5 decimeters (dm) tall and gray-villous throughout. Its leaves are positioned in a basal rosette, oblanceolate, about 5 centimeters long and generally 4 to 7 millimeters (mm) wide, rounded apically (see Figure 4, Page 1). The inflorescence is relatively dense on the secondary branches, with solitary involucres, smooth or somewhat ventricose basally, 3-angled and 6-ribbed, villous, with an obvious white membranous margin, the teeth uncinate with one approximately 3.5 mm long and the remainder 2 to 3 mm long (Hayes and Taylor 2006b).

2.2.1.4 Summary of Biology and Ecology

This plant occurs in areas of relatively mild maritime climate, characterized by fog and winter rains (USFWS 1998). The fog helps keep summer temperatures cool and winter temperatures relatively warm, and provides moisture in addition to the normal winter rains.

Seed dispersal is facilitated by the involucral spines, which attach the seed to passing animals (USFWS 1998). This species has a preference for gaps in the vegetation or sparsely vegetated areas on sandy substrate, which allows seedlings to establish in areas that are relatively free from other competing native species (USFWS 1998). This species is also known to exhibit population densities directly related to the previous year's seed set, and negatively associated with time since the most recent El Niño Southern Oscillation (ENSO) event (Fox et al. 2006).

2.2.2 Sand Gilia

Sand gilia *(Gilia tenuiflora* ssp. *arenaria)* is an annual plant currently classified in the phlox family (Polemoniaceae, Figure 4, Pages 2 and 3).

2.2.2.1 Flowering Period

There appears to be disagreement in the literature as to peak flowering period for this species. Hayes and Taylor (2006c) state that this species flowers in May and June, but the U.S. Fish and Wildlife Service (USFWS) reports that seeds germinate from December to February, and fruit is set from the end of April to the end of May (USFWS 1998). Experience in the former Fort Ord area indicates that the peak flowering period (i.e., the period during which surveys for this species should be conducted) is approximately 30 days long and the onset of this period varies somewhat from year to year. The peak flowering period for this species typically is encompassed within that of Monterey spineflower.

2.2.2.2 Habitat

Sand gilia occurs in loose (not compacted) dune sands and open sandy washes at base of erosion of paleosol (compacted Pleistocene marine) sands with predominately low silt content reminiscent of beach sands (very sandy; see Figure 4, top of Page 3). The species is usually tolerant of small amounts of drifting sand, but tends to occur in stable areas with minimal sand accretion or deflation (USFWS 1998).

Gaps in low growing maritime chaparral (<1 meter in height) and coastal dune scrub often serve as suitable habitat (USFWS 1998; Hayes and Taylor 2006c). Absence of exotic annual grasses and non-native herbaceous species (e.g., *Erodium* spp.) is preferred by the species, but areas where there is low cover of such species may be tolerated by sand gilia. In some of its microhabitats, this species is known to co-occur with Monterey spineflower (Figure 4, bottom of Page 3).

The species also prefers areas low in cover of native herbaceous species (<60% cover), but the presence of *Cardionema ramosissimum, Eriastrum virgatum,* and/or *Navarretia atractyloides* may serve as a field indicator of suitable habitat. Low-growing dune scrub species associated with *sand gilia* include silver beach lupine (*Lupinus charnissonis*), *Phacelia distans, Amsinckia spectabi*/*is,* beach sagewort, mock heather (*Ericameria ericoides*), and coast buckwheat, and low-growing herbs such as *Camissonia contorta*, *C. micrantha*, *C. cheiranthifolia*, *Linaria canadensis*, *Crassula connata,* and several species of *Chorizanthe* (USFWS 1998). Within the open, sparsely vegetated dunes, associated species include Monterey spineflower, dune knotweed, slender fescue (*Vulpia octoflora*), blue toadflax (*Linaria canadensis*), and popcorn-flower (*Cryptantha lejocarpa*; USFWS 1998).

2.2.2.3 Appearance

Plants are less than 1.7 dm tall with a basal rosette of leaves (USFWS 1998; Hayes and Taylor 2006c). The central stem is erect with several other stems spreading out from the base which are covered with dense glandular hairs, sometimes giving a cobwebby appearance near the base (USFWS 1998). This subspecies has funnel-shaped flowers with narrow petal lobes 2 to 4 mm wide and a narrow, purple throat 2 to 3 mm wide; other characteristics that distinguish this subspecies from the other three subspecies include relatively large fruit capsules that are 5 to 6 mm long and stamens that are only slightly exerted (USFWS 1998). Sand gilia locally intergrades with *G. tenuiflora* ssp. *tenuiflora* at the more inland areas of its distribution at the former Fort Ord (USFWS 1998).

2.2.2.4 Summary of Biology and Ecology

The species is thought to be primarily self-pollinating based on its stamens not protruding from the flower, no observations of pollinators, and very viable seed (USFWS 1998). The species appears to produce viable seed even at very small statures, which are dispersed by wind throughout the dune openings; dispersal, however, is inhibited by dense stands of low-growing dune scrub (USFWS 1998).

According to the literature on the species, sand gilia resides as a large, multi-year seed bank in shallow surface soil. It is thought that optimal conditions trigger large-scale germination from this seed bank. The germination success of any particular year is thought to be independent of germination success of the previous year (Fox et al. 2006). Rabbit herbivory significantly affects the survival of young seedlings and adult plants (USFWS 1998). Mice or voles may also graze the species, but if the basal rosette is not entirely taken, the plant often recovers and sets seeds.

2.2.3 Seaside Bird's-Beak

Seaside bird's-beak (*Cordylanthus rigidus* ssp. *littoralis)* is an annual bushy herb currently classified in the Scrophulariaceae or figwort family (see Figure 4, Page 4).

2.2.3.1 Flowering Period

The flowering period of this species begins in June (occasionally May) and continues to August, with identification possible into October (Hayes and Taylor 2006a).

2.2.3.2 Habitat

Seaside bird's-beak grows in young marine sand deposits along the coast or inland on older elevated marine terraces with very sandy soils, and occasionally in loose residual soils in adjacent sites (Figure 4, bottom of Page 4; Hayes and Taylor 2006a). It can often be found in sandy soils of stabilized dunes covered by closed-cone pine forest, cismontane woodland, or maritime chaparral (DFG 2008; Hayes and Taylor 2006a). The species often thrives in areas of recent surface soil disturbance or in areas with reduced levels of competition from shrubs and herbaceous plants (DFG 2008).

2.2.3.3 Appearance

This species is a bushy, erect herb up to 2 feet tall, and the entire plant is yellow (chlorotic) to yellowish green with leaves covered in fine hairs (DFG 2008; Hayes and Taylor 2006a). Its flowers are clustered in dense bracteate heads, with each flower subtended by outer as well as inner bracts, and the corolla is yellowish with white pouches.

C. rigidus is a variable species with geographically separated but intergrading races (Chuang & Heckard 1986, as cited by Hayes and Taylor 2006a). Seaside bird's-beak can be distinguished from ssp. *rigidus* and ssp. *setigerus* by shape of the outer inflorescence bracts and generally by color (reddish and with higher chlorophyll concentrations in the latter two subspecies, this perhaps indicating a lesser nutritional reliance on parasitism (Hayes and Taylor 2006a).

2.2.3.4 Summary of Biology and Ecology

According to Hayes and Taylor (2006a), the species is hemi-parasitic on the roots of (presumably) annual dicots and graminoids, but there is nearly nothing known about the hosts required or their ecology.

The historic distribution of seaside bird's-beak was, until recently, thought to be restricted to northern Monterey County; the recent base closure of Fort Ord resulted in the protection of several of these populations (DFG 2008). However, in the early 1980s, several collections from Burton Mesa in Santa Barbara County were identified as this subspecies. At some of the Santa Barbara County sites, subspecies *littoralis* hybridizes with subspecies *rigidus*, with the latter also native to this area (DFG 2008).

3.0 METHODS

In 2008, the Army requested that the ESCA Remediation Program (RP) conduct a vegetation survey in the IAR MRA using the “Draft Protocol for Conducting Vegetation Monitoring in Compliance with the Installation-Wide Multispecies Habitat Management Plan at Former Fort Ord” (“the 2006 Protocol”; Burleson 2006) with a few modifications requested by the Army (pers. comm. William Collins, Wildlife Biologist, of the Fort Ord Base Realignment and Closure [BRAC] Office 2008).

3.1 HMP Annuals

3.1.1 Sand Gilia and Monterey Spineflower

Surveys for both species were conducted from April 28 through May 14, 2008 by LFR staff with subcontractor assistance. Based on reconnaissance field observations, this period coincided with the peak bloom period for both species. The 2008 wet season was relatively dry and precipitation occurred late in the season.

The 2008 sample population was composed of a randomly selected 5% subsample of the 100-foot square grid cells where each species had been recorded as being present in the 2005 survey. A map of the IAR MRA with all sampled grid cells is shown on Figure 3. Because the spatial distributions of the two species were different, the 2008 sample populations were independently determined for each of the two species. In the 2005 survey, each grid cell where sand gilia was observed to be present was placed into one of four density ranges (see Section 5.1.4 for details). To obtain a representative subsample for the 2008 survey, each density range was employed as a sampling stratum and grid cells within each stratum were assigned a sequential number according to their occurrence on the grid coordinate system. The assigned numbers were sampled using a random number table until slightly more than 5% of the total number of grid cells within the stratum had been selected. The process was repeated for all strata where abundance was >0 so that the total number of grid cells selected accumulated to slightly more than 5%. Selected grid cells exceeding the 5% value were held in reserve to be sampled if one or more of the 5% grid cells could not be sampled owing to field conditions.

The 2005 survey for Monterey spineflower, in contrast to that of sand gilia, only recorded the presence of the species within the 100-foot grid cells. Accordingly, the method used to determine where the Monterey spineflower survey would be conducted in 2008 involved a 5% sample of all grid cells where the species was recorded as being present in 2005, using the same method as was used for each of the strata of the sand gilia data set.

Because the distributions of the two species substantially overlapped and sample populations of grid cells for each of the two species were selected independently of each other, it was possible for a grid cell to be selected for monitoring of both species; however, there was no overlap in grid cells selected for sampling.

In the course of the survey, one of the selected grid cells was so densely populated with poison oak that sampling could not have been safely conducted. In this instance, the cell was eliminated and one of the reserve grid cell samples was substituted.

All four corners of each grid cell were loaded into a Global Positioning System (GPS) unit with identifying information so that field staff could precisely navigate to any selected cell and know whether it was to be sampled for sand gilia or Monterey spineflower. Per the BRAC Wildlife Biologist (pers. com. 2008), each sample cell was thoroughly canvassed and the location where the highest population was present was selected as the center point for the sample plot.

The survey plots were 5-meter-diameter circles centered on a point that was then recorded into the GPS unit with sub-meter accuracy (see Figure 3 for data, Figure 4 for data collection photographs). Because the sampling design was based on the grid cell system, plot locations were adjusted, if needed, so that no part of the plot extended outside of the grid cell being sampled.

Individual plants within the plots were counted with a tally counter, and the total was recorded both in the GPS unit and on field data sheets. Whereas sand gilia plants were sparse enough so that a fairly reliable count of plants was possible, counts from dense patches of Monterey spineflower should be considered as estimates with an increasing degree of uncertainty (i.e., increase in counting error) as density increases.

Placing the sample plot in the area of the grid cell with the highest density introduces bias into the sample data. Observations during the survey revealed that there was often a high degree of clumping of Monterey spineflower and sand gilia and that many of the sample plots encompassed all or most of their populations present within the grid cell. Therefore, total population estimates based on scaling from plot area to grid cell area could substantially overestimate the species population.

The generally cryptic condition of plants of these two species (especially sand gilia) in the survey area as well as the relatively short flowering period in 2008 (see discussion in Section 5.1.1) could have reduced the ability of field personnel to detect plants in the field and therefore could have resulted in false negative data. Survey success of sand gilia in particular is dependent on the survey being conducted during the peak flowering period for that year, as the plants are inconspicuous and presence of the small flowers are critical to detecting the plants in the field. Therefore, a procedure was adopted whereby field staff confirmed that a sand gilia reference population was in flower each day prior to beginning the survey for these two species. The reference population selected was located within the IAR MRA. By implementing this procedure, there is greater confidence that failure to detect the species in portions of the IAR MRA survey area means that plants of the species were not present in those portions in 2008.

3.1.2 Seaside Bird's-Beak

Surveys for seaside bird's-beak were performed from July 28 through July 30, 2008, by LFR staff with subcontractor assistance. This period coincided with the peak bloom period for the species in this year, due in part to a dry, late rainy season. In the 2005 survey of Ranges 43-48 MRS, seaside bird's-beak was recorded in 93 grid cells that occurred within IAR MRA. Because the grid cell population to be sampled was less than 100, a 5% sample would have generated too few data points to provide a reasonable population estimate. In the 2005 survey report, each grid cell where seaside bird's-beak was observed to be present was placed into one of four density ranges (see Section 5.1.4 for details). To obtain a representative subsample for the 2008 survey, each density range was employed as a sampling stratum and a minimum of five grid cells were selected from each stratum. Seven cells were selected from the "1-50" density range, because nearly half of the 93 cells fell into this group. Consequently, the 2008 sample size was 22 cells. A map of the IAR MRA with all sampled grid cells is shown on Figure 3. Sampling and plant counting methods were the same as those for sand gilia and Monterey spineflower described above.

3.2 Shrub Communities

3.2.1 Line-Intercept Sampling

Shrub (line-intercept) transect surveys were performed from July 30 through August 7, 2008, by LFR staff with subcontractor assistance (Figure 4, Page 5). As with the HMP annual species, this survey is a continuation of work performed previously in the Ranges 43-48 MRS of which the IAR MRA is a portion. The IAR MRA encompassed 33 of the previously established transects.

The transect endpoints that had been recorded in the 1999-2000 survey were downloaded from the Geographic Information System (GIS) database into the sub-meter accuracy GPS field unit. In the field, personnel navigated to the points, drove a stake at each transect end and strung a 50-meter measuring tape between them. Each transect was sampled in accordance with the 2006 Protocol. Data collected along the transect were of the line-intercept type. The interval along the transect intercepted by each shrub species, bare ground, or herbaceous vegetation was recorded. The sum of all these lengths is often greater than the length of the transect because of overlapping types of cover, and the total length of all vegetated segments recorded can be indicative of the overall density of the cover in the area of the transect.

The following conventions and requirements were used:

- Plant names are to be recorded as Latin binomials
- Bare ground will be recorded as "bare ground" or "bg"
- If no shrub species are present, but an herbaceous understory exists, “vegetated" or "veg." will be recorded
- If two (or more) shrub species overlap within a segment on the transect, all the species will be recorded for that segment
- Plants occupying less than 1 dm along the tape measure will not be recorded

The field procedure for collecting transect data followed these steps:

1. Starting at the beginning of the transect, write a "0" under "Start Distance" in the first row of the data sheet.
2. Proceed down each transect and record the beginning and ending points of the segment and the species present in that segment. Segments begin and end where species composition over the transect changes or where bare ground or vegetation begins or ends.
3. Continue this procedure until the end of the transect is reached.

Field data were recorded on the transect monitoring data sheets shown in Appendix A.

3.2.2 Quadrat Sampling

The 2006 Protocol also indicates that along transects where herbaceous species comprise a significant amount of the cover, quadrat sampling along the transect should also be performed to record these species. These areas are generally found in firebreaks or recently burned areas that have young maritime chaparral shrubs and lack the dense overstory canopy that shades out herbaceous vegetation in mature chaparral stands.

Quadrat sampling was performed on transects where the areas along the transect have:

- A high proportion of cover contributed by herbaceous plants
- A relatively low proportion of cover from shrubs

If these criteria were met, quadrats 0.25-square-meter (0.5- by 0.5-meter) square were placed at 10-meter intervals, alternating on the right and left sides of the transect line.

The procedure for these areas was as follows:

1. Place the 0.25-square-meter quadrat on the right side of the line at the 0.0 meter starting point.
2. Record the location of the monitoring quadrat on the top of the Quadrat Survey Form (Appendix A).
3. Identify all plant species present within the quadrat and estimate the percent relative cover for each. Enter the species names and cover values on the Quadrat Survey Form under the columns "species" and "percent areal cover," respectively.
4. For shrubs and rare plants within the quadrat, count the number of individuals of each and enter this number under the last column on the Quadrat Survey Form.
5. Estimate total vegetative cover within the quadrat and enter this number under "percent total vegetative cover" on the Quadrat Survey Form.
6. Repeat steps 2 through 5 at 10-meter intervals to the end of the transect, alternating right and left sides of the transect every 10 meters.

4.0 RESULTS

The results of the HMP annual and shrub community sampling efforts conducted in 2008 are reported in this section.

4.1 HMP Annuals

HMP annual surveys were conducted for Monterey spineflower, sand gilia, and seaside bird's-beak in 2008. Results are reported in this section.

4.1.1 Monterey Spineflower

Survey results for Monterey spineflower are shown on Figure 3. The species was recorded in all but two of the 26 grid cells sampled. The highest number of individuals recorded in a sample plot was 483, with a median of 37, a mean of 90, and a standard deviation of 115. The difference between the median and mean indicate substantial skewness in the data. These results were generated by a 5% sample of all the grid cells in which the species had been recorded in 2005. The sampling design therefore assumes that Monterey spineflower did not occur in 2008 outside the grid cells where it was recorded in 2005. However, as discussed in Section 5.1.4, not all of IAR MRA was surveyed for Monterey spineflower in 2005; therefore, a survey scaling factor of 1.061 is applied to compute the population in IAR MRA.

Assuming that the 2008 results reflect a valid sample and that sample plots encompassed all of the plants within each sampled grid cell, the total population of Monterey spineflower in the IAR MRA in 2008 is estimated by the following formula:

[A] (mean # plants/plot) x ((total number of occupied grid cells = (number of grid cells sampled x 20)) x (scaling factor) = total population

[B] (90) x (520 = (26 x 20)) x (1.061) = 49,655

The area encompassed by the circular plots was 211.1 square feet (sq ft) and each grid cell area is 10,000 sq ft, a factor of 47.37. Assuming that sample plots are representative samples of each sampled grid cell, the total population of Monterey spineflower in IAR MRA in 2008 is estimated by multiplying the result of [B] by the sample scaling factor of 47.37:

[C] 49,655 x 47.37 = 2,352,157

As indicated in Section 3.1.1, this species exhibited a highly clumped distribution at the survey area; therefore, [B] is considered to be the more accurate population estimate. Based on this consideration, the total population estimate of Monterey spineflower in the IAR MRA in 2008 is 49,655 plants.

4.1.2 Sand Gilia

Survey results for sand gilia are shown on Figure 3. The species was recorded in nine of the 22 cells sampled. The highest number of individuals recorded in a sample plot was 5, with a median of 0, a mean of 1, and a standard deviation of 1.53. These results were generated by a 5% sample of all the grid cells in which the species had been recorded in 2005. The sampling design therefore assumes that the species did not occur in 2008 outside the grid cells where it was recorded in 2005. As discussed in Section 5.1.4, not all of IAR MRA was surveyed for sand gilia in 2005; however, the survey data collected for this species were considered to be spatially complete. Therefore, a survey scaling factor of 1.061 is not applied to compute the population of this species in IAR MRA.

Assuming that the 2008 results reflect a valid sample and that sample plots encompassed all of the plants within each sampled grid cell, the total population of sand gilia in IAR MRA in 2008 is estimated by the following formula:

[D] (mean # plants/plot) x ((total number of occupied grid cells = (number of grid cells sampled x 20)) = total population

[E] (1) x (22 x 20) = 440

It should be noted that because the population estimate is a relatively small number, it is likely subject to a high degree of relative uncertainty, as indicated by the high standard deviation around the mean.

The area encompassed by the circular plots was 211.1 sq ft and each grid cell area is 10,000 sq ft, a factor of 47.37. Assuming that sample plots are representative samples of each sampled grid cell, the total population of sand gilia in the IAR MRA in 2008 is estimated by multiplying the result of [E] by the scaling factor of 47.37:

[F] 440 x 47.37 = 20,842

As indicated in Section 3.1.1, this species exhibited a highly clumped distribution at the survey area; therefore, [E] is considered to be the more accurate population estimate. Based on this consideration, the total population estimate of sand gilia in the IAR MRA in 2008 is 440 plants.

4.1.3 Seaside Bird's-Beak

Survey results for seaside bird's-beak are shown on Figure 3. The species was recorded in all but one of the 22 cells sampled. The 2005 survey recorded seaside bird's-beak in 93 cells within the IAR MRA, of which the 22 cells of the current survey are a subsample (0.2366 of the total number of grid cells). The sampling design therefore assumes that the species did not occur in 2008 outside the grid cells where it was recorded in 2005. The highest number of individuals recorded in a sample plot was 226, the median was 100, the mean was 88, and the standard deviation was 65.19. The difference between the median and mean may indicate some skewness in the data.

Assuming that the 2008 results reflect a valid sample and that sample plots encompassed all of the plants within each sampled grid cell, the total population of seaside bird's-beak in IAR MRA in 2008 is estimated by the following formula:

[G] (mean # plants/plot) x ((total number of occupied grid cells = (number of occupied grid cells sampled x 4.227)) = total population

[H] 88 x (22 x 4.227) = 8,183

Field observations in 2008 indicated that seaside bird's-beak did not exhibit as high a degree of clumping as was the case with Monterey spineflower and sand gilia. Therefore, the sample plots for seaside bird's-beak typically did not encompass all of the plants within a grid block and [H] is likely an underestimate.

The area encompassed by the circular plots was 211.1 sq ft and each grid cell area is 10,000 sq ft, a factor of 47.37. Assuming that sample plots are representative samples of each sampled grid cell, the total population of seaside bird's-beak in IAR MRA in 2008 is estimated by multiplying the result of [H] by the scaling factor of 47.37:

[I] 8,183 x 47.37 = 387,629

However, the sampling method had an inherent bias owing to the procedure for locating the sample plots in areas of highest density, so that [I] is likely an overestimate. Because [H] is considered to be an underestimate, whereas [I] is considered to be an overestimate, a value midway between [H] and [I] or 197,906 plants is judged to be a reasonable estimate of the total population of seaside bird's-beak in the IAR MRA in 2008.

4.2 Shrub Communities

Table 1 presents a comprehensive list of all plant species recorded on the IAR MRA transects in 2008. A total of 38 species (or lowest identifiable taxonomic unit) and one physical feature (bare ground) were recorded on the 2008 transects (i.e., this list includes all species recorded during both line-intercept and quadrat observations).

The 2000 baseline survey report placed each transect in a class based on seral characteristics including plant stature: disturbed, intermediate-age, or mature. Frequency and mean line-intercept distance data ("abundance" in this report) from the 2008 survey are shown in Table 2, by transect class.

4.2.1 Line-Intercept Data

Of the 33 transects in the GIS database that fell within the IAR MRA, three transects were excluded from line-intercept sampling; one because of very low shrub density at the firebreak along which it was located, and two because they were added in 2005 and were not established as part of the 2000 baseline survey. Therefore, only 30 of the 33 transects located within the survey area were sampled in 2008.

Only two of the transects classified as disturbed in 2000 fell within the IAR MRA and the values presented for this class are the averages of data from both transects. The five most abundant species were: shaggy-barked manzanita (25.6%), Monterey ceanothus (16.9%), dwarf ceanothus (12.3%), chamise (10.7%), and sandmat manzanita (5.3%). HMP species recorded on these transects were Monterey ceanothus, sandmat manzanita, and seaside bird's-beak. Bare ground was recorded at 29.8%.

Twelve of the transects classified as intermediate-age in 2000 fell within the IAR MRA and the values presented for this class are the averages of data from all of these transects. The five most abundant species on intermediate-age transects were: shaggy-barked manzanita (23.8%), dwarf ceanothus (20.4%), rush rose (17.9%), Monterey ceanothus (13.4%), and chamise (11.3%). HMP species recorded on these transects were seaside bird's-beak, sandmat manzanita, Monterey ceanothus, and Eastwood's goldenbush. Bare ground was recorded at 22.1%.

Sixteen of the transects classified as mature in 2000 fell within the IAR MRA and the values presented for this class are the averages of data from all of these transects. The five most abundant species on mature transects were: shaggy-barked manzanita (37.3%), dwarf ceanothus (27.9%), Monterey ceanothus (14%), deerweed (9.1%), and rush rose (8.5%). HMP species recorded on these transects were: Monterey ceanothus, sandmat manzanita, and Eastwood's goldenbush. Bare ground was recorded at 20.2%.

4.2.2 Quadrat Data

There were four transects with sufficient herbaceous cover to warrant quadrat sampling for herbaceous species. One of these four transects was excluded from the analysis because it had been established in 2005 (i.e., no baseline data were available). The second transect was excluded per the 2006 Protocol because it was located along a firebreak margin and there were insufficient shrubs for collection of line-intercept data. A summary of the quadrat data from the two remaining transects is shown in Table 3. Across a single transect, bare ground in quadrats was observed to vary by as much as 80%. Cover included shrubby species, as well as herbaceous plants too small to be counted in the transect survey (less than 0.1 meter along transect), but significant in some quadrats. These included species such as wedgeleaf horkelia (*Horkelia cuneata*; occupying 40% of one quadrat), silver carpet (*Lessingia filaginifolia*), and blue ryegrass (*Elymus glaucus*), among others.

5.0 DISCUSSION AND FINDINGS

The 2008 results presented in this report represent one of an ongoing series of surveys of plants conducted in the IAR MRA. The baseline surveys were conducted in 2000. For HMP annuals, subsequent surveys were conducted in 2004 and 2005. For shrub communities, a subsequent survey was conducted in 2005. This section evaluates all of the results to determine overall temporal trends in species and community populations and includes discussion of key factors that potentially may have influenced the trends.

5.1 HMP Annuals

5.1.1 Influence of Wet Season on Populations

Anecdotal information from experienced local botanists in winter/spring 2008 in advance of the survey work indicated that extant plants of sand gilia and Monterey spineflower were in general less frequent, more diminutive, less well developed, and with fewer and smaller flowers in spring 2008 than they had been in recent years. Also, it was thought that the 2008 peak flowering period would be shorter than the normal 30-day period. These differences were attributed to the substantially sub-optimal 2008 wet season.

The populations of annual plants produced each year are substantially affected by growing-season conditions and other factors. While many factors may influence inter-annual variations in annual plant species populations, wet season precipitation is no doubt a major factor influencing the annual species discussed in this report. In the Northwest Pacific Coast climate type to which the survey area is subjected, precipitation is temporally limited, resulting in a winter wet (i.e., growing) season alternating with a summer dry season. Both amount and temporal distribution of rainfall within the wet season are parameters that influence annual plant populations. Annuals are present during the dry season as a seed bank in the near-surface soil horizon. After the first substantial rain event, seeds germinate into plants that grow through the wet season. Toward the end of the wet season, as surface soils desiccate, plants reach maturity, become fertile, set seed, and senesce.

When wet season conditions are optimal (i.e., adequate rainfall evenly and widely distributed over the course of the wet season) annual species populations typically are relatively large, individual plants are robust, and seed set is high. At the end of such a wet season, the population is visually more evident and thus field surveys are more likely to detect the species, but accurate population counts may be difficult to obtain wherever the species populations are present in high densities.

When wet season conditions are substantially sub-optimal (i.e., inadequate rainfall infrequently and narrowly distributed over the course of the wet season) annual species populations may be relatively small or even non-existent, individual plants may be highly diminutive, and seed set may be low or absent. At the end of such a wet season, the plants are more cryptic (infrequent, diminutive, less well developed) and thus more difficult to detect in field surveys but population counts of detected populations may be more accurate because a greater portion of the species populations are present in low densities and those populations occur within a smaller footprint.

To evaluate the influence of the wet season on annual populations, rainfall data for the nearest publicly available station, the Monterey National Weather Service Forecast Office, were tabulated for the 2000-2008 wet seasons. These data were collected about 4 miles south of the survey area; therefore, they likely provide an acceptable general estimate of historical rainfall in the former Fort Ord area. The data on Figure 5 are organized according to wet season months (i.e., October of prior year through September of current year) and reveal that rainfall total for the 2008 wet season was 12.42 inches, lower than the total for 2000 (16.15 inches), substantially lower than that for 2005 (24.7), and marginally lower than that for 2004 (13.45 inches). The differences between years is even more marked when monthly rainfall amounts for the four sampling years are examined (Figures 6 through 9). The monthly data reveal that substantial rainfall in 2008 (i.e., greater than 3 inches per month) was mostly limited to a single month in contrast to the other years when substantial rainfall was recorded in two or more months. These results are consistent with the perceived association between rainfall and condition of the species populations observed in the 2008 survey (see below).

5.1.2 Population Status in 2000

Baseline surveys for HMP annuals were conducted in 2000 and reported in the 2000 Annual Monitoring Report (HLA 2001). These surveys were conducted over a wide area that included two sub-areas (“2000 burn area” and “MRA North”) that overlapped with the IAR MRA. Because the IAR MRA is not separately identified in the HLA report, results presented in the text and tables are not directly comparable to the 2008 survey results for the IAR MRA.

HMP annual data are included on Plate 14 of the 2001 report. For sand gilia and seaside bird’s-beak, “counts” were actual “direct” counts of plants in all areas where they were detected within the survey area. For Monterey spineflower, which occurred in much greater density, a scheme of abundance classes was employed to estimate populations: zero population, low density (1-500 plants), medium density (500+ to 5,000 plants), and high density (5,000+ plants). These density classes were associated with specific polygons and not with a fixed spatial unit. Zero population polygons included only a few small areas. The low density category was a default designation in that “the entire survey area is estimated to contain low-density spineflower unless otherwise noted” (p. 19).

To make a comparison between the 2000 and 2008 survey results, it was necessary to convert and tabulate the relevant data presented in Plate 14 of the 2001 report to produce total species population estimates within the area that is currently designated as the IAR MRA. For sand gilia and seaside bird's-beak, all direct plant counts within the IAR MRA footprint were tabulated. For Monterey spineflower, all polygons within the IAR MRA footprint were converted and tabulated into a total population estimate. Density categories were converted by using the midpoint of the density class or the low value of the highest density class (i.e., low density = 250 plants, medium density = 2,750 plants, high density = 5,000 plants). Our conversion of the high density class may therefore underestimate the population of Monterey spineflower in those areas. The results of these tabulations and conversions are presented in Table 4.

5.1.3 Population Status in 2004

Surveys for HMP annuals were performed in 2004 in the Ranges 43-48 MRS (MACTEC 2005). As previously discussed in this report, the IAR MRA is a portion of the Ranges 43-48 MRS. The 2004 surveys used three density classes similar to those used by HLA (2001). However, in contrast to the HLA density classes which were spatio-unit independent, these density classes are associated with a fixed spatial unit (i.e., number of plants per acre). The three density classes were defined as low (1-100 plants/acre), medium (101-1,000 plants/acre), or high (>1,001 plants/acre); a fourth unnamed class was 0 plants/acre as revealed in Plates 3, 4, and 6 of the report. Sample units were 100- by 100-foot (projected area) grid cells created by overlaying a coordinate system on an aerial photograph of the area. Projected area is not equivalent to general surface area except over terrain that is practically level and without significant topographical variation. Although there is a moderate degree of topographical variation within the IAR MRA, the error introduced by use of projected area is likely not substantial relative to other uncertainties associated with the sampling methods. The 2004 survey apparently involved a 100% sample of all grid cells located within the IAR MRA.

To make a comparison between the 2004 and 2008 survey results, it was necessary to convert and tabulate the relevant data presented in Plates 3, 4, and 6 of the MACTEC 2005 report to produce total species population estimates within what is currently designated as the IAR MRA. For each of the three species, only the grid cells that were >50% within the IAR MRA footprint were employed in this process. Density categories were converted to unit population estimates by using the midpoint of the density class or the low value of the highest density class (i.e., low density = 50 plants, medium density = 500 plants, high density = 1,001 plants). Our conversion of the high density class may therefore underestimate the population in those areas. Total species population estimates for 2004 were computed for IAR MRA by employing the following formula:

[J] [(50) (number of low density grid cells) + (500) (number of medium density grid cells) + (1,001) (number of high density grid cells)] (grid cell area in sq ft/acre in sq ft) = total species population

The results of conversion and tabulation of the 2004 data are presented in Table 5.

5.1.4 Population Status in 2005

Surveys for HMP annuals were performed in 2005 in the Ranges 43-48 MRS (Parsons 2005). As previously discussed in this report, the IAR MRA is a portion of the Ranges 43-48 MRS. Owing to lack of time, 32 acres of the Ranges 43-48 MRS were not surveyed for sand gilia and Monterey spineflower. Examination of Maps 3 and 5 in the Final 2005 Annual Biological Monitoring Report (Parsons 2005) reveals that 50 of the 876 grid cells in what are now the IAR MRA were not sampled for the two species in 2005. Parsons stated that the areas not surveyed were tall grass areas unsuitable for sand gilia and therefore the 2005 survey for that species is considered to be spatially complete for the purposes of this report. Parsons did not state that the areas not surveyed were unsuitable for Monterey spineflower and therefore a scaling factor is required in the formula used to compute the 2005 population estimate of Monterey spineflower in the IAR MRA. The scaling factor is computed by dividing the total number of grid cells in the IAR MRA (876) by the number of grid cells sampled in 2005 (826) which equals 1.061. The survey for seaside bird's-beak was limited to areas where the species had been recorded in the 2004 survey. The absence of the species outside the 2005 survey area was verified by reconnaissance observations in 2005. Parsons' (2005) sand gilia and seaside bird's-beak data that were obtained within the IAR MRA (i.e., for grid cells that were >50% within the IAR MRA boundary) were retrieved from the GIS database and the results are summarized in Table 5. The Monterey spineflower survey was qualitative: only presence/absence was recorded for each grid cell and it is not possible to compute a population estimate for the species in 2005. However, the report stated that "visual observations during surveys for other species confirmed consistently high densities of spineflower in many areas of the site. Many of these were areas where spineflower is known to have also occurred in high densities in 2004" (p. 12).

5.1.5 Discussion of HMP Annual Status in the Interim Action Range 2000-2008

The purpose of these surveys was to evaluate trends in species populations over time by comparing subsequent population surveys with that of the "baseline" condition in 2000. The goal of this comparison is to evaluate within a large spatial context the responses of the species populations to post-baseline disturbances such as burns and/or MEC clearance activities. It is important to emphasize that the "baseline" established in 2000 was presumed to be a condition toward which the species populations will return over time; however, there are no data to independently verify this assumption. It is worth noting that the 2000 survey reported that the chaparral community in the IAR MRA exhibited a wide range of seral stages. Also, as discussed above, there is evidence to indicate that populations of these species may exhibit substantial inter-annual variations in undisturbed areas, possibly caused in part by varying wet-season conditions.

5.1.5.1 Spatial Extent

Spatial extent of species populations is a qualitative parameter that may be related to population size but may also provide different insights into species trends over time. In this report spatial extent (i.e., dispersion) is expressed as a frequency function, namely the number of locations where a species was observed to occur in the IAR MRA. "Location" for the 2000 survey is defined in this report as all observations within an approximate 100-foot radius or, for large polygons, the estimated area in sq ft divided by 10,000 (approximate number of 100- by 100-foot grid cells). For the 2004 and 2005 surveys, "location" was defined as the number of 100 by 100-foot grid cells wherein the species was recorded. The frequency value for Monterey spineflower in the 2005 survey was adjusted (multiplied by 1.061) to account for the fact that not all of the IAR MRA was included in the survey for this species (see discussion in Section 5.1.4). For the 2008 survey, "locations" were computed as the number of grid cells wherein the species was recorded multiplied by the sampling factor (e.g., times 20 for a 5% sample of grid cells). A tabulation of these frequencies is presented in Table 6. To assist in comparison of these values, the percentage frequency of occurrence (based on the total number of grid cells in IAR MRA) is also presented in the table for each value. Error associated with the areal discrepancies resulting from these calculations is considered to be acceptable for this comparison and within the same order of magnitude as field sampling error.

Sand gilia is a rare species and its spatial frequency generally is expected to be low. Table 6 indicates that this species exhibited a very low frequency (2.6%) in the baseline survey (2000), but its frequency increased by more than a factor of 10 to 32.3% in 2004 and by a factor of 20 to 50.9% in 2005. Its frequency in the 2008 survey decreased to just over 20%. While the frequency data generally follow the same pattern as that of the population estimates (Section 5.1.5.2), there are two notable differences: population values in 2004 and 2005 exhibited much higher ratios relative to the 2000 population, and the frequency of the 2008 population was disproportionately higher relative to the population value. The first difference may result from micro-habitat fidelity of the species, whereas the second difference may reflect the influence of the sub-optimal wet season and/or the seral stage of the surrounding plant community in 2008.

Monterey spineflower was much more frequent (over 17.4%) in the IAR MRA than sand gilia in 2000. In 2005, its frequency increased by more than a factor of three over that of 2000, indicating a larger population (however, population data were not collected for this species in 2005). While the population estimate of 2000 was double that of 2008 (Section 5.1.5.2), the frequency in 2008 was just under three times that of 2000. This difference is similar to that seen in sand gilia.

The substantially higher sand gilia frequencies after 2000 likely reflect the influence of changes in ecological factors controlling the inter-annual dispersion of populations of this species in IAR MRA. One potential controlling factor is wet season condition. Total annual rainfall (Figure 5) does not correlate with changes in frequency of occurrence during 2000 to 2008. However, rainfall monthly distribution appears to correlate more closely with frequency of occurrence of this species, particularly after the 2000 survey. Rainfall distribution in 2000 was narrower than that in the years 2004 and 2005, but the 2000 rainfall distribution was broader than that in 2008 (Figures 6 through 9). The burn event of 2003 is a co-factor that likely had a major influence on this species' frequency distribution in the IAR MRA. As discussed in Section 5.2.3, this event reset IAR MRA to a uniform initial seral stage. The major alteration in plant community ecology resulting from the burn very likely contributed to the trend in frequency in IAR MRA over the period from 2004 to 2008.

On a frequency basis, seaside bird's-beak was slightly less rare than sand gilia during the baseline survey (2.3%); however, its population was nearly ten times greater than that of sand gilia (Section 5.1.5.2). In 2004, frequency of seaside bird's-beak increased slightly, while its population decreased slightly. This relationship between the two parameters was not observed in any other year and/or species and may not be significant relative to estimate errors. The frequency of this species increased by a factor of about three from 2004 to 2005 while the population increased by a factor of ten. In 2005 and 2008 the frequency of this species was nearly the same, while the population increased by more than an order of magnitude. These data may indicate that the substantially increased populations of seaside bird's-beak in 2008 were more highly clumped and were less influenced by dispersal when compared with the 2005 populations. The trend of initial increase in frequency from 2000-2005 and the subsequent leveling off of frequency from 2005-2008 may be an indication of seral progression in the IAR MRA. Overall, the frequency of this species does not appear to be positively correlated with increased rainfall (total or seasonal distribution).

5.1.5.2 Population Trends

Quantitative or semi-quantitative data were collected for sand gilia and seaside bird's-beak in IAR MRA in 2000, 2004, 2005, and 2008. Quantitative or semi-quantitative data were collected for Monterey spineflower in 2000, 2004, and 2008.

Substantial variations in the scale of the surveys and methods employed over time dictated the need for a uniform parameter upon which population comparisons could be based. The parameter employed in this report was to compute a total population estimate for each species within the IAR MRA for each year that quantitative data were available. Owing to the numerous uncertainties and assumptions employed in making these calculations across several data sets as discussed above, substantial (though unquantifiable) errors may have been introduced. Additionally, evidence of skewness in some of the data sets indicates that those sets may not exhibit normal distributions of data and therefore use of parametric approaches may introduce uncertainties in the estimation results. For these reasons, only broad trends in the results are discussed in this report.

The population estimates are presented in Table 5. The Monterey spineflower 2000 population was estimated as 20,500, and in 2004 the population increased more than six times, to 138,275. By 2008, however, the Monterey spineflower population estimate decreased to 49,655 - about 2.4 times the population in 2000. As discussed in Section 5.1.4, the 2005 Monterey spineflower population was not quantified but was thought to be approximately equivalent to that of the 2004 population. Sand gilia was very rare in 2000 (193 plants - approximately one one-hundredth that of Monterey spineflower), and increased to a high of nearly 100,000 in 2005. In 2008, the population decreased to 440 - about 2.3 times the population in 2000. It is quite remarkable that the ratios of the 2000 and 2008 populations of these two species are nearly identical. The trend for seaside bird's-beak is quite different. Compared with the 2000 population, the 2004 population decreased (0.6 times as large), the 2005 population increased by a factor of 10, and the 2008 population was even larger, 114 times that of 2000.

If these estimates are a reasonably accurate reflection of population trends, a few general conclusions may be drawn. All species populations increased over the initial five years (except possibly seaside bird's-beak in 2004). Sand gilia and Monterey spineflower populations decreased while seaside bird's-beak increased dramatically between 2005 and 2008. All species had larger populations in 2008 than in 2000. It is remarkable (given that the annual surveys were conducted by different organizations and employed different methods) that sand gilia and Monterey spineflower populations were both about 2.3 times as large in 2008 as they were in 2000 despite large absolute differences in populations between the two years. These results may indicate that inter-annual variations in environmental factors have similar influence on the populations of these two species in the IAR MRA. Of the three species, Monterey spineflower was most abundant in 2000, but seaside bird's-beak was about 4 times more abundant than Monterey spineflower in 2008.

5.1.5.3 Causal Factors

Disturbances in the IAR MRA during the period from 2000 to 2005 (burns, MEC clearance) do not appear to have resulted in a decrease in population of any of the species, with the possible exception of seaside bird's-beak in 2004. On the contrary, substantial population increase occurred over this period. The substantial decreases in populations of sand gilia and Monterey spineflower between 2005 and 2008 could be attributed to the sub-optimal 2008 wet season and/or inhibition of their populations as natural succession led to seral progression of surrounding communities. The former idea is supported by the diminutive condition of the plants observed in 2008 as well as the rainfall pattern of that wet season. The latter idea is circumstantially supported by the shrub transect results. The 2005 shrub survey, two years after a burn, revealed that bare ground occurred over 38-45% of the transects, whereas in the 2008 survey bare ground had decreased to about 20-30%.

Parsons (2005) speculated that Monterey spineflower "may depend less on rainfall for germination than either sand gilia or seaside bird's-beak," an idea supported by Fox et al. (2006). Fox et al. (2006) also suggested that the species population declines with the passage of time since the most recent ENSO. Such events have occurred in the following recent rain seasons: 1997-1998, 2002-2003, 2004-2005, and 2006-2007. This idea is supported by the fact that the 2005 (immediately after an ENSO event) survey showed a larger population than was observed in 2004 (over a year after the previous ENSO, as in the current survey; Parsons 2005).

5.2 Shrub Communities

Shrub community surveys were conducted in 2000 (baseline survey), 2005, and 2008. This type of survey was not conducted in 2004 as was done for HMP annuals.

5.2.1 Community Status in 2000

A baseline survey for shrubs was conducted in 2000 and reported in the 2000 Annual Monitoring Report (HLA 2001). The 2000 survey was conducted over a wide area that included two sub areas ("2000 burn area" and "MRA North") that encompassed the IAR

MRA. Results presented in the text and tables of the HLA report therefore are not specifically limited to the IAR MRA. In this survey transects were established within chaparral communities that were assigned to one of three seral classes based on visual inspection. These classes were: disturbed, intermediate-age, and mature. A total of 33 transects were sampled in the IAR MRA.

5.2.1.1 Line-Intercept Sampling Results

The monitoring protocol includes line-intercept sampling on transect lines. On the transects labeled as "disturbed" dominant shrub species (defined as those composing 4% or more of the transect) included sandmat manzanita (50.4%), shaggy-barked manzanita (21.8%), chamise (12.2%), and Monterey ceanothus (7.6%). Two of these dominants, Monterey ceanothus and sandmat manzanita, are HMP species. Bare ground was reported at 11%.

In the transects classed as intermediate-age-age dominant species were shaggy-barked manzanita (31.6%), sandmat manzanita (27.7%), chamise (16.6%), Monterey ceanothus (8.8%), black sage (5.6%), and dwarf ceanothus (4.3%). Observed HMP species included Monterey ceanothus, sandmat manzanita, and Eastwood's goldenbush (0.03%). Bare ground was reported at 13.4%.

In the transects classed as mature, the dominants were shaggy-barked manzanita (63.4%), chamise (16.3%), and sandmat manzanita (7.3%). Observed HMP species included Monterey ceanothus, sandmat manzanita, and Eastwood's goldenbush (0.01%). Bare ground was reported at 9%.

5.2.1.2 Quadrat Sampling Results

The monitoring protocol includes quadrat sampling for herbaceous species adjacent to the transect line. However, quadrat sampling is conducted only if 20% or more of the transect line intersects predominantly herbaceous communities. Herbaceous communities occupied less than 20% of the transect line and therefore no quadrat sampling was conducted in 2000.

5.2.2 Community Status in 2005

The first post-baseline and post-disturbance shrub survey was conducted in 2005 and reported in the Final 2005 Annual Biological Monitoring Report (Parsons 2005). These results are referred to in this report as the "2005 survey." The survey was conducted over the Ranges 43-48 MRS, an area that encompassed IAR MRA. Results presented in the text and tables of the Parsons report therefore are not specifically limited to the IAR MRA. The same transects established in 2000 were re-occupied in this survey. The site burned in October 2003 (22 months prior to the survey).

5.2.2.1 Line-Intercept Sampling Results

The monitoring protocol includes line-intercept sampling on transect lines. However, the 2005 survey was conducted 22 months after a burn and the vegetation was comprised almost entirely of small shrub and perennial seedlings. Therefore, line-intercept data were not collected.

5.2.2.2 Quadrat Sampling Results

The monitoring protocol includes quadrat sampling for herbaceous species adjacent to the transect line. According to the protocol, quadrat sampling is conducted only if 20% or more of the transect line crosses predominantly herbaceous communities. Because of the condition of the vegetation in the IAR MRA in 2005 as discussed in the preceding section, quadrat sampling was conducted in this survey, but the data collected differed from what was prescribed in the protocol. Seedling count data were collected for a number of shrub species as well as percentage cover data for the categories: live vegetation, dead vegetation, wood and litter, and bare ground. Most of these data are not comparable to quadrat data collected in 2008. The data for bare ground overall in the IAR MRA quadrats were relatively high, 38-45% when compared with the 2000 survey results, which were 9-13.4%. This difference is not surprising in light of the burn event that occurred less than two years prior to the 2005 survey.

5.2.3 Discussion of Shrub and Herbaceous Community Status in the Interim Action Range 2000 to 2008

The purpose of these fixed-transect surveys was to evaluate trends in shrub and herbaceous plant communities over time by comparing subsequent surveys with that of the “baseline” condition in 2000. The goal of this comparison is to evaluate within a large spatial context the responses of the community to post-baseline disturbances such as burns and/or MEC clearance activities. It is important to emphasize that the “baseline” established in 2000 was presumed to be a condition toward which the plant community would return over time. The 2000 survey reported that the chaparral community in the IAR MRA exhibited a wide range of seral stages; however, the entire community in the IAR MRA was reset to initial seral stage by the 2003 burn event. If time is the primary determinant of seral stage in the IAR MRA, it is unlikely that the plant communities in the area will return to the mixed-seral 2000 baseline until succession is again reset in portions of the IAR MRA.

5.2.3.1 Shrub Community Status

Two line-intercept transect surveys (2000 baseline and 2008) were conducted in the IAR MRA. Although the transects were sampled in 2005, only quadrat data were collected in that survey. The most substantial disturbance to vegetation between the two surveys was the burn event that occurred in October 2003, which removed most of the aboveground vegetation.

On the transects classed as “disturbed” in 2000, dominant species shaggy-barked manzanita and chamise were at similar percentages in the two surveys, whereas Monterey ceanothus was about twice as abundant in 2008. Sandmat manzanita, the most abundant species in 2000, was present but not nearly as abundant in 2008. Dwarf ceanothus was dominant in 2008 but not in 2000. Bare ground occupied 11% of the transects in 2000 and 17% in 2008.

On the transects classed as intermediate-age in 2000, the most dominant species in both surveys was shaggy-barked manzanita, which occurred at comparable abundances in the two surveys. Chamise occurred at slightly lower abundance in 2008. Monterey ceanothus occurred at slightly higher abundance in 2008. Dwarf ceanothus was about five times more abundant in 2008 (20%) than in 2000 (4%). Two dominants in the 2000 survey, sandmat manzanita and black sage, were not dominant in 2008, but sandmat manzanita was present on the transects. Bare ground occupied about 13% of the transects in 2000 and about 22% in 2008.

On the transects classed as mature in 2000, shaggy-barked manzanita was the most dominant in both surveys, but abundance in 2008 was slightly more than one-half that in 2000. Two of the 2000 dominants, sandmat manzanita and chamisse, were not dominant but sandmat manzanita was present. Monterey ceanothus, dwarf ceanothus, deer weed, and rush rose were dominants in 2008 but not in 2000. Bare ground occupied about 9% of the transects in 2000 and about 20% in 2008.

5.2.3.2 Herbaceous Plant Status

Herbaceous plant cover was minimal in 2000 and no data were collected. Only two transects sampled in 2008 had sufficient herbaceous cover to warrant sampling of herbaceous plants. The absence of baseline information and the paucity of 2008 data provide little basis to draw any conclusions regarding trends or status of this vegetation type.

5.3 Findings

From 2000 to 2008, the IAR MRA experienced natural fluctuations in environmental conditions, seral progression of vegetation, and anthropogenic disturbances. “Anthropogenic disturbances” here means human-caused events that did or could result in alterations in plant populations and communities in the MRA.

HMP annual species Monterey spineflower, sand gilia, and seaside bird’s-beak exhibited frequency of occurrence and population increases during the 2000 to 2008 period. While sand gilia (and likely Monterey spineflower) peaked in frequency and abundance in 2005, seaside bird’s-beak reached peak frequency and abundance in 2008. Sand gilia and likely Monterey spineflower populations exhibited substantial decreases from their peaks between 2005 and 2008 (a 2005 population estimate was not available for Monterey spineflower - the likelihood of a decrease for this species is based on the 2004 results together with anecdotal information regarding the 2005 population). These decreases appear to be correlated with the substantially sub-optimal wet season conditions in 2008, although the concomitant seral progression of the plant communities (see below) may also have contributed to this decline. On the other hand, the populations of both species in 2008 (when wet season parameters appear to have been less suitable) were more than twice as large as those in 2000 (when wet season parameters appear to have been more suitable). Overall, the results possibly indicate that wet season conditions and community seral stage have substantial influence on the populations of sand gilia and Monterey spineflower, but there is no obvious correlation between these factors and seaside bird's-beak populations during the period.

The most obvious disturbance in the IAR MRA during the period was the burn event that occurred in 2003. This disturbance, although of anthropogenic origin, is essentially identical to natural burn events that commonly occur in chaparral communities. The burn event substantially disturbed shrub communities by removing most aboveground vegetation, resulting in a successional "reset" of the entire IAR MRA to initial seral stage. Five years after the burn, the 2008 communities had progressed in seral development. This is evident in that some of the 2000 dominant shrub species were also dominant in 2008, and most of the 2000 dominant species were present in 2008. An important metric of seral age for this community, shrub stature, is not included in the monitoring protocol, but the 2000 survey report indicated that 20-foot tall shrubs characterized as mature-seral were present in portions of the IAR MRA. The fact that shrubs of such stature were not observed in 2008 lends support to the conclusion that the 2008 vegetation in the IAR MRA resulted from a natural seral progression to an early-intermediate seral stage. There was no evidence of major interference by invasive exotic species (i.e., appearance as dominants on transects) in the natural successional process.

After the 2000 survey, the Army conducted MEC removal in the IAR MRA, an anthropogenic disturbance. The absence of detailed descriptions of these activities in previous monitoring reports precludes a detailed evaluation of their effects on HMP annuals or shrub communities. However, the fact that the three HMP annual species populations increased after these disturbances and that the shrub communities appear to be experiencing a normal successional trajectory following the 2003 burn support the finding that removal disturbance did not have a lasting negative effect on HMP annuals or shrub communities in the IAR MRA.

6.0 REFERENCES

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Table 1
Species Included in this Report
2008 Interim Action Ranges Annual Biomonitoring Report
FORA ESCA RP

Abbreviation Used On Datasheets	Species Name	Status	Common Name
BG	na	na	Bare Ground
ADFA	*Adenostoma fasciculatum*	--	chamise
ARTO	*Arctostaphylos tomentosa*	--	shaggy-barked manzanita
ARPU	*Arctostaphylos pumila*	HMP	sandmat manzanita
BAPI	*Baccharis pilularis*	--	coyote brush
BRsp	*Bromus (species unknown)*	--	grass
CAED	*Carpobrotus edulis*	--	African ice plant
CARA	*Cardionema ramosissimum*	--	sand mat
CAsp	*Carex* sp.	--	sedge
CEDE	*Ceanothus dentatus*	--	dwarf ceanothus
CERI	*Ceanothus cuneatus var. rigidus*	HMP	Monterey ceanothus
CHPU	*Chorizanthe pungens var. pungens*	FT/HMP	Monterey spineflower
CIOC	*Cirsium occidentale*	--	cobweb thistle
CORI	*Cordylanthus rigidus* ssp. *littoralis*	HMP	Seaside bird's-beak
CRCA	*Croton californicus*	--	California croton
ELGL	*Elymus glaucus*	--	blue ryegrass
ERCO	*Eriophyllum confertiflorum*	--	golden yarrow
ERER	*Ericameria ericoides*	--	mock heather
ERFA	*Ericameria fasciculata*	HMP	Eastwood's goldenbush
GAEL	*Galium elliptica*	--	coast silktassel
GITA	*Gilia tenuiflora ssp. arenaria*	FE/ST/HMP	sand gilia
GNCA	*Gnaphalium californicum*	--	green everlasting
HESC	*Helianthemum scoparium*	--	rush rose
HEGR	*Heterotheca grandifolia*	--	telegraph weed
HEIN	*Hemizonia increscens*	--	grassland tarweed
HOCU	*Horkelia cuneata*	--	wedgeleaf horkelia
LEFI	*Lessingia filaginifolia*	--	silver carpet
LOSC	*Lotus scoparius*	--	deerweed
LUCH	*Lupinus chamissonis*	--	chamisso bush lupine
MIAU	*Mimulus aurantiacus*	--	sticky monkeyflower
PTAQ	*Pteridium aquilinum* var. *pubescens*	--	bracken fern
QUAG	*Quercus agrifolia*	--	coast live oak
RHCA	*Rhamnus californica*	--	coffeeberry
RUAC	*Rumex acetosella*	--	sheep sorrel
SAME	*Salvia mellifera*	--	black sage
SOUM	*Solanum umbelliferum*	--	blue witch
STVI	*Stephanomeria virgata* ssp. *virgata*	--	tall milk aster
SYMO	*Symphoricarpos mollis*	--	trailing snowberry
TODI	*Toxicodendron diversilobum*	--	poison oak

Notes:
FE = federal endangered
FT = federal threatened
ST = state threatened
HMP = "HMP Species" per Habitat Management Plan
-- = no HMP or federal ESA status
na = not applicable

Table 2
Line-Intercept Data Summary
2008 Interim Action Ranges Annual Biomonitoring Report
FORA ESCA RP

Species Name	Common Name	HMP Species[1]	Frequency Across All Transects (30 total)	Transects Classified as Disturbed in 2000 (2 Transects)			Transects Classified as Intermediate-Age in 2000 (12 Transects)			Transects Classified as Mature in 2000 (16 Transects)		
				Species Abundance Rank	Frequency of Occurrence	Average Percentage Cover	Species Abundance Rank	Frequency of Occurrence	Average Percentage Cover	Species Abundance Rank	Frequency of Occurrence	Average Percentage Cover
na	Bare Ground	na	30	na	2	29.8%	na	12	22.1%	na	16	20.2%
Arctostaphylos tomentosa	shaggy-barked manzanita	--	30	1	2	25.6%	1	12	23.8%	1	16	37.3%
Ceanothus cuneatus var. rigidus	Monterey ceanothus	X	30	2	2	16.9%	4	12	13.4%	3	16	14.0%
Ceanothus dentatus	dwarf ceanothus	--	30	3	2	12.3%	2	12	20.4%	2	16	27.9%
Helianthum scoparium	rush rose	--	30	6	2	3.8%	3	12	17.9%	5	16	8.5%
Adenostoma fasciculatum	chamise	--	29	4	2	10.7%	5	12	11.3%	6	15	7.7%
Eriophyllum confertiflorum	golden yarrow	--	23	7	2	3.4%	7	11	3.8%	10	10	1.2%
Salvia mellifera	black sage	--	20	9	1	1.9%	8	8	2.2%	7	11	4.6%
Lotus scoparius	deerweed	--	19	np	0	np	6	6	4.6%	4	13	9.1%
Arctostaphylos pumila	sandmat manzanita	X	16	5	2	5.3%	9	7	1.7%	11	7	1.0%
Horkelia cuneata	wedge-leaf horkelia	--	13	10	1	< 1%	10	7	1.6%	12	5	< 1%
Carpobrotus edulis	African ice plant	--	12	10	1	< 1%	12	3	< 1%	12	8	< 1%
Ericameria ericoides	mock heather	--	6	9	1	1.9%	12	4	< 1%	12	1	< 1%
Mimulus aurantiacus	sticky monkeyflower	--	6	10	1	< 1%	np	0	np	9	5	1.5%
Baccharis pilularis	coyote brush	--	5	np	0	np	12	1	< 1%	11	4	1.0%
Rhamnus californica	coffeeberry	--	5	10	1	< 1%	11	4	1.3%	np	0	np
Toxicodendron diversilobum	poison oak	--	4	np	0	np	12	1	< 1%	8	3	3.5%
Ericameria fasciculata	Eastwood's goldenbush	X	4	np	0	np	12	3	< 1%	12	1	< 1%
Quercus agrifolia	coast live oak	--	3	np	0	np	12	1	< 1%	12	3	< 1%
Galium elliptica	coast silktassel	--	3	np	0	np	12	2	< 1%	12	1	< 1%
Cordylanthus rigidus ssp. littoralis	Seaside bird's-beak	X	3	8	1	2.7%	12	2	< 1%	np	0	np
Lessingia filaginifolia	silver carpet	--	2	np	0	np	12	2	< 1%	12	2	< 1%
Lupinus chamissonis	chamisso bush lupine	--	2	np	0	np	12	2	< 1%	np	0	np
Gnaphalium californicum	green everlasting	--	2	np	0	np	12	2	< 1%	np	0	np
Carex sp.	sedge	--	2	10	1	< 1%	np	0	np	12	1	< 1%
Croton californicus	California croton	--	2	10	1	< 1%	12	1	< 1%	np	0	np
Pteridium aquilinum var. pubescens	bracken fern	--	2	10	1	< 1%	12	1	< 1%	np	0	np
Heterotheca grandifolia	telegraph weed	--	1	np	0	np	12	1	< 1%	np	0	np
Cirsium occidentale	cobweb thistle	--	1	np	0	np	12	1	< 1%	np	0	np
Symphoricarpos mollis	trailing snowberry	--	1	np	0	np	12	1	< 1%	np	0	np

Notes:
np = not present
[1] = per Habitat Management Plan
X = HMP species
-- = no HMP or federal ESA status
na = not applicable

Table 3
Quadrat Data
2008 Interim Action Ranges Annual Biomonitoring Report
FORA ESCA RP

Disturbed Transect BE10 Percentage Cover

Species	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Quadrat 5	Quadrat 6	Frequency	Mean	Rank
Bare Ground	52	0	52	64	20	0	4	31.3	na
Adenostoma fasciculatum	0	100	0	0	0	100	2	33.3	1
Cardionema ramosissimum	4	0	0	0	0	0	1	0.7	8
Ceanothus cuneatus var. *rigidus*	0	0	0	0	60	0	1	10.0	3
Cordylanthus rigidus ssp. *littoralis*	0	0	0	0	8	0	1	1.3	7
Elymus glaucus	4	0	0	4	8	0	3	2.7	6
Eriophyllum confertiflorum	0	0	0	32	4	0	2	6.0	5
Ericameria ericoides	0	0	48	0	24	0	2	12.0	2
Helianthum scoparium	4	0	0	0	0	0	1	0.7	8
Horkelia cuneata	40	0	0	0	0	0	1	6.7	4
Lessingia filaginifolia	0	0	0	4	0	0	1	0.7	8

Intermediate-Age Transect BG1 Percentage Cover

Species	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Quadrat 5	Quadrat 6	Frequency	Mean	Rank
Bare Ground	80	0	20	0	0	20	3	20.0	na
Adenostoma fasciculatum	16	20	0	0	60	80	4	29.3	1
Arctostaphylos tomentosa	0	0	0	4	0	0	1	0.7	7
Ceanothus cuneatus var. *rigidus*	0	0	0	0	60	0	1	10.0	4
Ceanothus dentatus	0	24	0	0	24	12	3	10.0	4
Cordylanthus rigidus ssp. *littoralis*	0	20	60	0	0	0	2	13.3	3
Eriophyllum confertiflorum	0	0	0	8	0	0	1	1.3	6
Helianthum scoparium	0	56	48	4	0	0	3	18.0	2
Horkelia cuneata	4	16	0	0	0	0	2	3.3	5
Lessingia filaginifolia	0	4	0	0	0	0	1	0.7	7

na = not applicable

Table 4
Baseline (2000) HMP Annuals Data
2008 Interim Action Ranges Annual Biomonitoring Report
FORA ESCA RP

	Sand gilia	Monterey spineflower [2]			Seaside bird's-beak
		High density	Medium density	Low density	
Count per Identified Population [1]	128	5000	2750	250	47
	9	5000	na	na	47
	6	5000	na	na	1465
	23	2500	na	na	170
	7	na	na	na	na
	1	na	na	na	na
	8	na	na	na	na
	4	na	na	na	na
	7	na	na	na	na
Total	193	20500			1729

Notes:

[1] These data were derived from Plate 14 of HLA (2001)

[2] These numbers are estimates based on selecting a reasonable value for each category defined in the 2000 survey;

In the original report, high density was defined as 5000+, medium density as 501 to 5000, and low density as 1 to 500 individuals in all areas not marked high or medium density. Because the high density category extended to infinity, a value of 5000 was assigned for this evaluation. The one 2500 value in that category represents a polygon that straddled the survey area boundary. The midpoint of the range was selected for the other two categories.

na = not applicable

Table 5
HMP Annual Species Estimated or Counted Historical and Current Populations [1]
2008 Interim Action Ranges Annual Biomonitoring Report
FORA ESCA RP

Species	2000 Estimate or Count	2004 Estimate or Count	2005 Estimate or Count	2008 Estimate [3]
Monterey spineflower	20,500	138,275	nd [2]	49,655
Sand gilia	193	17,128	96,958	440
Seaside bird's-beak	1,729	1,058	17,563	197,906

Notes:

[1] Historical values calculated by checking counts mapped in previous years within what is now the IAR MRA. Where ranges were given, values were assigned as in Table 4.

[2] nd = no data. 2005 data were quantified only as acres covered (i.e. only as presence/absence in areas); therefore it was not possible to compute a population estimate for this species in 2005.

[3] These values were computed as described in Section 4.

[4] The 2005 Monterey spineflower value is scaled to compensate for small areas not surveyed

Table 6
Spatial Frequency of Occurrence of HMP Annual Species
2008 Interim Action Ranges Annual Biomonitoring Report
FORA ESCA RP

Species	Year 2000 Estimated Number of Locations [a]	2000 Percentage in IAR [b]	2004 Number of Locations	2004 Percentage in IAR [b]	2005 Number of Locations [c]	2005 Percentage in IAR [b]	2008 Estimated Number of Locations [d]	2008 Percentage in IAR [b]
Monterey spineflower	152.7	17.4%	680	77.6%	561	64.1%	440	50.2%
Sand gilia	23.1	2.6%	283	32.3%	446	50.9%	180	20.5%
Seaside bird's-beak	19.8	2.3%	32	3.7%	93	10.6%	89	10.1%

Notes:

[a] Values computed from hand measurements of Plate 14 from HLA 2001 as follows:

Points (and closely grouped clusters of points) from Plate 14 are assumed to be equivalent to 100' x 100' cells' sample plots

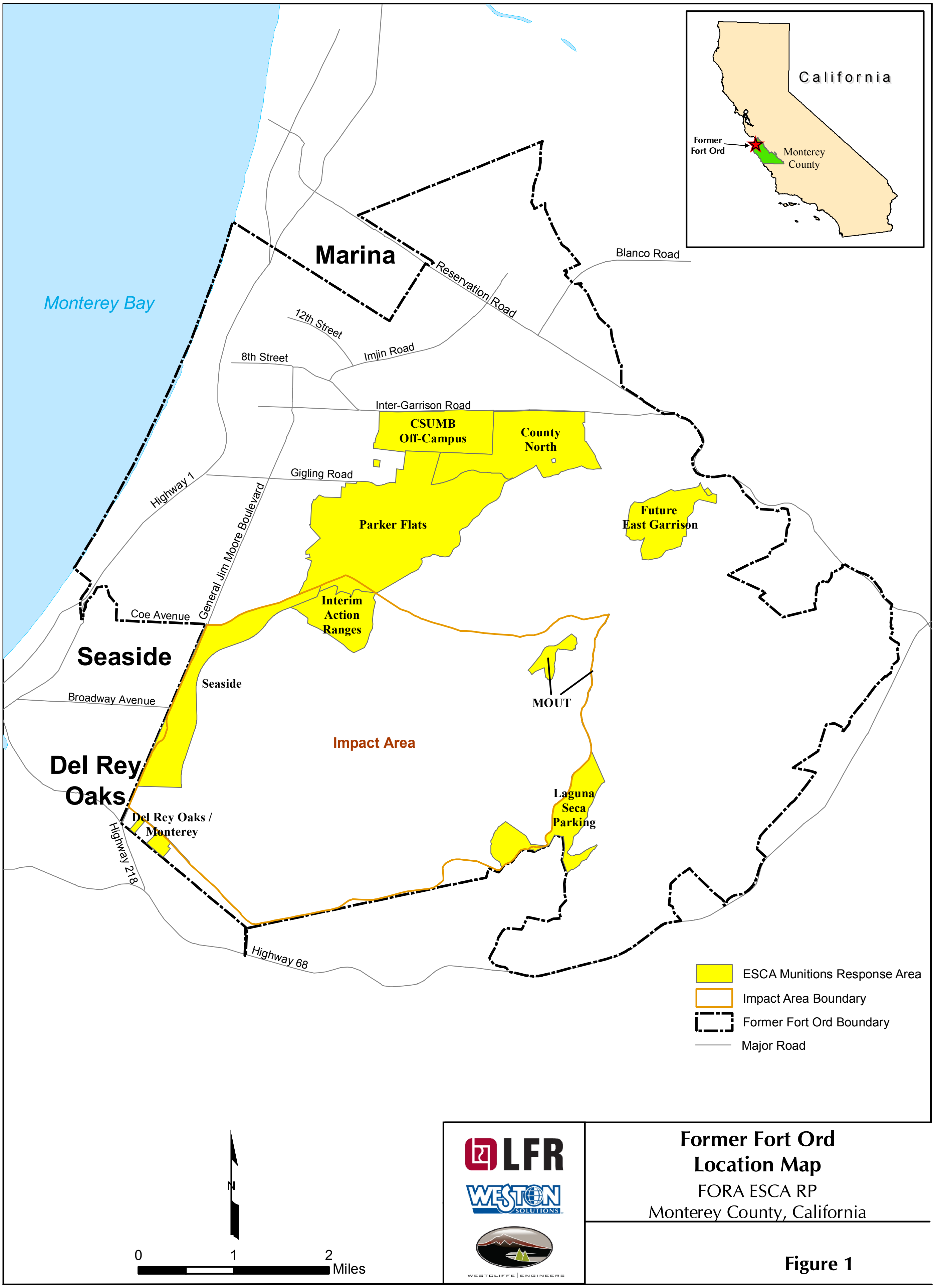
Lines from plate 14 are normalized by dividing estimated (ruler/scale measured) length by 100'

Areas from plate 14 are normalized by dividing their square footage by 10,000', the area of a 100x100 cell

[b] Percentage calculated based on total number of 100 by 100 ft grid cells within IAR MRA (= 876).

[c] The 2005 Monterey spineflower value is scaled to compensate for small areas not surveyed

[d] Values computed by multiplying the 5% sample results by 20 for sand gilia and Monterey spineflower, and by normalizing Seaside bird's-beak data to the total number of cells in IAR MRA.



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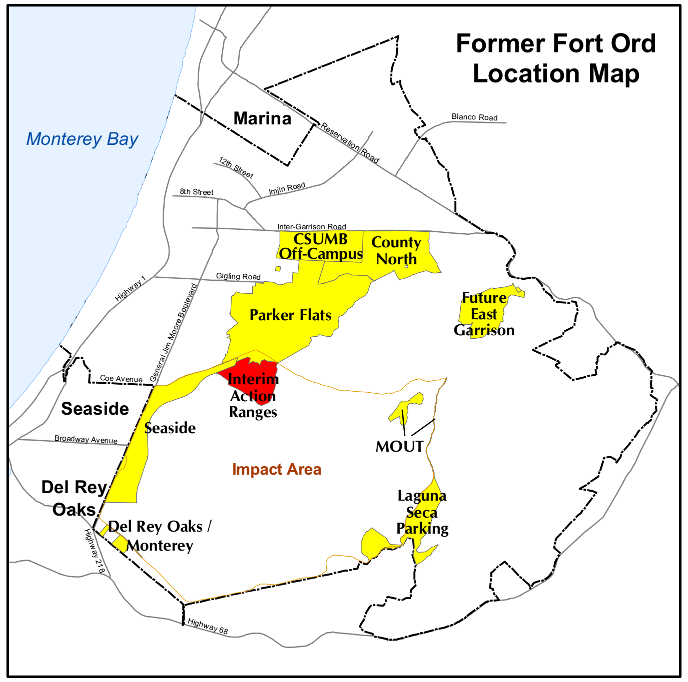
Legend

- School
- Fire Station
- Gate
- Entry Forbidden Sign
- Sign
- Hydrant
- High-Power Transmission Line Tower
- Electrical Line Pole
- Munitions Response Area
- Major Road
- Electrical Line
- Fence
- Gas Line
- Storm Line
- Telephone Line
- Water Line
- Sewer Line
- High-Power Transmission Line and Right of Way
- R9211 Structure
- E23.1 USACE Parcels



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Interim Action Ranges MRA
Facility Profile
Physical Features
2007 Orthophotos
FORA ESCA RP
Monterey County, California

Figure 2

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Interim Action Ranges MRA
2008 Sand Gilia, Monterey Spineflower, and Seaside Bird's - Beak Survey

FORA ESCA RP
Monterey County, California

Figure 3

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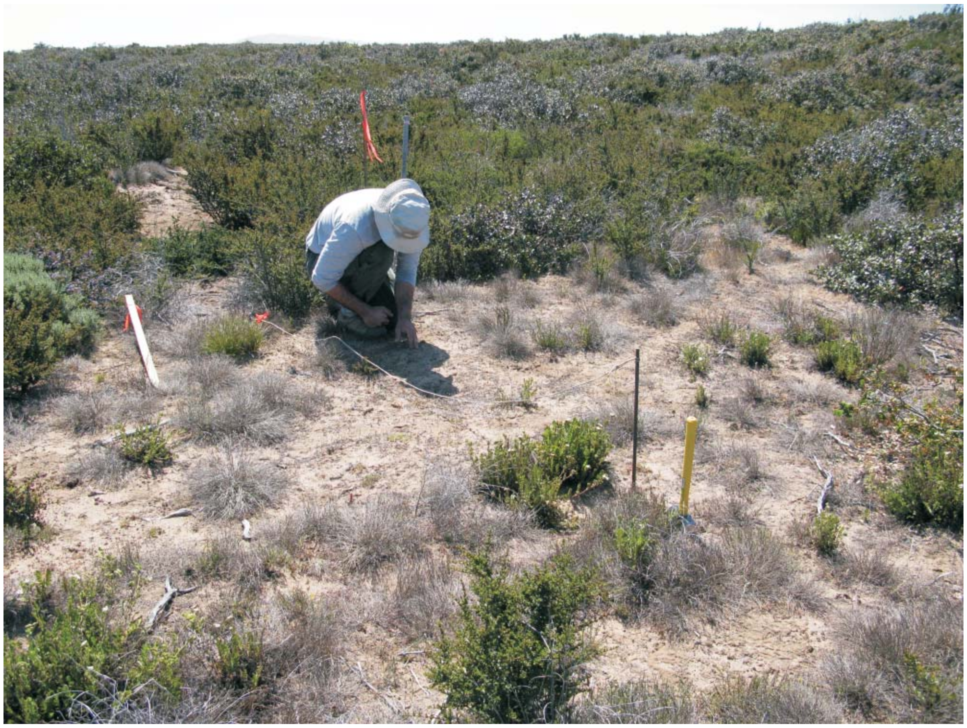
Monterey Spineflower (Note Pink Flowering Parts, Wooly Leaves)



Monterey Spineflower Habitat

Photolog Page 1

FORA ESCA RP
Monterey County, California

Figure 4

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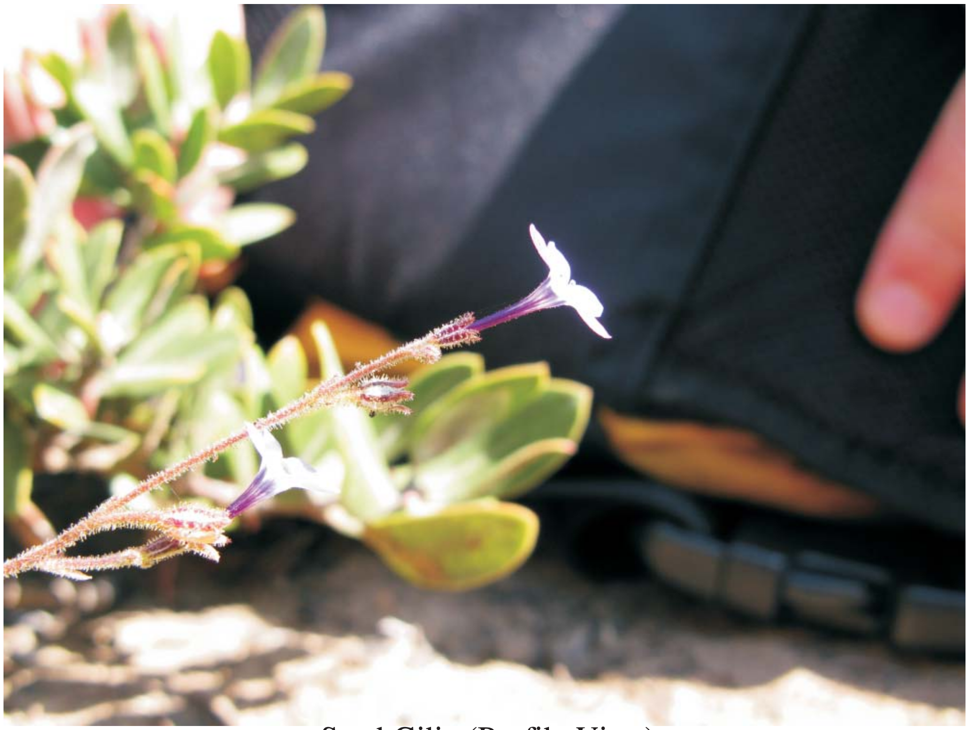
Sand Gilia (Inflorescence)



Sand Gilia (Profile View)

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Photolog Page 2

FORA ESCA RP
Monterey County, California

Figure 4

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Sand Gilia Habitat (Flagging Plant Locations)

Sand Gilia and Monterey Spineflower Co-Occurring

DESIGN\036\09595\07\Photologs\Photolog Nov 2008.cdr

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Photolog Page 3

FORA ESCA RP
Monterey County, California

Figure 4

Seaside Bird's-Beak

Seaside Bird's-Beak Habitat

Photolog Page 4

FORA ESCA RP
Monterey County, California

Figure 4

DESIGN\036\09595\07\Photologs\Photolog Nov 2008.cdr


HMP Annual Survey Method (Chalk-Spraying 5-Meter Sample Plot)


Line-Intercept Sampling (Bare Ground Measured at 14%)

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Photolog Page 5

FORA ESCA RP
Monterey County, California

Figure 4

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Quadrat Sampling

Photolog Page 6

FORA ESCA RP
Monterey County, California

Figure 4

DESIGN\036\09595\07\Photologs\Photolog Nov 2008.cdr

Figure 5
Wet Season Rainfall Totals 2000-2008

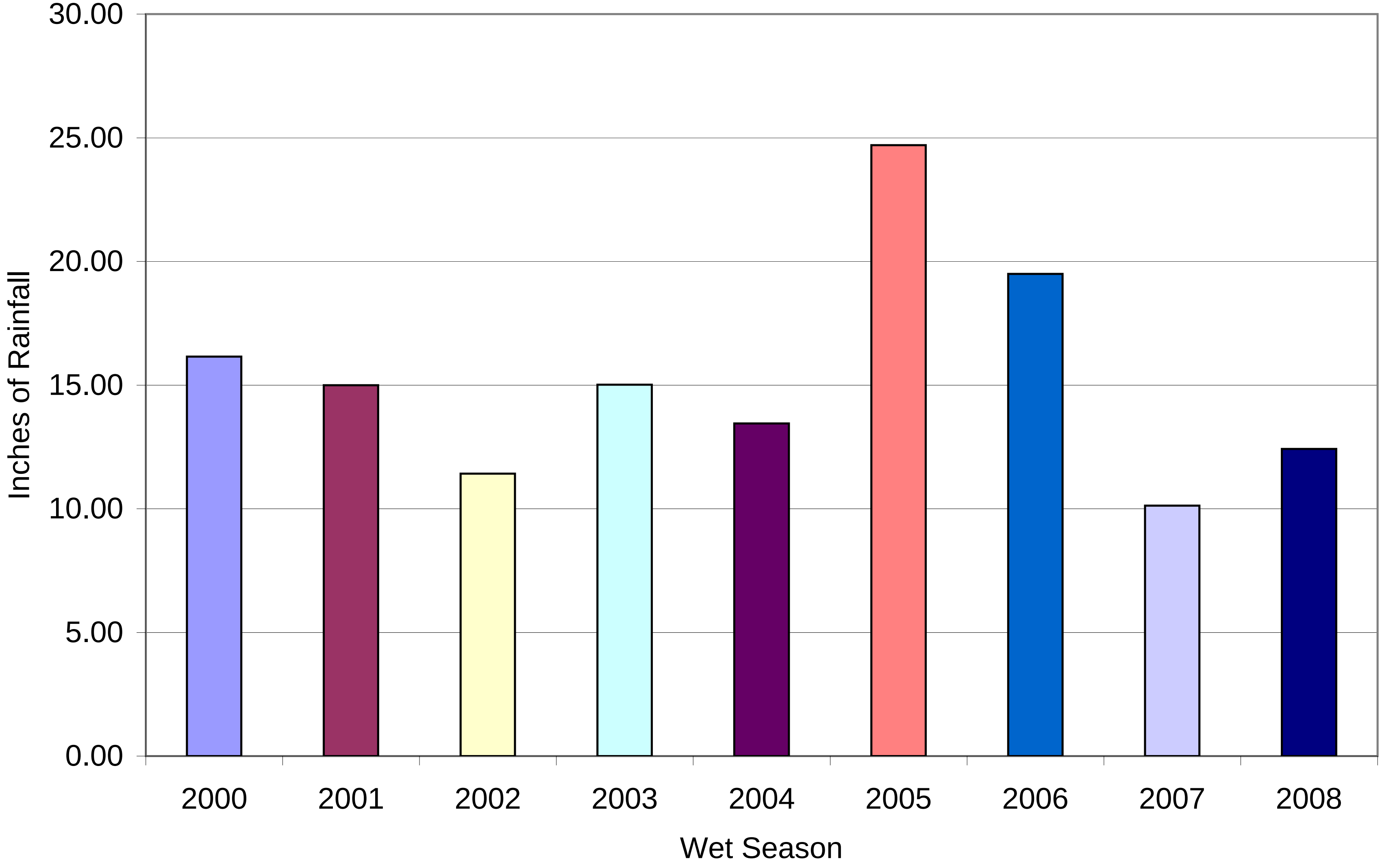


Figure 6
2000 Wet Season Monthly Rainfall

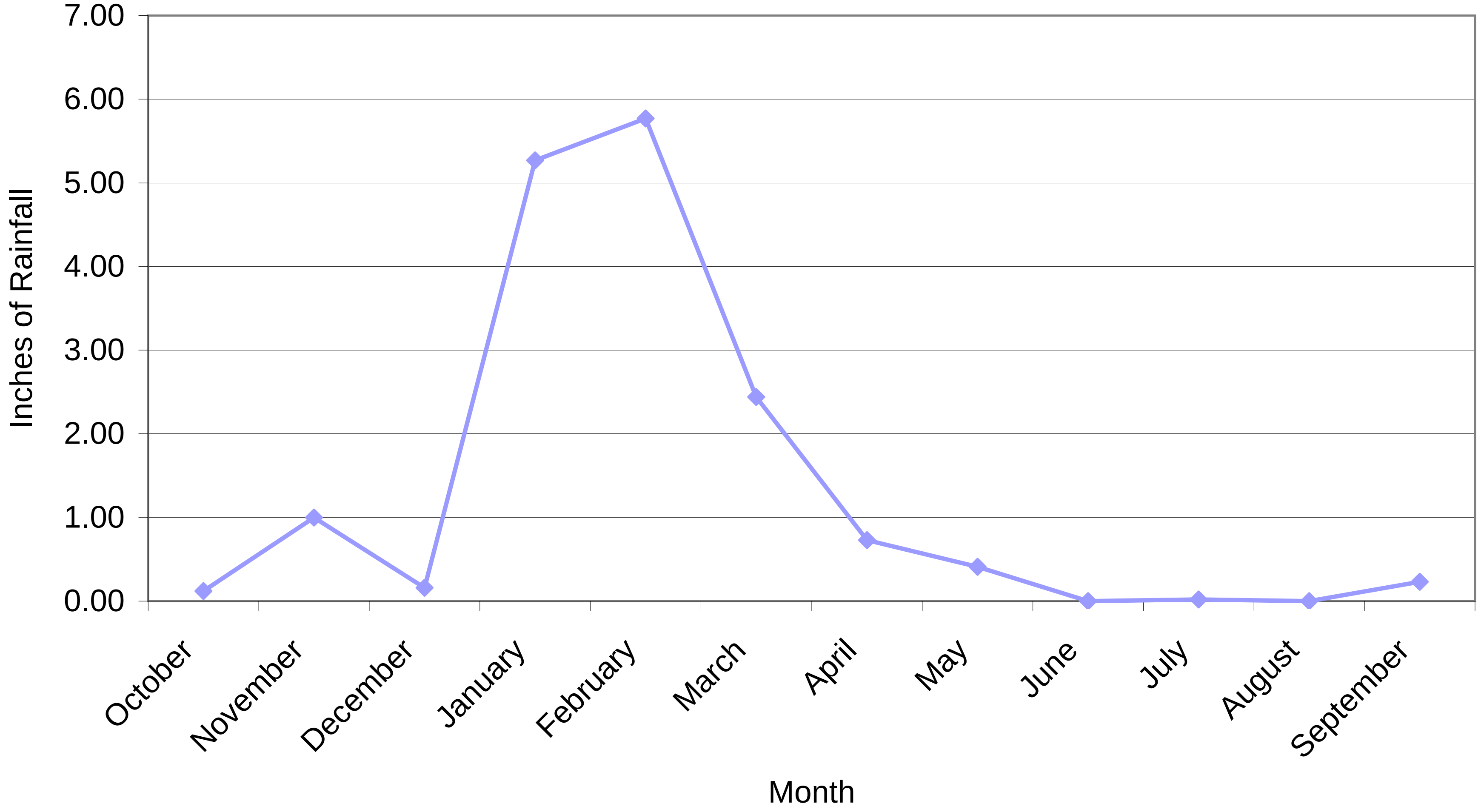


Figure 7
2004 Wet Season Monthly Rainfall

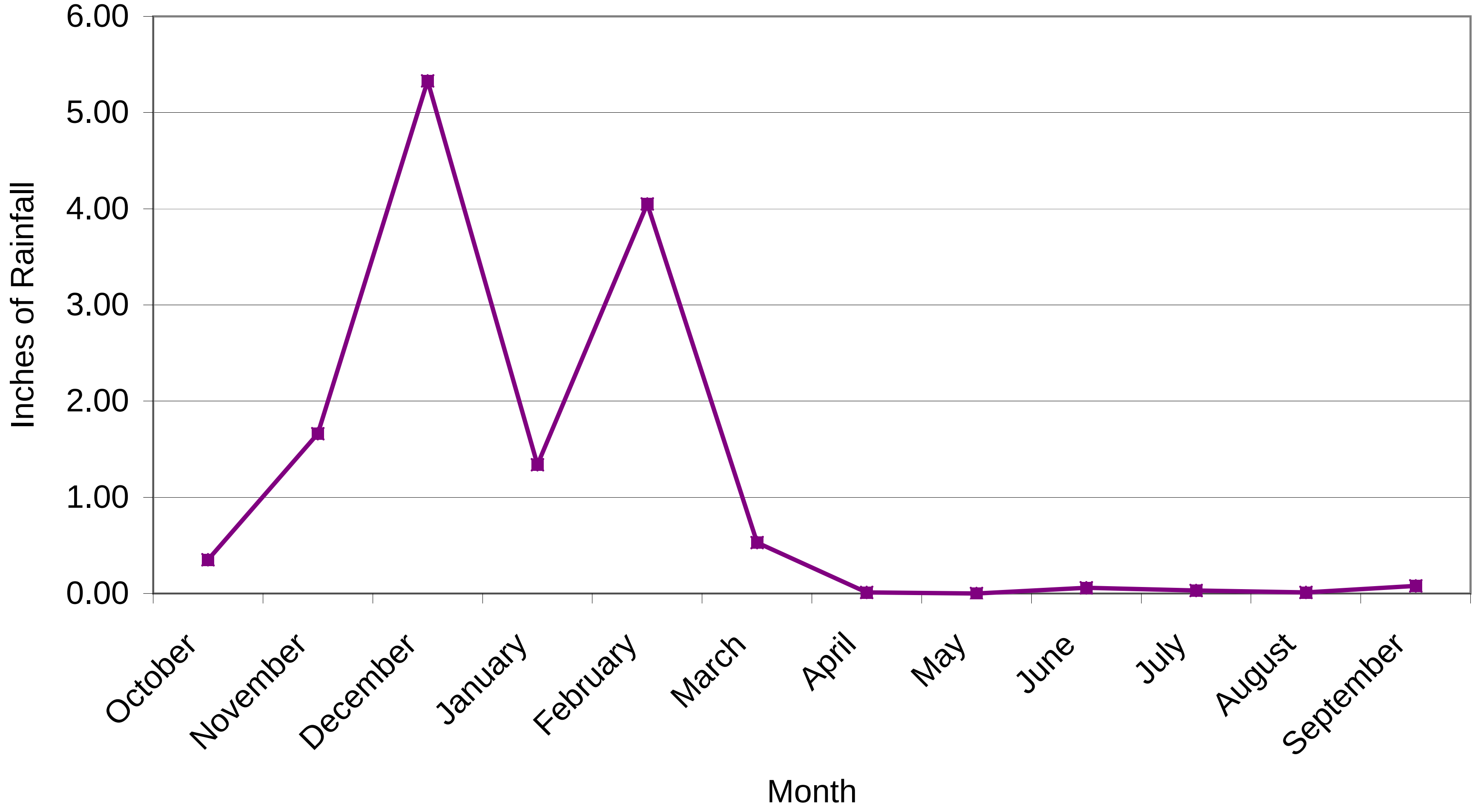


Figure 8
2005 Wet Season Monthly Rainfall

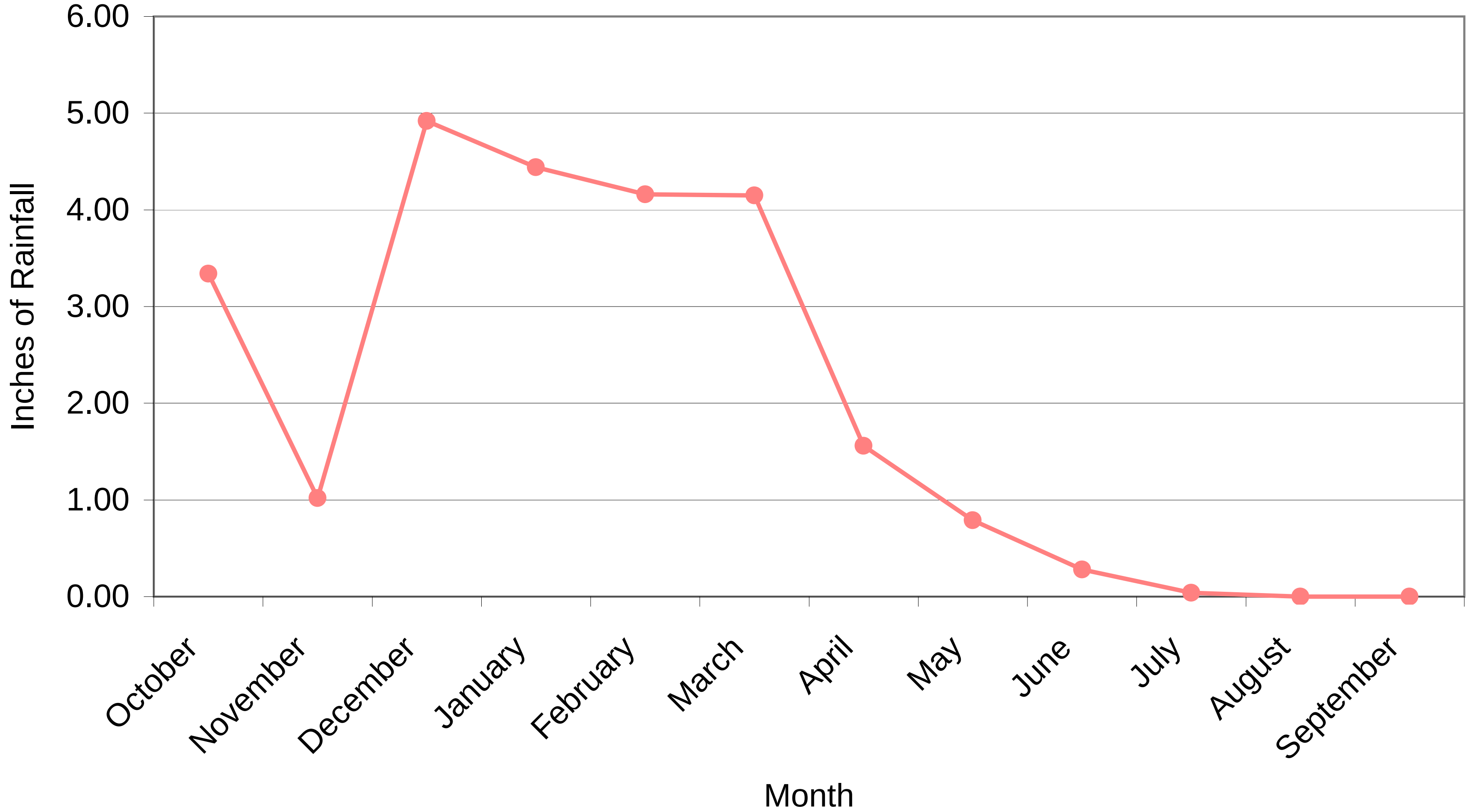
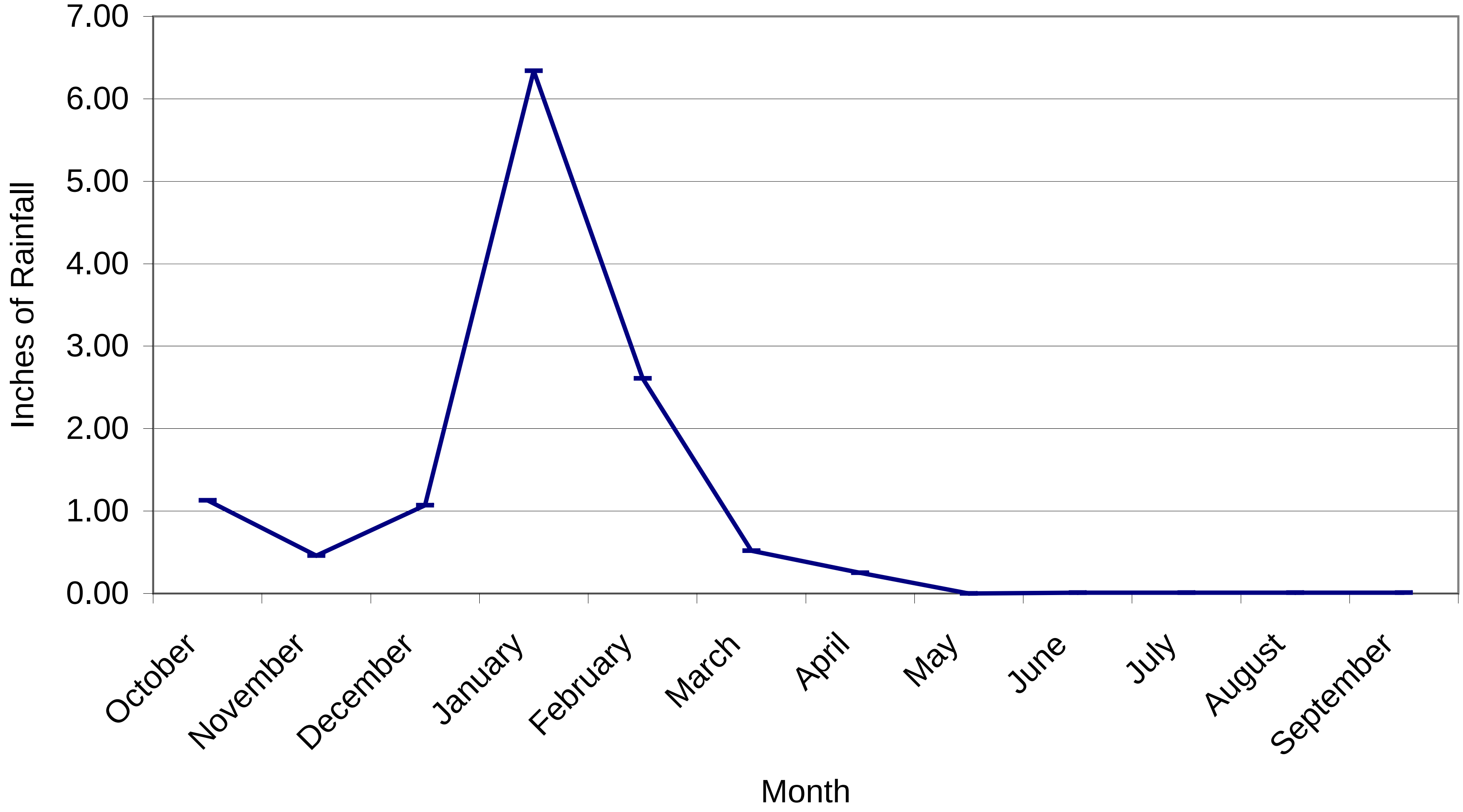


Figure 9
2008 Wet Season Monthly Rainfall



APPENDIX A

Field Data Sample Forms

FORT ORD
TRANSECT SURVEY FORM

MRS #:	**Date:**
Transect #:	**Survey Team:**
Location of transect (distance, direction from known location):	
Direction of transect (e.g., north-south):	
Comments:	

Start Distance (feet)	End Distance (feet)	Species*

Start Distance (feet)	End Distance (feet)	Species*

FORT ORD
QUADRAT SURVEY FORM

MRS Site #:	**Date:**
Transect #:	**Survey Team:**
Quadrat #	
Quadrat is located between : m and m along transect.	
Percent total vegetative cover:	
Comments:	

	SPECIES	PERCENT AREAL COVER	NO. INDIVIDUALS (FOR SHRUBS AND RARE PLANTS)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			