State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

FINAL
LAND MANAGEMENT PLAN
BURTON MESA ECOLOGICAL RESERVE

August 31, 2007

Prepared By
Elihu Gevirtz, Mary Carroll, Katrina Burton, Paul Collins, Mark Holmgren,
Larry Spanne and Anthony Nelson

CONDOR ENVIRONMENTAL
PLANNING SERVICES, INC.

3944 State Street, Suite 310, Santa Barbara, CA 93105
Tel: (805) 898-2000 • info@condorenvironmental.com

FINAL
LAND MANAGEMENT PLAN
FOR
BURTON MESA ECOLOGICAL RESERVE

PREPARED FOR:

California Department of Fish and Game
South Coast Region
4949 Viewridge Avenue
San Diego, CA 92123

PREPARED BY:

Condor Environmental Planning Services Inc.
3944 State Street
Suite 310
Santa Barbara, CA 93105
Phone (805) 898-2000

APPROVED BY:

Mr. Sonke Mastrup
Deputy Director, Resources Management and Policy Division

9/10/07
Date

Mr. John McCamman
Acting Director, Department of Fish and Game

9/10/07
Date

TABLE OF CONTENTS

I. INTRODUCTION 1

A. Purpose of This Land Management Plan 1
1. Purpose of the Acquisition 1
2. Acquisition History 2
a) Exceptions 4

B. Funding of this Land Management Plan 4

C. Geographic Information System (GIS) 5

II. PROPERTY DESCRIPTION 7

A. Location 7

B. Geographical Setting 7

C. Property Boundaries and Adjacent Lands 8

D. Management Units 8
1. Property Boundaries 11
2. Adjacent Lands 11
3. Easements, Covenants and Restrictions 12
a) Easements on State's Land Retained by Unocal: Roads, Power Lines, Utility Lines, Pipelines. 12
b) Consultation Regarding Change of Use in Specific Areas 14
4. 47-Acre Transfer from Santa Barbara County to State of California 14
5. Unocal's 200-Acre Open Space Easement 15
6. State Water Line Lease 15
7. County Sheriff Equestrian Training Facility 15

E. Geology, Soils, Hydrology, Climate 19
1. Geologic Setting 19
a) General Introduction 19
2. Soils 27
a) General Introductions 27
b) Principal Soils and Distribution 27
3. Hydrologic and Hydrogeologic Setting 32
a) General Introduction 32
b) Surface Water 32
c) Groundwater 38
4. Climate 39

F. Cultural Features 41
1. Prehistory and Early History 42
2. Previous Investigations 42
3. Results of Cultural Resources Investigation 43
4. Categories of Sensitivity of Cultural Resources 51
a) Class I: High Sensitivity Sites 51
b) Class II: Medium Sensitivity Sites 52
c) Class III: Low Sensitivity Sites 52
d) Other Areas: Potential for Buried Sites 52
5. Data Gaps in Cultural Resources 52

G. Historic Land Use 53
1. Agricultural Operations 54
2. Military Operations 57
3. Oil Exploration 57
4. Fire History and Behavior 57
a) Pre-European Fire History 58
b) Recent Fire History and Behavior 59
5. Urban Development 63
6. Existing Structures and Other Development 63
H. Existing Public Use Features 69
1. Public Facilities and Uses 69
a) Trails Plan 70
I. Existing Commercial Lease Features 75
1. Lease Information 75
2. Current Cultivated Agriculture 75
3. Current Cattle Grazing 76
4. Beekeeping 76
5. Sheriff Equestrian Training Facility 76
6. CCWA Chaparral Restoration Site 77

III. HABITAT AND SPECIES DESCRIPTION 79

A. Introduction 79
1. Biological Setting 79
B. Vegetation Communities, Habitats and Plant Species 82
1. Methods 82
a) Database Review 82
b) Interviews and Consultations 83
c) Vegetation Surveys 83
d) Distribution of Non-Native Species 90
e) Rare Plants 91
C. Upland Communities 95
1. Maritime Chaparral 95
a) Variations in Community Composition 95
2. Coast Live Oak Woodland and Forest 111
a) Variation in Community Composition 111
b) Oak Forest Surveys at the Reserve 114
3. Central Coastal Scrub 115
a) Variations in Community Composition 115
b) Coastal Scrub surveys at the Reserve 118
4. Grassland 121
a) Variations in Community Composition 121
b) Grassland surveys at the Reserve 123
5. Bishop Pine Forest 126
a) Variations in Community Composition 126
b) Bishop pine surveys at the Reserve 127
D. Wetland Communities 131
1. Riparian Woodland 131
a) Variation in Community Composition 131

b) Riparian vegetation surveys at the Reserve *133*
2. Freshwater Marsh 136
a) Variations in Community Composition *136*
3. Emergent wetland vegetation surveys at the Reserve 139
4. Vernal Pool surveys at the Reserve 141
a) Vernal wetlands vegetation surveys at the Reserve *143*
E. Non-Native Communities 145
1. Eucalyptus Woodland (Non-Native) 145
2. Open ("Ruderal") Areas 146
F. Wildlife Surveys 146
1. Wildlife Survey Methodology 146
a) Database Review *146*
b) Reptile, Amphibian and Mammal Surveys *147*
c) Bird Surveys *148*
2. Wildlife Species and Habitats 157
a) Coastal Scrub *157*
b) Coastal Scrub *158*
c) Maritime Chaparral *159*
d) Coast Live Oak Woodland and Forest *160*
e) Bishop Pine Forest *161*
f) Grassland (native and non-native) *161*
g) Riparian Woodland *162*
h) Riparian Woodland *163*
i) Freshwater Marsh and Springs *164*
j) Vernal Pond and other Vernal Wetlands *166*
G. Rare, Threatened and Endangered Species: Plants 167
1. Species Descriptions: Selected Sensitive Dominant Plants 175
H. Non-Native Species 181
1. Non-Native Plants 181
2. Sudden Oak Death (Phytophthora ramorum) 187
3. Hybridization 188
4. Non-Native Animals 188
I. Rare, Threatened and Endangered Species: Animals 189
1. Rare, Threatened, and Endangered Wildlife Species Descriptions 199

IV. MANAGEMENT GOALS AND TASKS 226

Definition of Terms Used in This Plan 227
A. Administration Element 229
1. Information Management 229
2. Site Security 229
3. Easement Management 230
4. Access 231
5. Existing Structures 233
6. Unauthorized Uses 233
7. Hazards 234
B. Biological Element 234
1. Biodiversity 234

2. Upland Resources 236
3. Wetland Resources 237
4. Water Quality 240
5. Non-Native Species and Nuisance Species 241
6. Wildlife 243
7. Habitat Restoration 244
8. Monitoring 245
9. Future Surveys and Research 246

C. Public Use Element 249
1. Compatible Public Uses 249
2. Public Education 250
3. Hunting 251
4. Public Safety 252
5. Coordination with Adjacent Land Owners and Neighbors 253

D. Cultural Resources Element 253
1. Protection 253
2. Compatible Uses 254

E. Commercial Lease Element 255

F. Fire Management Element 255
1. Tasks - Before Fire: 258
2. Tasks – Wildfire Response During a Fire: 260
3. Tasks - After Fire: 260
"Fuel Break" vs "Fuel Management Zones" 261

V. BURTON MESA FUEL MANAGEMENT PLAN 265

A. Introduction 265

B. Project Description 265
1. Shrubs: 265
2. Subshrubs/Herbaceous Vegetation: 266
3. Coast Live Oaks 266

C. Timing of Installation 266

D. Menu of Treatment Methods 266
1. Yard Waste Removal 266
2. Removal of Flammable Invasive Vegetation 267
3. Mowing Annual Herbaceous Growth 267
4. Removal of Decadent/Dead Shrubs 267
5. Chipped Material 267
6. Pruning ("Uplifting") of Coast Live Oaks 268
7. Thinning Shrubs and Subshrubs 268
8. Pile Burning 268
9. General Weed Control 268

E. Implementation Practices 269

VI. OPERATIONS AND MAINTENANCE SUMMARY 273

A. Operations and Maintenance Tasks to Implement Plan 273

B. Existing Staff and Additional Personnel Needs Summary 273

REFERENCES 275

FIGURES

Figure A-1:GIS Geodatabase Pathway 6
Figure 1:Project Region 9
Figure 2:Project Site 10
Figure 3:Vandenberg Management Unit 11
Figure 4:Santa Lucia Management Unit 12
Figure 5:Purisima Hills Management Unit 13
Figure 6:Encina Management Unit 14
Figure 7:La Purisima Management Unit 15
Figure 8:Easements 17
Figure 9:Geologic Columnar Section of the Southern Santa Maria Basin 23
Figure 10:Distribution of the Three Ages of Sand Dune in Western Santa Barbara County . 24
Figure 11:Geology 25
Figure 12:Soils 29
Figure 13:Elevation and Hydrology 35
Figure 14:Annual Precipitation Totals at Lompoc, Ca, 1985-2004 40
Figure 15:Archaeology 49
Figure 16:1938 Aerial Photograph 55
Figure 17:Fire History 61
Figure 18:Structures and Infrastructure 67
Figure 19:Proposed Trail Plan 73
Figure 19.1:Proportions of Habitat Areas at BMER 86
Figure 20:Survey Locations: Vegetation 87
Figure 21:Plant Communities 93
Figure 22:Percent Cover of Dominant Species in Maritime Chaparral 106
Figure 23:Percent Cover of Species in Oak Woodland and Forests 114
Figure 24:Percent Cover of Dominant Species in Coastal Scrub 119
Figure 25:Percent Cover of Non-Native Grassland 124
Figure 26:Percent Cover of Dominant Species in Bishop Pine Forest 128
Figure 27:Percent Cover of Dominant Species in Riparian Forest & Scrub 135
Figure 28:Percent Cover of Dominant Species in Vernal Wetlands 140
Figure 28a:Percent Cover of Dominant Species in Vernal Wetlands 144
Figure 29:Survey Locations: Animals 155
Figure 30:Rare, Threatened and Endangered Plants 173
Figure 31:Rare, Threatened and Endangered Animals 191
Figure 32:Wildfire Response Plan & Fuel Break Segments 271

TABLES

Table 1:	Land Acquisition Summary	3
Table 2:	Land Transfer Documents	4
Table 3:	Easement Summary Table	13
Table 4:	Easement Locations within the Reserve by Unit	14
Table 5:	Principal Geologic and Soil Characteristics of Each Management Unit	27
Table 6:	Average Temperature and Precipitation Data for Lompoc, California 1950-2004	40
Table 7:	Cultural Resource Sites Within and Adjacent to the Reserve With Key Characteristics *(Confidential)*	44
Table 8:	Existing Structures within the Reserve	66
Table 9:	Trail Plan on the Reserve	71
Table 10:	Regional Endemic Plants on the Reserve	82
Table 11:	Rapid Assessment Dates and Observers 2003-2004	85
Table 11.1:	Habitat Area Acreage	86
Table 12:	Rapid Assessment Locations and Environmental Attribute 2003-2004	89
Table 13:	Adaptations to Fire of Dominant Maritime Chaparral Species	102
Table 14:	Classification of Chaparral at the Reserve	110
Table 15:	Classification of Oak Woodland at the Reserve	115
Table 16:	Classifications of Coastal Scrub at the Reserve	121
Table 17:	Classifications of Grassland at the Reserve	125
Table 18:	Classifications of Bishop Pine Plots at the Reserve	130
Table 19:	Classifications of Riparian Woodland at the Reserve	136
Table 20:	Classifications of Emergent Wetland at the Reserve	140
Table 20a:	Cassifications of Vernal Pool at the Reserve	145
Table 21:	Wildlife Surveys 2003-2004	150
Table 22:	Focused Sensitive Wildlife Species for Surveys	152
Table 23:	Animal Diversity on Burton Mesa Ecological Reserve	157
Table 24:	Rare, Threatened and Endangered Plants Occurring on the Reserve	168
Table 25:	Rare, Threatened and Endangered Plants Not Occurring on the Reserve	171
Table 26:	Prominent Weeds of Burton Mesa Ecological Reserve	181
Table 27:	Rare, Threatened, Endangered and Locally Important Species: Animals	193

APPENDICES

Appendix 1 Plant species of the Burton Mesa Ecological Reserve

Appendix 2 Wildlife species of the Burton Mesa Ecological Reserve

Appendix 3a Wildlife Survey Observations: 2004 GIS Meta Data

Appendix 3b Bird Species observed during Point Counts

Appendix 4a Museum Records of Rare, Threatened and Endangered Animals (pre-2004)

Appendix 4b Museum Records of Non-Rare, Threatened and Endangered Animals (pre-2004)

Appendix 5 California Natural Diversity Database Records

Appendix 6 Rapid Assessment Plot Data
- Maritime Chaparral
- Coast Live Oak Woodland and Forest
- Coastal Scrub
- Grassland
- Riparian Forest and Scrub
- Wetlands
- Bishop Pine Forest

Appendix 7a Bird Survey Point Count Form

Appendix 7b Rapid Assessment Vegetation Field Sampling

Appendix 8 Final Environmental Impact Report "EIR"
- 8.1 NOP, NOC, NOD, and Initial Study
- 8.2 Botanical and Wildlife Surveys in Fuel Management Segments
- 8.3 Cultural Surveys of Fuel Management Segments
  (Confidential, not included in public version of Land Management Plan)
- 8.4 Public Outreach Summary and Response to Public Comments

Appendix 9 Detailed Project Description of Fuel Management Zone Segments

ACKNOWLEDGEMENTS

Condor wishes to acknowledge individuals who have assisted us in this endeavor. Kari Lewis, Felix Arteaga, Mary Meyer and Terri Stewart of the California Department of Fish and Game guided the project from its inception, providing us with direction and support.

Todd Keeler-Wolf and Diana Hickson gave us guidance on vegetation sampling and classification of vegetation, and Diana Hickson shared her knowledge and data from her research on the Burton Mesa in the 1980s. Craig Turner, California Department of Fish and Game GIS Specialist and Geographer, provided valuable support and input into creation of the GIS.

Tom Olson wrote several of the sensitive species accounts. Mary Meyer, Kari Lewis, Terri Stewart, Dennis Odion, Ralph Philbrick, Lyann Comrack and Tim Hovey provided helpful comments on earlier drafts. Frank Davis shared his knowledge and perspective of the Burton Mesa. Ralph Philbrick shared his knowledge of *Opuntia*. Mike Caterino provided information about the invertebrates on the Burton Mesa. Wayne Ferren, shared his botanical and geologic observations and his understanding of the processes on the Burton Mesa. Steve Junak provided observations of weedy species and several helpful suggestions. Mark Bright and Brett Buyan of the Santa Barbara County Planning and Development Department provided access to the 1935 Weislander maps, the historic aerial photographs and other County geographic the data that appear in the GIS.

Leticia Gallardo helped conduct two of our field surveys. Jack Levy provided his observations of the Lompoc Small Blue Butterfly. Bob Lynch at the State Lands Commission provided several legal documents. Nadine Martins created two of the maps. Nadine Martins and Jennifer Jackson helped with final production of the document, including edits to the maps and text.

We are grateful for all of the help that we have received and for the opportunity and the experience of our 2004 surveys. We hope that our work will be a contribution to preservation and learning on the Burton Mesa.

AUTHORS OF THIS PLAN

Elihu Gevirtz	Elihu Gevirtz is the President of Condor Environmental, and the Project Manager. He has 15 years experience in project management, biological surveys, management plans and habitat restoration, including 10 years as a Senior Planner and Biologist for the Santa Barbara County Planning and Development Department. He helped conduct several of the wildlife and botanical surveys, is the editor of this report, principal author of several sections including the Management Goals and Tasks, and contributing author of others.
Mary Carroll	Mary Carroll is an expert in the botanical resources of southern and central California, having over 25 years of experience conducting botanical field research including rare plant surveys and vegetation sampling in southern and central California. She has a Masters Degree in Botany, and served as the Director of Education at the Santa Barbara Botanic Garden for many years. She conducted the vegetation and rare plant surveys with Katrina Burton, and is the principal author of the botanical sections of the report.
Katrina Burton	Katrina Burton, Biologist and GIS Specialist of Condor Environmental, is an expert in the development of Geographic Information Systems. Her experience includes biological surveys, vegetation mapping, and GIS development in California and Western Australia. She conducted the vegetation surveys with Mary Carroll, created the GIS, co-designed and produced all of the maps, and is a principal author of the report.
Paul Collins	Paul Collins, Wildlife Biologist is the Curator of Vertebrate Zoology at the Santa Barbara Museum of Natural History. He is an expert in the wildlife of southern and central California, having over 30 years experience working on numerous wildlife research and environmental projects. He conducted surveys for amphibians, reptiles and mammals, and is the principal author of the species accounts for the sensitive taxa in these groups.
Mark Holmgren	Mark Holmgren, Ornithologist is the Assistant Director of the Museum of Systematics and Ecology at UCSB. He is a recognized expert in the birds of Santa Barbara County, having more than 25 years of experience conducting avian surveys throughout the region. He conducted the surveys for birds and is the principal author of the species accounts for these taxa.
Larry Spanne	Larry Spanne, Condor Associate Archaeologist is an expert in the cultural resources of the central coast, having more than 30 years of experience conducting archaeological assessments in this area. He has served for many years as the Chief of Cultural Resources at Vandenberg Air Force Base. He conducted the cultural resources investigation and is the principal author of that section of the Land Management Plan.
Anthony Nelson	Anthony Nelson, Registered Geologist has over 20 years experience in environmental consulting. He contributed to the Geology and Hydrology Sections as well as the Real Estate Sections of the Plan.

I. INTRODUCTION

A. Purpose of This Land Management Plan

The purposes of this Land Management Plan are as follows:

1. The plan guides management of habitats, species, and programs described herein to achieve the mission of the Department of Fish and Game (DFG) to protect and enhance wildlife values.
2. The plan serves as a guide for appropriate public uses of the property.
3. The plan serves as a descriptive inventory of fish, wildlife and native plant habitats which occur on or use this property. Integral to this inventory is the Geographic Information System (GIS) that has been developed for the Reserve that provides many "layers" of information and can be supplemented by the Department over time.
4. The plan provides an overview of the property's operation and maintenance, and personnel requirements to implement management goals. It serves as a budget planning aid for annual regional budget preparation.
5. The plan provides a description of potential and actual environmental impacts and subsequent mitigation which may occur during management, and contains an Environmental Impact Report (EIR) to comply with the California Environmental Quality Act (CEQA).

1. Purpose of the Acquisition

The Burton Mesa Ecological Reserve (Reserve) was acquired by the State of California because of the high value of its environmentally sensitive resources, particularly the rich botanical diversity of the property's Burton Mesa Chaparral. This property supports one of the last significant natural stands of maritime chaparral in central California. In 1988, the original extent of Burton Mesa Chaparral was estimated to be over 22,000 acres, reduced to 14,550 acres in 1938, and further reduced to less than 8,645 acres in 1988 (Davis, Hickson, and Odion 1988). Additional loss of habitat has occurred on Vandenberg Air Force Base due to the spread of exotic plant species (Odion, Hickson, and D'Antonio 1992).

Burton Mesa Chaparral is a unique form of chaparral that is restricted to the aeolian sands of the Orcutt Formation north of the City of Lompoc, California. This chaparral occurs on undisturbed upland areas of the Burton Mesa and is characterized by the endemic shagbark and Purisima manzanitas (*Arctostaphylos rudis* and *A. purissima*), varieties of Lompoc and Santa Barbara ceanothus (*Ceanothus cuneatus* var. *fascicularis* and *C. impressus* var. *impressus*) and local varieties of a widespread monkey flower and suffrutescent wallflower. Many of the species unique to the Burton Mesa chaparral are narrowly restricted in distribution (Philbrick and Odion, 1988; Ferren et al., 1984; Smith, 1976). Unusual, low-growing, multi-trunked coast live oaks are found interspersed throughout the chaparral which may be indicative of genetic differences, or may be reflective of response to previous large scale disturbance, such as fire (Gevirtz, *pers. observation*).

Because of the number of endemic taxa, the unusual oaks, a rich herbaceous understory, and high animal diversity (Gevirtz et. al 2005, and this study), Burton Mesa Chaparral is recognized as a valuable biological resource. The remaining acreage is located on Vandenberg Air Force Base, the Burton Mesa Ecological Reserve, La Purisima Mission State Park, and the privately owned lands known as the "Lompoc Wye" surrounding the intersection of Highway 1 and Harris Grade Road. Plans for development of the Lompoc Wye area, adjacent to the southern boundary of the Reserve are being considered by the City of Lompoc. It is not known how many acres of Burton Mesa chaparral remain, but a significant proportion (over 3,000 acres) is located on the Burton Mesa Ecological Reserve.

Beyond the Burton Mesa, Central Maritime Chaparral also occurs in Santa Barbara County in the Solomon Hills between Orcutt and Los Alamos, and on the Purisima Hills easterly to Ballard Canyon, on the Casmalia Hills westerly to Point Sal. Figures 1 and 9 illustrate the physical relationships of this distribution. Over 3,000 acres of Burton Mesa Chaparral occur on the Reserve; and therefore, the development and implementation of this land management plan is essential for the persistence of this unique ecosystem.

In 2004, while this planning effort was occurring, the Department of Fish and Game (Department) recommended that the Fish and Game Commission designate the Burton Mesa Management Area as an Ecological Reserve. The Commission approved the designation in August 2004, and the land officially became an Ecological Reserve in November 10, 2004, as defined in Section 630, Title 14, California Code of Regulations for the protection of the rare Burton Mesa chaparral and associated sensitive species, including Purisima manzanita, shagbark manzanita, silvery legless lizard and the San Diego desert wood rat. This Land Management Plan reflects the ecological reserve status and regulations.

2. Acquisition History

The State, acting through the State Lands Commission (SLC), received approximately 5,078 acres of property as "Sovereign Land[1]" from Union Oil of California (Unocal) as part of a settlement of two antitrust lawsuits reached in July 1991 (State of California 1991 a, b, and c, CDC Engineering 1991). This transfer of property was not mitigation for a project pursuant to the California Environmental Quality Act (CEQA), nor the National Environmental Policy Act (NEPA). This conveyance did, however, include 200 acres northwest of Cabrillo High School that had been previously dedicated (in May 1986) to the County of Santa Barbara as an irrevocable Open Space Easement, as described below. Selection and acceptance of the 5,078 acre property as an area for preserving Burton Mesa Chaparral was based upon several studies including Howald and Davis (1985) and Philbrick and Odion (1988).

Santa Barbara County purchased a 34-acre parcel next to Cabrillo High School in Vandenberg Village in 1997 (Briggs 1997). This parcel was divided into a 27-acre parcel that was granted to the State and added to the Burton Mesa Ecological Reserve (in the Santa Lucia Management Unit), and a 7-acre parcel that was kept by the County as a County Park to be used for recreational purposes. (The 7-acre parcel is presently used as

[1] Sovereign Land is held by the State in order to be protected for its highest natural value and cannot be sold. It can only be traded for land of equal or greater value.

Little League fields and other uses.) Through the same conveyance as the 27-acre parcel from the County to the State Lands Commission, the County also transferred ownership of the adjacent 20-acre parcel (on the north side of Highway 1) to the State Lands Commission to be part of the Reserve. With this last transfer, the total acreage of the Reserve is now approximately 5,125. In addition, 60.7 acres on the west side of south Vandenberg Village was granted to the State Lands Commission in 1995. These transactions are summarized in Tables 1 and 2.

A map of the 5,078 property was produced in 1991 for Union Oil that is in Department of Fish and Game files in Sacramento. The bearings on the map are based upon the bearing between two capped pipes at the southwest corner of the Vandenberg Management Unit of the Reserve (CDC Engineering 1991). Although some of the Reserve's boundaries were marked by Department signs posted in 2004, there are boundaries that remain unmarked.

The State Lands Commission authorized a 49-year lease (SLC# 8129) of the Burton Mesa Ecological Reserve by the California Department of Fish and Game on December 3, 1999; and it was signed by the Chief of the State Lands Commission on January 20, 2000 (State of California Lands Commission 2000). The purpose of the lease is management, operation and maintenance of these sovereign lands for the sensitive species and habitats they support.

Table 1
Land Acquisition Summary
Burton Mesa Ecological Reserve

Date	Description	Acres of Land*
1991	Original grant by Union Oil to State of California. (Includes 200-acre Open Space Easement).	5,078
1997	County grant of 27-acre portion of 34-acre parcel purchased by County plus 20 acre County-owned parcel to the State.	47
1995	Single parcel west of Vandenberg Village, south of Hwy 1.	61
Total as of April 2005		**5,186**

Table 2
Land Transfer Documents
Burton Mesa Ecological Reserve

Document	Entities Involved	Date	Document Number
Recording of Irrevocable Dedication of Open Space Easement on 200 acres	From Union Oil to County of Santa Barbara	May 8, 1986	unknown
Property Agreement	Between Union Oil Company of California and the State of California acting by and through the California State Lands Commission	July 19, 1991	unknown
Certificate of Acceptance and Consent to Recording	By the County of Santa Barbara to the California State Lands Commission	June 19, 1991	91-038941
Certificate of Acceptance and Consent to Recording	By the County of Santa Barbara to the California State Lands Commission	June 19, 1991	91-038942
Grant Deed conveying 27 acres and 20 acres of County land to the State Lands Commission	By County of Santa Barbara to the California State Lands Commission	Dec. 18, 1997	County Board of Supervisors Agenda Letter
Conveyance of 60.7 acres west of Vandenberg Village	Union Oil to California State Lands Commission	1995	95-047208

a) Exceptions

Many exceptions to the transfer of land are listed within the legal description under Recording #91-038941. These excepted areas were not sold or otherwise transferred to the State, are not owned by the State, are not a part of the Ecological Reserve, and are therefore not discussed further in this document.

B. Funding of this Land Management Plan

Development of the Land Management Plan is funded by the State Lands Commission as trustee of the Kapiloff Land Bank Fund, from mitigation funds deposited by the Central Coast Water Authority (State of California Lands Commission 2002). These were paid to mitigate impacts of its activities to Burton Mesa Chaparral on Vandenberg Air Force Base and the Reserve during construction of the State Water Project (SAIC, 1993, State of California Lands Commission 1994).

C. Geographic Information System (GIS)

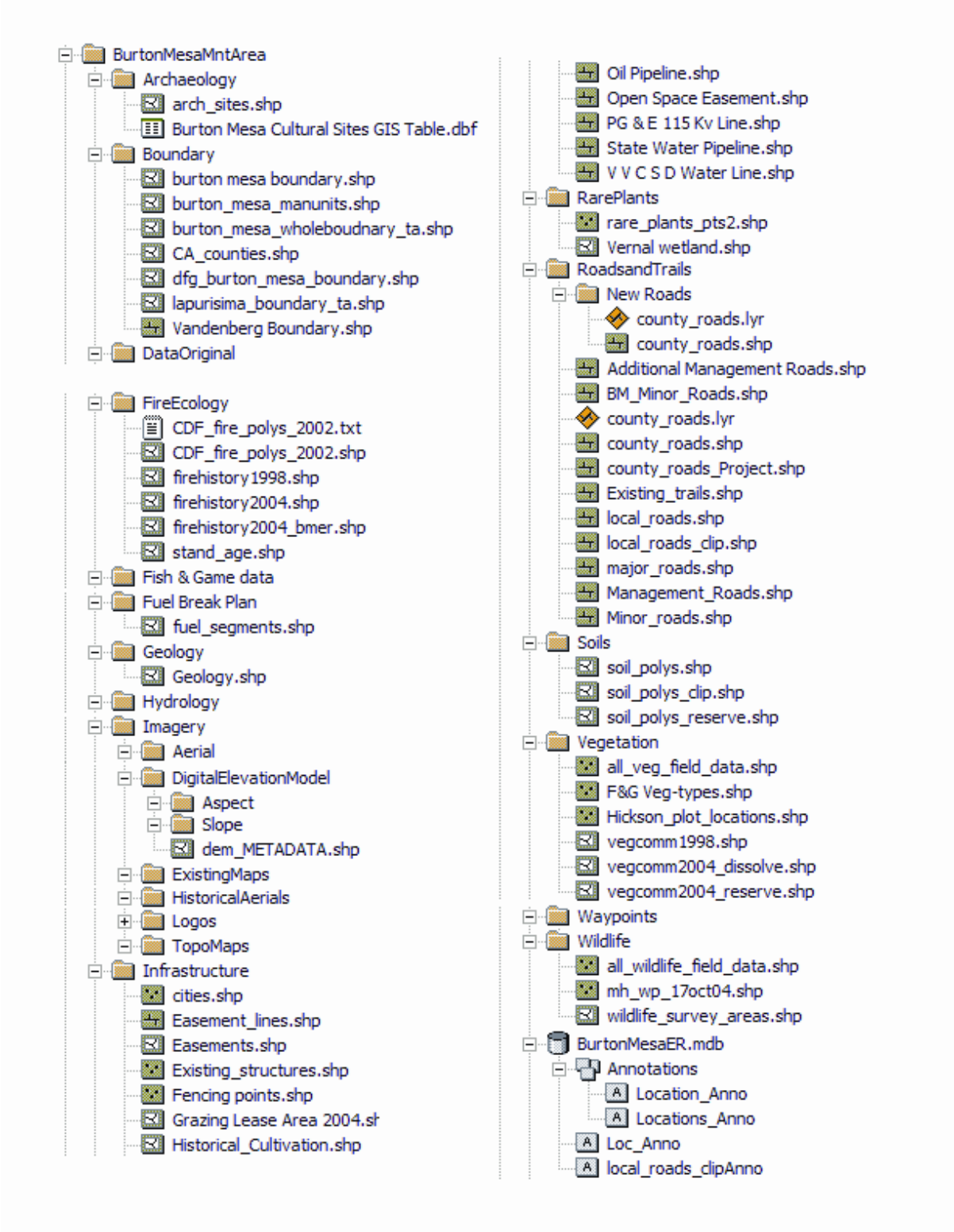
A geographic information system (GIS) was developed by Condor specifically for the Burton Mesa Ecological Reserve. This system is based on the standards developed by the California Department of Fish and Game. The GIS was created in ArcGIS 9.0 and all of the GIS layers were in NAD27, Teale Albers projection and datum, consistent with Department protocol at that time. The GIS layers are accompanied by relevant metadata files for ease of use.

The GIS incorporates previously collected information (such as Hickson 1987) and new physical and biological information collected by Condor during this study. It can be querried for specific features such as rare plants or specific animals, fire history, soils, geology, archaeology, etc. The GIS is an interactive tool containing all pertinent information on the Reserve that can and should be continually used and updated over time. Therefore, the results of future studies should be added to the GIS as they are completed. The GIS geodatabase pathway is illustrated in Figure A-1 to familiarize the reader with the contents and capabilities of the GIS. The main body of the Land Management Plan contains graphic representations of the individual GIS layers/feature classes, as illustrated in the gray box here. This is to indicate the existence and layer name and location of specific feature classes pertaining to the discussion in the text, in order to facilitate understanding of the GIS and encourage its continued use.

GIS Feature Class(es):
Boundary

burton mesa boundary
burton_mesa_mapunits
burton_mesa_wholeboundary_ta
CA_counties
dfg_burton_mesa_boundary
lapurisima_boundary_ta
Vandenberg Boundary

Figure A-1:
GIS Geodatabase Pathway



II. PROPERTY DESCRIPTION

A. Location

The Reserve is located in northern Santa Barbara County, California between Latitude 34.60 and 34.80 N and between Longitude -120.40 and -120.49 W. It is approximately 4 miles north of the City of Lompoc, and approximately 20 miles due north of Point Conception and from 7 to 13 miles inland (east) of the Pacific Ocean (Figure 1). The Reserve is located within two USGS topographic maps: Lompoc 7.5 Minute Quadrangle TCA1378 and Lompoc Hills 7.5 Minute Quadrangle TCA1379.

B. Geographical Setting

The Burton Mesa Ecological Reserve is situated on the eastern Burton Mesa and foothills of the Purisima Hills north of the Santa Ynez River at the northeastern end of the Lompoc Valley (Figure 1) in Santa Barbara County. The Reserve occurs in a region of California that is characterized by varying topography, with extensive coastal dunes and bluffs, a major river system, marine terraces, and interior valleys, along with hills and mountains.

North of this region, the Coast Ranges trend southeast-northwest from San Luis Obispo County to Alaska. This is known as the "Coast Range Geomorphic Province of California". At Point Conception, the California coastline turns eastward, mirroring the east-west orientation of the Transverse Ranges, including the Santa Ynez Mountains, Purisima Hills, and San Rafael Mountains (the Transverse Range Geomorphic Province). This change in coastline affects both ocean and air currents and creates a major geologic and climatic transition zone, with cooler, windier, and moister conditions along the unprotected coast north of Point Conception, and drier and warmer conditions to the south, especially along the South Coast, with the northern Channel Islands providing additional protection (Ferren et al., 1984). The Santa Maria Basin, in which the Reserve lies, is considered the transition zone between the Coast Range Geomorphic Province and the Transverse Range Geomorphic Province, and thus contains structural trends common to both provinces (Hunt 1993).

The Reserve lies between the low-lying Purisima Hills to the north (highest elevation is about 1,200 feet) and the Santa Ynez Mountains to the south (Mt. Tranquillon on Vandenberg Air Force Base is 2,159 feet). The Santa Ynez River bisects the valley between these two ranges, carving a gently undulating valley about 90 miles in length that drains westward before reaching the Pacific Ocean at the community of Surf. The Reserve itself is situated on the Burton Mesa, a low, flat-topped series of hills averaging 400 feet in elevation (Santa Barbara County 1998; Ferren et al. 1984). The Purisima Hills occur on the northern edge of the Reserve. The southern boundary of the Reserve contacts the northeastern edge of the Lompoc Valley.

The terrain on the southern section of the Reserve is relatively flat and is part of the Burton Mesa. Terrain on the northern section is part of the Purisima Hills and has low-lying hills that slope generally in a southwesterly direction and are cut by several canyons. Elevations at the Reserve range from about 115 feet in the south of the Reserve to over 1,000 feet above sea level in the north, with the highest point in the Reserve being approximately 1,120 feet above sea level.

C. Property Boundaries and Adjacent Lands

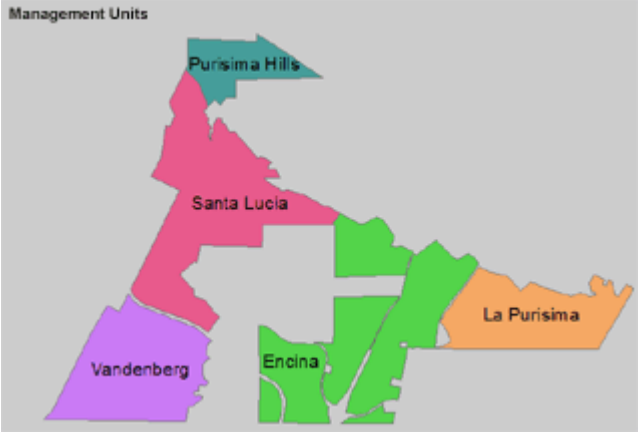
The Reserve is not entirely contiguous; rather it has an irregular boundary and is fragmented into discrete sections by several major roads and residential communities, including Highway 1, Harris Grade Road, Rucker Road, Burton Mesa Boulevard and Vandenberg Village. The Reserve surrounds Vandenberg Village, and is adjacent to Mission Hills and Mesa Oaks (Figure 2). Santa Lucia Canyon Road is parallel to the Reserve's southwestern boundary. Property boundaries, adjacent land use and ownership, access and easements within the Reserve play a role in how the area is managed and how the Reserve is used. The following sections provide a general discussion on property boundaries and conditions, adjacent lands and easements as they pertain to land management.

GIS Feature Class(es):
Boundary

burton mesa boundary
burton_mesa_manunits
burton_mesa_wholeboundary_ta
CA_counties
dfg_burton_mesa_boundary
lapurisima_boundary_ta
Vandenberg Boundary

D. Management Units

In order to facilitate greater understanding of specific features of the Reserve, the property is divided into five management units, each one, roughly 1,000 acres, except for the northern unit which is somewhat smaller. The names of the units are: Vandenberg (Figure 3), Santa Lucia (Figure 4), Purisima Hills (Figure 5), Encina (Figure 6), and La Purisima (Figure 7).



INSERT FIGURE 1: Project Region

INSERT FIGURE 2: Project Site

INSERT FIGURE 3: Vandenberg Management Unit

INSERT FIGURE 4: Santa Lucia Management Unit

INSERT FIGURE 5: Purisima Hills Management Unit

INSERT FIGURE 6: Encina Management Unit

INSERT FIGURE 7: La Purisima Management Unit

This page left blank intentionally.

1. Property Boundaries

The majority of the Reserve's boundary is open and unfenced with the property boundaries not always apparent. In some cases the property boundary is only delineated by Department boundary signs, fences, major roads and the adjacent residential communities. In other cases, the boundary is not marked at all. Where the boundary traverses land away from public roads, access to the Reserve is largely uncontrolled. One exception is the Vandenberg Management Unit where portions of the northern, western and southern boundaries were fenced and signed by the Department in 2004. The Department also installed signs marking the boundary of the Reserve next to the communities of Vandenberg Village, Mission Hills, and Mesa Oaks, as shown in Photo 1.

Photo 1: Boundary signs on the Reserve. *Photograph by Katrina Burton.*

2. Adjacent Lands

Land surrounding the Reserve consists of property owned by various parties, including the U.S government and private land owners. The western boundary of the Reserve is shared with Vandenberg Air Force Base (VAFB), owned by the U.S. Department of Defense, and is delineated by a 100-foot wide fuel break. Beyond the southern boundary is another federal holding, now owned by the Department of Justice (formerly owned by the U.S. Air Force) that houses the U.S. Bureau of Prisons federal penitentiary complex at Lompoc. The jagged northern perimeter is adjacent to an active oil field, now operated by Plains Exploration and Production Company.

La Purisima Mission State Historic Park, owned and managed by California State Parks, is adjacent to and south of the eastern La Purisima Management Unit. The Reserve surrounds the community of Vandenberg Village, which consists of more than 2,400 private homes, public schools, roads and a golf course. Cabrillo High School is located adjacent to the Reserve, with high school students often using the area for athletic and educational programs, and recreational purposes. The County Sheriff and Fire Departments have stations and an equestrian training facility located on Burton Mesa Boulevard next to the Encina Unit.

The Vandenberg Village Community Services District (VVCSD) has a well, water tanks and a water processing plant and at least one water line within the Reserve accessed from the south off Highway 1 and from the north off Burton Mesa Boulevard in the Encina Management Unit (Figure 6). The VVCSD also owns two storage tanks in the Reserve north of Vandenberg Village in the Santa Lucia Management Unit (Figure 4). Plains Exploration and Production Company operates the Lompoc Oil and Gas Plant north of the La Purisima Management Unit of the Reserve on the east side of Harris Grade Road (Figure 2). Plains also owns an oil processing plant off of Rucker Road that is surrounded by the La Purisima Management Unit of the Reserve (Figure 7) and lands to the north of the La Purisima and Santa Lucia Management Units. Plains Exploration and Production Company requires access to these areas for their operation. These access points also present opportunities for access to the Reserve. The Vandenberg Village Golf Course is located within Vandenberg Village in the northeast part of the community. Water from

the golf course, and a spring north of Burton Mesa Boulevard and west of Clubhouse Road, flow into Davis Creek which runs through the southern portion of the Encina Management Unit of the Reserve (Figure 6).

The neighborhood of Mesa Oaks is situated next to the southern boundary of the Encina Management Unit of the Reserve, south of Burton Mesa Boulevard and east of Harris Grade Road (Figure 6). The Mission Hills neighborhood lies east of Rucker Road, east of the Encina Management Unit and south of the La Purisima Management Unit (Figure 6).

Public roads that transect portions of the Reserve include State Highway 1 (also called "Lompoc-Casmalia Road", Santa Lucia Canyon Road (called the "Floradale Road" further south), Harris Grade Road, Rucker Road and Burton Mesa Boulevard. These roadways are open for public use and result in some unregulated access where fencing is not present.

3. Easements, Covenants and Restrictions

a) Easements on State's Land Retained by Unocal: Roads, Power Lines, Utility Lines, Pipelines.

Easements are legally recorded documents that run with the deed, and are therefore transferred with the property from owner to owner. There are different types of easements, and they typically preserve the rights of an entity other than the landowner. The 1991 Certificate of Acceptance and Consent of Recording (Recording #91-038941) identifies 18 separate easements, reserved by Unocal and its successors, to allow access to 'lands retained by Unocal' (lands adjacent to the conveyed lands). These easements are generally 50.00 feet wide and are of varying lengths (CDC Engineering 1991). The easements are for the purpose of maintaining, repairing, replacing and installing roads, power lines, utility lines and pipelines needed to conduct operations on Unocal's adjacent lands. Figure 8 shows the easements on to the Ecological Reserve and lands retained by Unocal.[2] Table 3 shows the easement holders and refers to parcels represented on the maps and within the referenced transfer documents. Table 4 lists easements by Management Unit.

[2] The original map of the transferred land (CDC Engineering 1991) shows "PCL", illustrated in Figure 8. The term is not defined on the original map.

Table 3
Easements on the Reserve

RECORDING DOCUMENT	PARCEL NO. (PCL #)	EASEMENT NO. (E-#)	USE	MANAGEMENT UNIT	EASEMENT HOLDER
Recording # 91-038941	PCL 1	E-36	Pipeline/Roadway	Purisima Hills	State Lands Commission
	PCL 2	E-26	Pipeline	Santa Lucia	State Lands Commission
	PCL 3	E-15	Pipeline	Encina	State Lands Commission
	PCL 4	E-29	Pipeline	Encina	State Lands Commission
	PCL 5	E-30	Pipeline/Powerline	La Purisima	State Lands Commission
	PCL 6	E-32	Powerline	La Purisima	State Lands Commission
	PCL 7	E-5	Pipeline	La Purisima	State Lands Commission
	PCL 8	E-7	Pipeline	La Purisima	State Lands Commission
	PCL 9	E-6	Powerline	La Purisima	State Lands Commission
	PCL 10	E-2	Pipeline/Roadway/Powerline	La Purisima	State Lands Commission
	PCL 11	E-4	Powerline	La Purisima	State Lands Commission
	PCL 12	E-11	Powerline	La Purisima	State Lands Commission
	PCL 13	E-31	Powerline	La Purisima	State Lands Commission
	PCL 14	E-14	Roadway/Pipeline	La Purisima	State Lands Commission
	PCL 15	E-48	Pipeline	Santa Lucia	State Lands Commission
	PCL 16	E-49	Pipeline	Santa Lucia	State Lands Commission
	PCL 17	E-1*	Powerline	La Purisima	State Lands Commission
	PCL 18	E-1*	Powerline	La Purisima	State Lands Commission
Recording # 91-038942		Esmnt # 1	Connector Access	Santa Lucia	Successors to Unocal
		Esmnt # 2	Connector Access	Santa Lucia	Successors to Unocal
		Esmnt # 3	Connector Access	Santa Lucia	Successors to Unocal
		Esmnt # 4	Connector Access	La Purisima	Successors to Unocal
		Esmnt # 5	Connector Access	La Purisima	Successors to Unocal
		Esmnt # 6	Lateral Easement	La Purisima	Successors to Unocal

* E-1 is represented by PCL 17 and PCL 18

Table 4
Easement Locations within the Reserve by Unit

MANAGEMENT UNIT	EASEMENTS
Vandenberg	none
Santa Lucia	26,48,49
Encina	15, 29
La Purisima	1,1,2,4,5,6,7,11,14,30,31,32
Purisima Hills	36

Easements on Unocal's Land Granted to the State include Roadways, Connector Roadways, Lateral Access for Farm Equipment, and Cut and Fill.

Recording # 91-038942 identifies five connector easements (for connecting existing roads), one lateral easement (for the purpose of farm equipment) and an easement to 'cut and fill' (for the purpose of maintaining State access roads and access itself). This recording indicates that Unocal granted easements across adjacent lands retained by Unocal so that the State of California may conveniently access, and utilize the Property (land transferred to the State of California. This is confirmed by a letter from Unocal to Santa Barbara County (Boyle 1992).

This easement agreement provides for 50.00-foot wide easements including (i) existing roadways, (ii) existing connector roadways [as depicted in exhibits with in the agreement] from existing roads on the Unocal property to the granted lands, and (iii) lateral access for farm equipment. (Any farm equipment transported over these easements must use tires to protect shallow subsurface pipelines). The language in Recording #91-038942 indicates the land associated with these connector easements is owned by Unocal's successors. Further, the easement protects the State of California's right to cut and fill areas of Unocal property necessary to maintain roads within the easement.

b) Consultation Regarding Change of Use in Specific Areas

Recording #91-038941 contains a Burton Mesa Deed Covenant that requires that the State Land Commission not change the land use on selected areas to new land uses that may be incompatible with the current use (oil production) without prior consultation with Unocal. This does not apply to the entire Reserve; rather, it applies only to designated areas. These designated areas are centrally located on the northern side of the conveyed lands, on both sides of Harris Grade Road, near the oil company's oil processing plant that is located north of the Reserve and east of Harris Grade Road (Figure 2).

4. 47-Acre Transfer from Santa Barbara County to State of California

The County transferred a total of 47 acres of land (now in the Santa Lucia Management Unit) to the State in December 1997 for inclusion in the Ecological Reserve (Figure 4). These 47 acres included 20 acres of land west of Vandenberg Village and north of Highway 1 that was originally granted to the County by the Vandenberg Village Development Company (Gevirtz *pers. comm.* 2004). In the late 1980s-early 1990s, the

County Parks Department developed plans for a Nature Reserve on the property (Oak Collaborative, 1990), but these plans were never implemented. The transfer of 47 acres of land from the County to the State in 1997 also included 27 acres of land that had been part of a 34-acre parcel purchased by the County using the County's Coastal Resource Enhancement Fund (Briggs, 1997, California State Lands Commission 1998). The remaining 7 acres of that 34-acre parcel was retained by the County as a park, and is presently used as little league fields.

5. Unocal's 200-Acre Open Space Easement

The 200-acre Open Space Easement (located northwest of Vandenberg Village in the Santa Lucia Management Unit) granted by Unocal to the County is on land now owned by the State of California. This easement served as mitigation for impacts to Burton Mesa Chaparral associated with Unocal's construction of the Point Pedernales Pipeline (Santa Barbara County 1990). The easement designates that "the use of the property shall be limited to natural open space for habitat protection, education, research and resource conservation uses; uses incidental or accessory thereto; uses for the protection of health and safety or the reduction of fire hazard; and for such further uses as are determined to be consistent with the purposes of this easement by the Director of the Public Works Department of the County of Santa Barbara" (Santa Barbara County 1990). The Ecological Reserve uses proposed in this Land Management Plan are consistent with the terms of the easement. The open space easement (shown in Figure 8) is granted in perpetuity with the exception that Unocal reserved rights to conduct subsurface oil and gas exploration and production in such a manner as to cause minimal disturbance to the protected property. These rights run with the land and are not invalidated by changes in ownership of fee title.

6. State Water Line Lease

The Central Coast Water Authority retains a 49-year lease over 23.60 acres of the Reserve to maintain the State Water Pipeline. It began November 16, 1994, and will end in 2043.

7. County Sheriff Equestrian Training Facility

The County Sheriff's Department retains a 15 year lease of a 3.04 acre parcel behind the Sheriff's station on Burton Mesa Boulevard for the purpose of establishing and maintaining an equestrian training facility. The lease began on May 3, 1995 and will end in 2010 (California State Lands Commission 1995).

This page left blank intentionally.

Insert Figure 8 - Easements

This page left blank intentionally.

E. Geology, Soils, Hydrology, Climate

1. Geologic Setting

a) General Introduction

GIS Feature Class(es):
Geology

Geology

The underlying geology of the Burton Mesa Ecological Reserve is relatively young, consisting of highly folded, lithified, older formations of marine origin that are 4 to 10 million years old. These formations are overlain by relatively undeformed, poorly consolidated formations of Pliocene and Pleistocene age that are 3 to 4 million years old.

The sequence of rock strata in the Reserve consists of a series of geologic formations, as described briefly below. With the exception of the Purisima Hills and streambeds, the Orcutt Formation is exposed at the ground surface. Beneath that is the Paso Robles Formation, underlain by the Careaga Formation, underlain by the Foxen Formation, underlain by the Sisquoc Formation, then the Monterey Formation (Figure 9). This is a generalization; not all rock units may be present at every location. Variations in thickness and presence or absence of some formations are expected (Norris 2003). Figure 9 shows the strata of geologic formations in the region.

The Monterey Formation is of Miocene age (that began 24 million years ago) and is from 2000 to 4500 feet thick. Robert Norris (2003) describes it as having "very little sandstone, clay shale or conglomerate. Instead, it is a mixture of deep water organic oozes, volcanic ash beds and chemical precipitates such as silica. For the most part, it bleaches on weathering to a pale color ranging from white to tan." The Monterey Formation does not outcrop within the boundaries of the Reserve.

Sisquoc Formation outcrops on the slopes of the Purisima Hills on the northwest portion of the Purisima Hills Management Unit of the Reserve. It is a marine deposit of Upper Miocene to Middle Pliocene age. These could range from 4 to 10 million years old. Locally this formation is composed mainly of well-laminated, silica-rich, diatomaceous clay shale that forms clay rich soils (Figure 9). The formation reaches thickness of 2,800 to 5,000 feet in this area (Norris 2003). Well-exposed outcrops can be observed along the southern flank of the Purisima Hills and are visible for the entire length of the range just north of the Reserve. The formation's clay-rich sediment weathers and provides clay detritus to nearby slopes, small arroyos and stream bottoms. Many of the numerous oil wells found just north of the Reserve's northern boundary draw oil from the Sisquoc Formation. Dr. Robert Norris (2003) writes:

> *"The Sisquoc Formation shares many characteristics with the Monterey and grades into it in some places. However, in others the two are separated by a short erosional interval. The lower part of the Sisquoc is usually very well laminated, indicating that it was deposited in quiet, stagnant water, which, like the Monterey, lacked bottom-living, burrowing organisms.*

> *The high organic content of the [Sisquoc and the Monterey formations] has made them a major source of oil and gas in many parts of California. Fractures and bedding planes provide extensive pore space for fluids such as oil, gas, and water. Exposures of the Sisquoc Formation on the south coast and in the Purisima and Solomon Hills have lower content of organic material and more clay than do the high purity diatomites [south of] Lompoc."*

Careaga Formation has limited exposure in the northern portions of the La Purisima Management Unit of the Reserve. This formation is mainly a marine sand of upper Pliocene age (three to four million years old). It is 0 – 800 feet thick (Norris 2003). Stratigraphically, it overlies the Sisquoc Formation and underlies the Paso Robles Formation. The Careaga Formation is divided into an upper and lower member. The lower member is described as fine-grained sand while the upper member is reported as a coarser grained unit with crossed bedded sand and pebble horizons. Portions of the Careaga are representative of littoral or beach sand deposits. The uppermost portions of this member consist of hundreds of feet of loose sand. These have been interpreted as wind-driven dune sand (Dibblee 1950). Dr. Robert Norris (2003) adds: "The Careaga sandstone is found mainly north of the Santa Ynez River, particularly in the Purisima and Solomon Hills. Most of this rock unit was deposited in a very shallow marine basin, as demonstrated by the abundant presence of sand dollars that occur in it on the north flanks of the Purisima Hills."

Paso Robles Formation within the Reserve only occurs within the La Purisima Management Unit. The Paso Robles is older alluvial deposit, and ranges in thickness from 0 to 4,500 feet (Norris 2003), and is reported as a series of continental gravel, sand, and clay of upper Pliocene and lower Pleistocene age (Upson et al., 1951). These formation materials are no older then a few million years. It is full of bleached whitish chips of Monterey shales. Along with the Careaga Formations, this unit influences soil formation in the upper portions of Purisima Canyon.

Orcutt Formation On top of these formations is the Orcutt Formation. Poorly consolidated sand from the Orcutt Formation is the most dominant formation on the Reserve. It is the parent material of many of the sandy soils found here. The Orcutt Formation is middle to late Pleistocene in age (a few hundred thousand years old) and is made up of non-marine sands and gravels.

On the Burton Mesa, the Orcutt Formation is made up of loose, medium grained, light buff sands that were probably deposited by wind from the northwest. These are very sand-rich materials, mainly composed of silica grains, similar to modern sand dunes. However there are some portions of the Orcutt Formation along the eastern extent of the Formation that are probably not wind driven material, and are described as "pebble and gravel stringers" (Norris 2003).

Formation of the Burton Mesa "During the Pliocene (about 5 to 2 million years ago) the seas withdrew from most of Santa Barbara County as the mountain building period began. The Sierra Madre, San Rafael and Santa Ynez ranges were elevated

and emerged from the sea at this time. Further, what are now the Purisima Hills, [along with] the Solomon, Casmalia, and Santa Rosa Hills were folded and began to emerge from the sea about five million years ago. A large area bounded on the south by the rising Santa Ynez Range, on the northeast by the Little Pine and related faults and the Sisquoc River, and on the west by the sea, remained under water. This marine embayment, below present sea level, formed a catchment, and is known as the Santa Maria Basin" (Norris 2003).

The Santa Maria Basin, which stretches from Morro Bay to Point Arguello (Figure 10) contains a very large system of dunes and is the subject of study by Cooper (1967), Orme and Tchakerian (1986), and is summarized by Lawrence Hunt (1993). These dunes were deposited by strong offshore winds over a series of episodes or phases of basin subsidence throughout Tertiary and Quaternary times, resulting in recurring dune development over time. The oldest of these phases occurred in the mid-Pleistocene (25,000 to 80,000, or as much as 200,000 years ago).

The Santa Maria Valley Dune Complex is one of three major dune complexes: Morro Bay, Santa Maria Valley, and the Santa Ynez Valley Dune Complexes. The Santa Maria Valley Dune Complex is the largest system of coastal dunes in California, extending 28 kilometers along the shore and 50 kilometers inland, and is composed of several distinct dune sheets. The Burton Mesa dune sheet is the largest exposure of mid-Pleistocene sands in the Santa Maria Basin (Hunt 1993). The Burton Mesa dune sheet extends from Shuman Canyon (on Vandenberg Air Force Base) southeasterly to the south-facing slopes of the Purisima Hills eastward approximately 35 kilometers from the present shoreline (Figure 10). Hunt (1993) reports that these Phase I dunes are old enough to have developed a soil profile, classified as Tangair and Narlon soils (Shipman 1972). These oldest of dune deposits lie beneath newer dunes that were deposited later.

The age of these more recent dunes deposited by offshore winds have been estimated at 10,000 to 25,000 to as much as 125,000 years old. Contributing to the formation of these vast dune systems was a rapid fall in sea level approximately 18,000 years ago, perhaps as much as 300 feet below the present shoreline. This exposed vast quantities of sediment that would later be transported miles inland by offshore winds.

These dunes are composed of poorly consolidated to unconsolidated red to yellow sands with a clay-enriched B-horizon profile, and the substratum is generally a dense, cemented sand layer. This cemented layer may contribute to the water holding capacity of the soil, which in turn, affects the types of plants and vegetation communities that are observed. Hunt (1993) reports that these older dunes, like the newer dunes, have substrates with have significantly higher proportions of fines compared to more recent deposits, thus forming a denser soil. He also points out that these dunes are vegetated by live oak woodland, chaparral and coastal sage scrub, indicative of a very long period of stability.

Terrace Deposits and Alluvium Alluvium and Terrace Materials (surficial sediments) include stream channel, valley, and flood plain deposits. Terrace deposits can be as old as upper Pleistocene while the Alluvium is contemporary (Holocene) in age. These materials could be up to many thousands of years old in

the lower sections of the alluvial deposits. However, they are current in age at the surface where they are continually eroded, transported and deposited in an ongoing sedimentary process. All stream-lain valley fill of recent age is mapped as alluvium by Dibblee (1950). He characterizes these sediments as unconsolidated loamy clays, silt sands and gravels. The largest occurrence of alluvium in the Reserve is in the large open agricultural fields northwest of Vandenberg Village in the Santa Lucia Management Unit (Figure 11). Other smaller alluvial filled drainages occur in both branches of Purisima Canyon in the La Purisima Management Unit of the Reserve. Most of the alluvium on the Reserve yields the Elder soil series and is either currently farmed or has been farmed in the past.

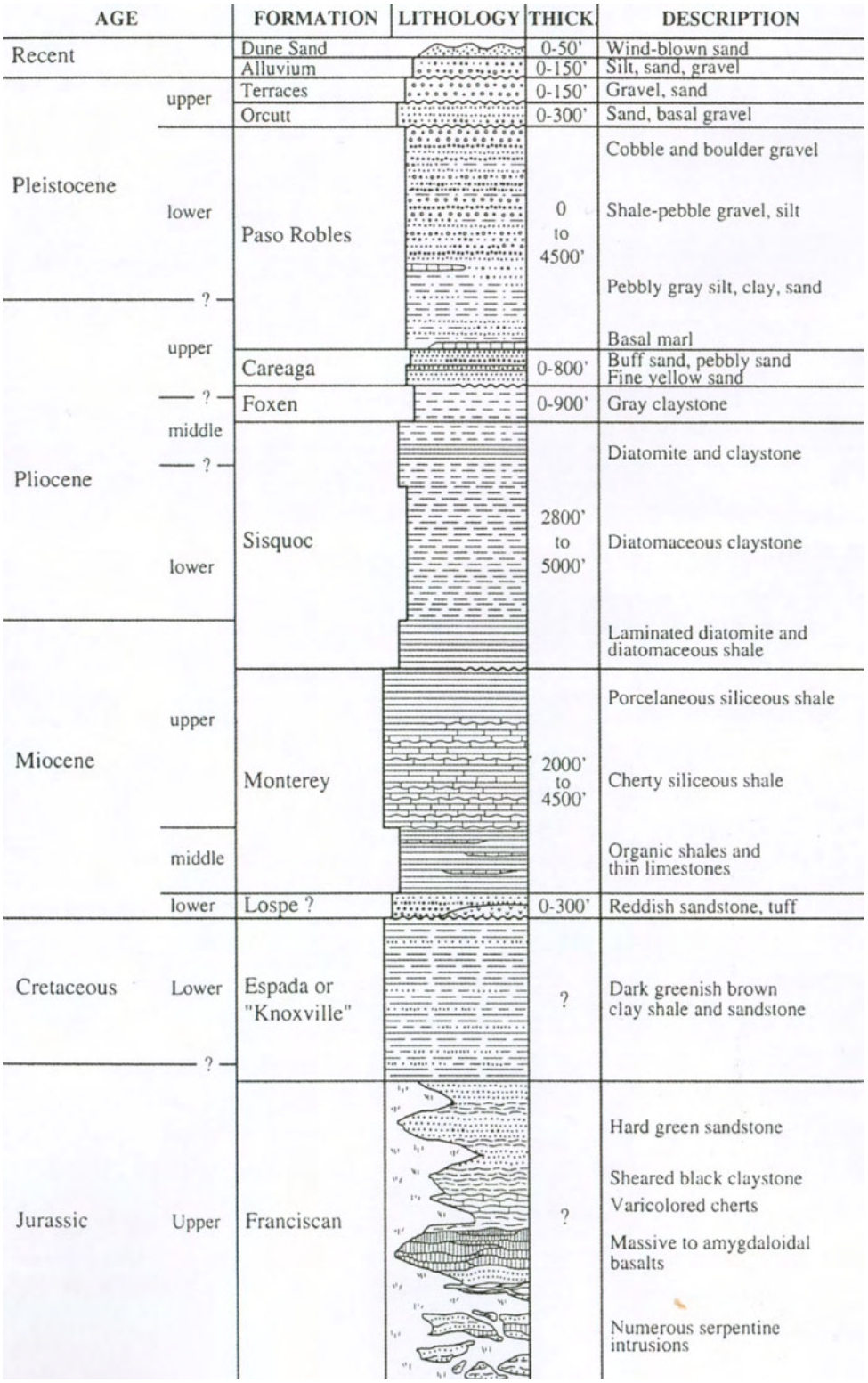


Figure 9: Geologic columnar section of the southern Santa Maria Basin.
Source: *Robert M. Norris 2003.*

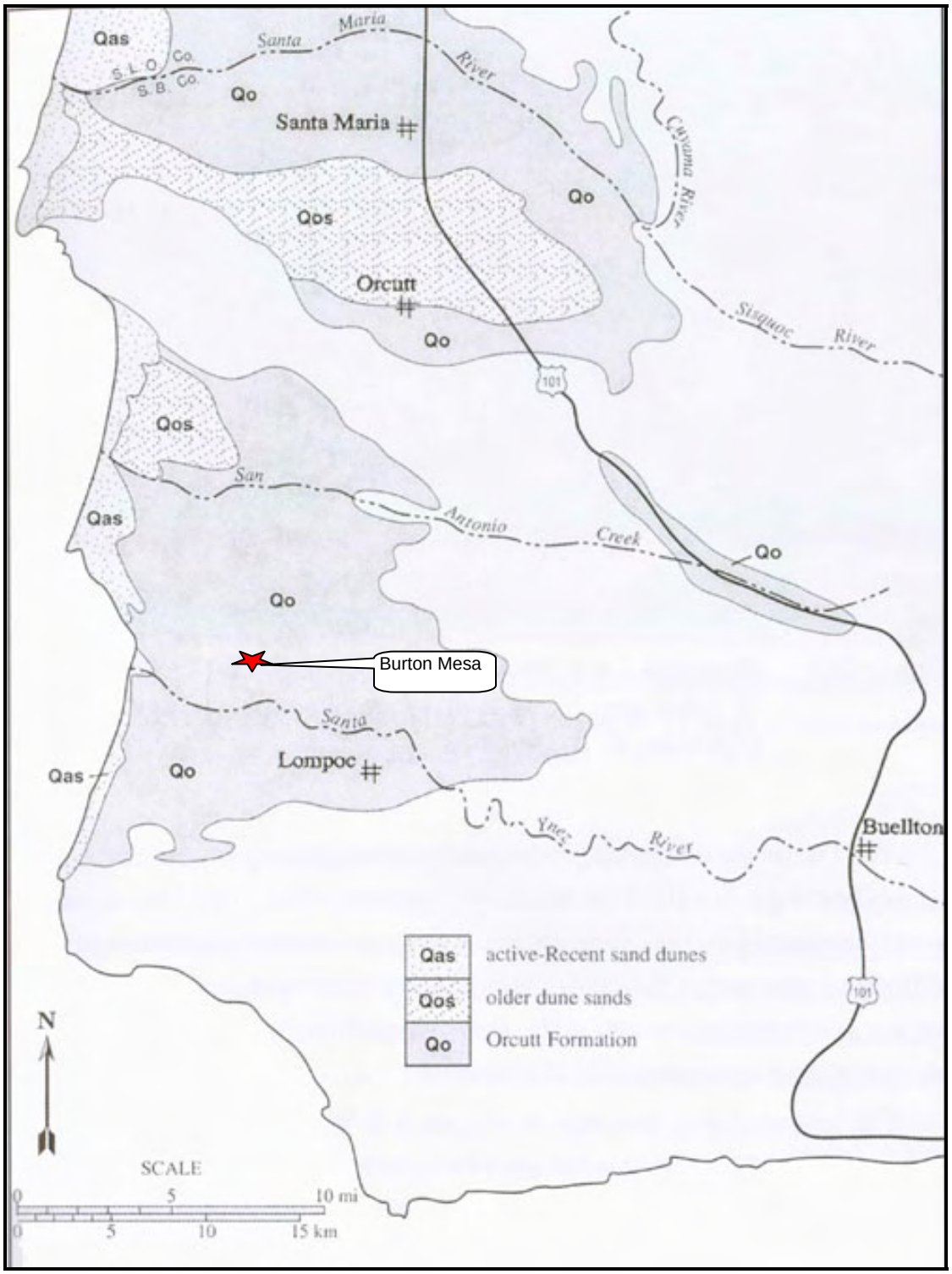


Figure 10: Distribution of the Three Ages of Sand Dune in Western Santa Barbara County. *Source: Robert M. Norris 2003.*

INSERT FIGURE 11 – GEOLOGY

This page left blank intentionally.

2. Soils

a) *General Introductions*

GIS Feature Class(es):
Soils

soil_polys
soil_polys_clip
soil_polys_reserve

The Marina-Oceano Soil Association dominates the Reserve. However there are over 17 separate types of soils within the Reserve as mapped by the U.S. Department of Agriculture Soil Conservation Service, 1972, and as shown on Figure 12. Of these 17 soils, six of these cover 90% of the area. These are discussed briefly below. Some soils of lesser interest are not discussed specifically because they occur in such limited areas. For instance, soils on the steep flanks of the Purisima Hills are made up mainly of the San Andreas-Tierra Complex. However, these slopes have exposed rock and contain the soils, Gullied Land, Sedimentary Rock Land, Rugged Broken Land and Terrace Escarpment. These are actual soil series, but in some sense these designations represent the absence of well formed soil. Table 5 presents the soils on the Reserve and their characteristics.

Soil development is influenced mainly by parent material, degree of slope, climate and biologic activity. Parent material can be evaluated by comparing the geologic map with the soil map. Parent materials affect the range of soils that may form through the weathering process, given a certain climate. The affect of slope on soils relates to both degree of slope and orientation. Orientation effects how microclimates and biota may interface with the original parent material as the development of soil proceeds. Degree of slope influences how the soil particles move about. Steeper slopes retain developed soil less readily, while gentle slopes can have soils of substantial thickness.

b) *Principal Soils and Distribution*

The characteristics of the principal soil types and their general location within the Reserve are described below. Table 5 summarizes the soil characteristics within each Management Unit, and Figure 12 illustrates their location.

Table 5
Principal Geologic and Soil Types of Each Management Unit

Management Unit	Dominant Geologic Formation	Dominant Soil Series	Unique Features
Vandenberg	Orcutt	Marina	Vernal Wetlands
Santa Lucia	Orcutt/Alluvium	Marina/Elder	Marsh, Springs, Vernal Wetlands
Encina	Orcutt	Marina	-
La Purisima	Careaga/Paso Robles	Arnold/Elder	-
Purisima Hills	Sisquoc/Orcutt/Alluvium	Exposed rock/ mixed soils	Steep slopes, exposed rock

This page left blank intentionally.

Insert Figure 12 – Soils

This page left blank intentionally.

Marina Series
Marina sand is one of several soils that are included within the Marina-Oceano Soil Association. This soil and others grouped within the Association are somewhat excessively drained sandy soils that are underlain by wind deposited sands and typically occur on mesa formations and can develop slopes up to 30%. They are easily eroded and can be deeply incised by drainages. Locally, they form on the Orcutt Sand Formation and are widely distributed across the Burton Mesa. They are by far the most abundant soils on the Reserve, occurring on most of the Encina, and substantial portions of the Vandenberg and Santa Lucia Management Units, as well as smaller areas of the Purisima Hills and La Purisima Management Units.

Elder Series
Elder series soils on the Reserve include Elder loam, Elder sandy loam, and Elder shaly loam, and are nearly flat lying, moderately drained soils comprised of a mixture of silt and sand deposits. These soils tend to form in stream bottoms and small arroyos as the result of stream erosion and depositional processes. In the Reserve, these soils occur in the large open fields in Santa Lucia and Purisima Canyons (Santa Lucia and La Purisima Management Units) where they are used for cultivated agriculture. They also form on nearby slopes and alluvial deposits draping canyon slopes.

Arnold Series
Arnold sand is made up of very well drained soils that develop on poorly indurated (hardened) sandstones. Typically these soils form on low to moderate slopes and are moderately erodable. On the Reserve, they are distributed in the La Purisima, Vandenberg, Encina, and Purisima Hills Management Units. The large vernal pond south of Highway 1 in the Vandenberg Management Unit occurs on Arnold sand.

San Andreas-Tierra Series
The San Andreas-Tierra complex of soils are made up of well-drained sandy soils that form on soft, poorly consolidated sand-rich formations. These soils form in the steeper terrains of the La Purisima Management Unit and the Vandenberg Management Unit of the Reserve. The Soil Conservation Service reports that the San Andreas soils are so intermingled with the Tierra soils in these areas that they are mapped as a complex and not as an individual soil series.

Tierra Series
The Tierra series includes Tierra loam and Tierra sandy loam and is made up of moderately well drained sandy soil underlain by more clayey subsoil. These form mainly on older water-deposited sediments. Locally these are associated with the San Andres series and occur in the Vandenberg Management Unit of the Reserve.

Corralitos Series
Corralitos sand is an excessively drained loamy soil that develops over recent water lain sediments. These occur mainly in the eastern portion of the La Purisima Management Unit vegetated by grassland.

Narlon Series, Hardpan Variant
Narlon sand is a hardpan variant of the Narlon series. The soils in this series characteristically form on sandy wind-borne deposits. Typically the sandy soil is situated at the surface and is underlain by a substratum that has a greater percentage of silt or clay. The permeability of these soils is low, and perched water is often associated with the soil, both at the surface and below the surface. These soils are found in the Santa Lucia Management Unit west of Cabrillo High School (supporting a vernal wetland) and in the Encina Management Unit.

3. Hydrologic and Hydrogeologic Setting

a) General Introduction

The Burton Mesa Ecological Reserve sits within the Lompoc subarea of the Santa Ynez River Groundwater Basin. The basin extends approximately 70 miles inland from the coast and varies from a few miles wide to approximately 15 miles wide. This wedge shaped basin is demarked by the Santa Ynez Mountains to the south; the Purisima and Santa Rita Hills to the north and the San Rafael Mountains to the east (Figure 1). The basin is broken into five sub-basins by Upson (1951). The Santa Ynez River flows generally westward from the San Rafael Mountains, through the sub-basins to its mouth at the Pacific Ocean, at the community of Surf. The Lompoc sub-area is the last and furthest west of the sub-basins. For groundwater management purposes, Santa Barbara County refers to this as the Lompoc Groundwater Basin, comprised of two hydrologically connected sub-basins: the Lompoc Uplands (where Burton Mesa sits), and the Lompoc Plain.

GIS Feature Class(es):
Hydrology

BM_Streams
grd_wa_basin
hyrdo_basins
hyrdo_lines
hydro_polys
hydro_pts
nwi_lompoc_line
nwi_lompoc_polys
Spring

b) Surface Water

Four streams in the Reserve flow southwesterly off the south-facing slopes of the Purisima Hills, across Burton Mesa and discharge into the Santa Ynez River, approximately one mile south of the Reserve's southern boundary. From east to west, these are both forks of Los Berros Creek (located in Purisima Canyon on the USGS quad, and channelized south of La Purisima State Park), both forks of Davis Creek (not shown on the USGS quad), an unnamed drainage west of Vandenberg Village, and a drainage within the east branch of Santa Lucia Canyon. With the exception of Davis Creek, which is fed by irrigation runoff from the golf course, all streams in the Reserve are intermittent, only flowing during the rainy season.

Santa Lucia Canyon and Purisima Canyon. The two larger drainages on the Reserve are within Santa Lucia Canyon and Purisima Canyon. Santa Lucia Canyon runs parallel to the western boundary of the Reserve and for the most part is just outside the Reserve boundary (Figure 1 and Figure 13). The eastern branch of Santa Lucia Canyon is within the northwestern portion of the Reserve in the Santa Lucia Management Unit, running its course through the middle of the largest agricultural field (Figure 4). Purisima Canyon (Los Berros Creek) is located in the far eastern

portion of the Reserve in the La Purisima Management Unit (Figure 1 and Figure 7). This canyon bottom is also farmed. The lower reaches are within La Purisima State Park.

Davis Creek, Meriam Creek and Other Drainages. Several smaller drainages exist on the Reserve. The largest of the smaller drainages is known locally as Davis Creek, and its easterly tributary is known as Meriam Creek in the Encina Management Unit (Figure 6). (They are unnamed on the USGS Lompoc Quadrangle map.) Davis Creek has perennial water flow, due in part to a spring at the top of the drainage and a second one located between Clubhouse Road and a Service Road of the Vandenberg Village Community Services District, but likely primarily due to irrigation runoff from the Vandenberg Village golf course (Figure 13). One small drainage in the southwest corner of the Reserve drains a large vernal pond and the relatively flat surrounding land in the Vandenberg Management Unit. This small drainage system quickly incises the terrain and creates two fairly steep canyons as they flow southward toward the Reserve's southern boundary (Figure 3).

This page left blank intentionally.

Insert 13 - Hydrology

This page left blank intentionally.

Springs. Several springs occur on the Reserve or near its boundaries. Some of these are shown on U.S. Geologic Survey topographic maps (Figures 1 and 13). One spring is mapped just outside the Reserve's western boundary and is located approximately 2,000 feet southwest of the large marsh in the Santa Lucia Management Unit. Another spring is mapped in what is now the Vandenberg Village Golf Course. A third spring is not mapped on USGS maps, but is shown in Figures 6 and 13 in the Encina Management Unit north of Burton Mesa Boulevard and just west of Clubhouse Road.

At least two additional springs occur north of the large agricultural field in the Santa Lucia Management Unit. One of these has an old spring box, suggesting that it was a source of fresh water in relatively recent history. A second spring in this area is on the west side of the Reserve. Flowing west off the property toward Santa Lucia Canyon, this spring supports wax myrtle and arroyo willow, among other wetland plants.

Vernal Wetlands. A large vernal pond and several smaller vernal wetlands occur in the southwestern portion of the Reserve, on the Vandenberg and Santa Lucia Management Units. These occur in the area mapped as Orcutt Formation and are associated with the Narlon sand. The vernal pond is large enough to be shown on the U.S. Geologic Survey 7 ½' Topographic quadrangle (Figures 3, 4, and 13).

Freshwater Marsh. Probably the most notable and distinctive surface water feature within the Reserve is a large marsh over 10 acres in size located on the eastern branch of Santa Lucia Canyon on the Santa Lucia Management Unit. The source of the water for this wetland area has not been identified, but is probably several springs hidden from view on the densely vegetated slopes surrounding the marsh, as suggested by the presence of other springs nearby.

Another possible explanation is the high groundwater table that apparently exists beneath the agricultural fields. A third possibility is historic agricultural practices that may have modified the natural drainage pattern and contributed to impoundment of water in this area. Water retention at the marsh may be aided by the accumulation of fine-grained, wind-driven materials (silts and clays) that settle on the water surface and then sink to the bottom, forming a fine-grained layer that becomes less permeable through time.

In summer 2004 (a year of lower than average rainfall), water flowed from two springs on the western boundary of the Reserve, and crossed the dirt road on the U.S. Air Force side of the fence separating the two properties (Figure 4). One of these springs is northwest of the large cultivated field on the Santa Lucia Management Unit and the other is southwest of the same field. The latter is in the same vicinity as the spring mapped on the USGS topographic quadrangle. This suggests that additional springs surrounding the marsh could provide an adequate supply of water to support the marsh, even in dry years, such as 2003-2004, when only 9 inches of rain fell.

Further support of this is provided in historical aerial photos. In the 1938 (Figure 16) and 1970 photographs, the marsh area was farmed as part of the now adjacent agricultural field. There is no evidence of water or the marsh in these photographs.

Rainfall in 1970 was about average with 14.12 inches of rain falling (average rainfall from the Lompoc Weather Station is 14.78 over the past 50 years); no rainfall data are available for 1938. However, in the 1989 aerial photo the marsh area is clearly visible although slightly smaller than in the 2002 aerial photograph. Rainfall was well below average in 1989 – only 3.12 inches of rainfall – which is considered a drought year. Further, rainfall in 2002 was also below average (8.75 inches) and the marsh is still present. The wettest year in the Weather Station's records is 1983 with 32.66 inches, with a close second of 32.49 in 1998. This information suggests that the marsh may not be dependent on rainfall, but rather on groundwater level and surrounding springs.

c) Groundwater

The Reserve is within the Lompoc sub-basin of the Santa Ynez River system. The sub-basin itself is divided into the Lompoc Plain and the Lompoc Uplands. The Lompoc Plain is mainly the flat-lying valley floor that contains the river channel itself, the City of Lompoc, and thousands of acres of farmland. The Lompoc Uplands consists of the elevated hills north of the Santa Ynez River. This area includes the physiographic area known as Burton Mesa, the Vandenberg Village and Mesa Oaks areas, and all of the Reserve.

The Lompoc Uplands groundwater basin is partially beneath the Burton Mesa and consists of the Terrace Deposits, Orcutt Sand, Paso Robles Formation, and the Careaga Sand (Bright, Nash, and Martin 1997). It is also present at depth, beneath the Upper Aquifer throughout the eastern two-thirds of the Lompoc Plain. It is the primary aquifer underlying the Reserve (Bright, Nash, and Martin 1997). The Terrace Deposits and Orcutt Sand are highly permeable; however, they are unsaturated in most of the Lompoc Upland area. Groundwater on Burton Mesa generally flows toward the ocean in a southwesterly direction. Flow becomes more westerly as groundwater approaches the Santa Ynez River.

Groundwater Wells. There are four wells on the Reserve and three additional wells in close proximity to the Reserve, as shown in Figure 13 (Dennis Gibbs, Santa Barbara County Water Resources Agency *pers. comm.* 2004). Most of these are owned and operated by the Vandenberg Village and Mission Oaks Community Services Districts to provide potable water for their respective communities. The well located in Purisima Canyon (Figure 13) is used only for monitoring purposes (Dennis Gibbs *pers. comm.*, June-July 2004). Although additional wells may be in the area, they are not documented in formal records obtained from the County.

Perched Water. Shallow (or perched) groundwater may be encountered at elevations above the aquifer. This shallow groundwater, perched at times, can occur due to a number of different processes. It may occur due to impermeability of the soil or geologic sequence. For example, soils such as the Elder series found in nearly flat lying stream and canyon bottoms may develop clay horizons that lead to temporarily perched water. Naturally occurring fine-grained sediment interbedded with more permeable sand, is not uncommon in the Orcutt Formation. Locally, the Orcutt Sand may contain some perched groundwater. This occurs particularly in areas where the Orcutt Formation contains fine-grained clayey laminations and thin

shale interbeds. Where Narlon Soils have formed hardpan layers, water may accumulate and remain on the surface through the spring season. The process of hardpan formation is called "cementation".

Secondary cementation is a process that may also contribute to the occurrence of perched water. Most commonly, water flowing through shallow soil horizons dissolves minerals and moves them. These dissolved minerals then precipitate and form hard layers with low permeability. These hard layers retain water for longer periods of time.

Fine grain silts and clays, driven by wind, can accumulate on temporary surface water trapped in low-lying areas or swales. These fine-grained, wind transported materials eventually settle to the bottom of standing water and tend to collect through time. This leads to thicker accumulation of mud thereby further reducing the downward infiltration of water. Given favorable conditions this process could contribute to the growth of water bodies such as vernal pools or other more persistent marshes.

4. Climate

The Reserve experiences a Mediterranean climate, with mild, moist winters and moderately warm, rainless summers. The region is strongly influenced by the prevailing westerly transoceanic air currents. These frequently strong winds blow across the mesa, sometimes causing localized blow-outs in sandy soils and wind-pruning of the vegetation along the west-facing slopes and their crests (Ferren et al., 1984). Late afternoon and early evening are often characterized by onshore breezes or winds during most of the year, but winds are strongest and persistent in late spring and early summer as a result of seasonally increasing daytime convection in the interior.

A marine layer or fog characterizes this coastal region and is heaviest during late spring and early summer mornings. Frost is also a regular occurrence in winter, especially in low-lying areas.

Temperature and precipitation data are recorded in the City of Lompoc, approximately 4 miles to the south of the Reserve (Table 6). Temperatures in the project area are relatively mild, with a mean annual temperature of 58.4°F; the average maximum July temperature is 72.7°F and the average January minimum temperature is 40.6 °F (Western Regional Climate Center, Lompoc): www.wrcc.dri.edu. Temperature minima are lower than are found in most areas along the Central California coast (Odion et al., 1993).

Table 6
Average Temperature and Precipitation Data
Lompoc, California
1950 - 2004

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
Average Maximum Temperature (°F)	65.0	66.2	66.5	68.3	69.1	71.1	72.7	73.6	75.3	74.6	70.1	65.8	**69.8**
Average Minimum Temperature (°F)	40.6	42.3	43.5	45.2	48.3	50.9	53.2	53.8	52.9	48.9	43.8	39.8	**46.9**
Average Total Precipitation (in.)	3.01	3.13	2.78	1.17	0.25	0.04	0.02	0.03	0.19	0.45	1.60	2.12	**14.78**

Source: Western Regional Climate Center, 2003.

Average yearly precipitation is estimated at 14.78 inches falling primarily between October and April. The local weather pattern of mild, wet winters and warm, dry summers is characteristic of Mediterranean-climate regions; and the effect of the dry summers on plants is ameliorated somewhat by cool temperatures, prevailing oceanic winds, and a marine layer.

Annual rainfall figures can vary dramatically from season to season, having a profound influence on ecosystems, fire frequency, and water availability. Figure 14 shows annual precipitation totals for the past 20 years in the Lompoc area *(from* www.wrcc.dri.edu*)*. The year of this study, 2003-2004, was considered a drought year, with only 9 inches of rainfall recorded.

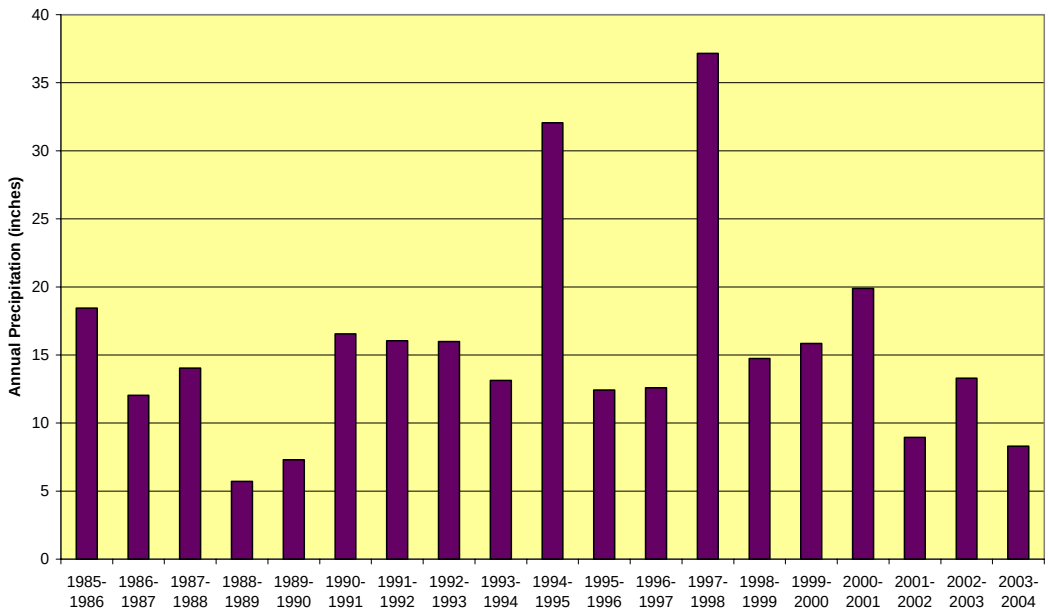


Figure 14. Annual precipitation totals at Lompoc, CA, 1985-2004.

Plants tend to grow when there is sufficient moisture and temperatures above freezing. As a result, plants begin to grow on the Burton Mesa and Purisima Hills at the onset of winter rains, continues through winter with the main burst of

vegetative growth and flowering in spring, and generally ceases in the summer. Chaparral shrubs such as *Arctostaphylos, Ceanothus* and *Ribes* often bloom in the winter months, and are followed in spring by a profusion of flowers produced by other shrubs, herbaceous perennials and annuals.

F. Cultural Features

The Burton Mesa Ecological Reserve is located within what was probably a marginal settlement and subsistence zone during prehistoric and early historic times. Major human settlements during these time periods were located much farther to the west along the coastline and also to the south in the Lompoc Valley and its major tributaries. This does not mean that what is now known as the Reserve was devoid of important resources. On the contrary, this area most likely provided a variety of resources that were used periodically in season or as required for subsistence.

The Chumash are known to have burned vegetation close to the coast in order to increase the quantities of desirable plant and animal resources (Timbrook, Johnson, and Earle, 1982). However, while it is possible that this practice was used on the Burton Mesa, there is no direct evidence (Timbrook *pers. comm.* 2005, Spanne *pers. comm.* 2005). That potential is partially indicated by historical records that document that seed collecting was a significant activity of the Chumash who moved to La Purisima Mission, but it is unknown whether seed collecting was occurring on the Burton Mesa, or at further distances from Mission, closer to the coast (Engelhardt 1932, pp 14, 15). There are very few areas of native grasslands at the Reserve; although it is possible that areas that are now agricultural fields may have been occupied by native grassland on clay and loam soils. In addition, gardening, more intensive cultivation of field crops, and grazing of livestock have occurred in this same area since the establishment of Mission La Purisima Vieja in 1787. Very early development of oil occurred in the northern portions of the project area when the Lompoc Oil Field was established in the early 1900s. As a result, numerous prehistoric (pre-European contact) and historic (post-European contact) cultural resources are found within or near the boundaries of the Reserve.

Larry Spanne, M.A., Condor Associate Archaeologist, completed this cultural resources analysis for the Burton Mesa Ecological Reserve. It includes the following components:

1. A records search and review of existing records and literature to determine if any known cultural resource locations are within the Reserve boundaries;
2. A sensitivity analysis of the cultural resources;
3. A discussion of prehistory, early history and cultural resource sites in the project area, in addition to impacts not mentioned elsewhere and management considerations for cultural resources; and
4. A Phase I field investigation at 15 meter transects on the potential fuel break areas. The areas surveyed included all of the fuel break area shown on Figure 32.

The findings of this evaluation are presented below.

1. Prehistory and Early History

This summary is based, in part, on a more detailed prehistoric overview presented by Tartaglia, Romani, and Schmidt (1999) in a report for a proposed residential development at the edge of the Reserve.

Prehistoric occupation of this southern portion of the Central Coast of California dates back to at least 9500 years ago and possibly much earlier based on recent finds. This period, which is not well known, is generally identified as the Early Holocene. No archaeological sites in the Reserve appear to date back to this time, although there may be sites of this age buried in the alluvium beneath the floors of the major drainages.

The Early Period, as identified in Chester King's chronological sequence (King 1981), dates from 5500 B.C. – 600 B.C. People occupying the South Central Coast during this period appear to have emphasized the exploitation of plant foods, as suggested by large numbers of milling stone artifacts. At the same time, artifact assemblages indicate much less dependence on hunting. Near the coastline, shellfish gathering and some fishing appear to have been important, based on the presence of remains of such foods as well as artifacts used in their procurement and processing. A few of the sites recorded within the Reserve appear to date from the Early Period.

The Middle Period, dating from 600 B.C. – 1150 A.D., is marked by the presence of new technology, including hunting equipment and faunal remains that suggest an increased dependence on both terrestrial and marine mammals. In addition, larger numbers of mortars and pestles indicate that acorns were of increasing importance. Fishing also appears to have been important in coastal areas. Population growth is suggested by the presence of larger numbers of residential sites and the presence of non-local materials in these sites have led some to hypothesize the existence of exchange networks that linked people over a broad area. A number of the sites within the Reserve appear to date to the Middle Period.

The Late Period, beginning at about A.D. 1150 and culminating in the classic Chumash Culture observed by Spanish explorers and colonists from A.D. 1542 to 1776, represents the florescence of one of the most complex non-agricultural, foraging societies ever known to have existed anywhere in the world. Human population continued to increase and subsistence was based on a wide variety of terrestrial and marine resources. Large trade networks were established and shell bead money was produced. The Chiefdom level of socio-political organization was attained during this period. Archaeological sites dating from the Late Period appear to be present within the Reserve.

2. Previous Investigations

The background and record search conducted for this project by Larry Spanne, M.A. revealed a total of 42 previous cultural resource investigations have been conducted within or near the boundaries of the Burton Mesa Ecological Reserve. The majority of these were Phase 1 Archaeological Surveys conducted either for oil, gas, and water pipelines along linear routes on the periphery of the Reserve or for proposed residential developments. A smaller number of projects involved limited subsurface archaeological testing of archaeological deposits.

A list of 39 reports provided by the Central Coast Information Center and the titles of three additional reports are on file at the Department of Fish and Game in Sacramento.

3. Results of Cultural Resources Investigation

A total of 53 cultural resource sites were identified during the record search as having been recorded within or immediately adjacent to the Reserve. These include 38 archaeological sites, one historic road or trail corridor, and 14 archaeological isolates, many of which may represent small or buried archaeological sites. No previously recorded sites are located within the proposed fuel break, and none were found in the 2004 survey within the proposed fuel break shown in Figure 32. The number of cultural resource sites is impressive, especially when one considers that previous cultural resource surveys mostly covered only small or linear zones along the periphery of the Reserve and not the interior. Table 7 provides summary information on the cultural resource sites. A map of the Cultural Resource sites has been prepared (Figure 15) but is not available for review by the public in order to prevent theft and pilferage and to protect these important cultural resources.

Table 7
Cultural Resource Sites Within and Adjacent to Burton Mesa Ecological Reserve

Confidential – Not Included in Public Version of Land Management Plan

This page left blank intentionally.

Figure 15 Archaeology. Confidential - Not Included in Public Version of Land Management Plan

Temporal placement of the 53 cultural sites is as follows: There are 32 prehistoric archaeological sites. Two of the resources, SBA-1772 (Matthew's Orchard) and the El Camino Real Corridor are historic and date from the Spanish Mission Period. Another 14 sites are historic, dating from the late 19th and early 20th centuries. Finally, there are 8 archaeological isolates of unknown age. Three of the sites combine prehistoric and historic deposits.

The site assemblage has been subdivided into a number of types. These are, for the most part, tentative designations due to the limitations of available data and the fact that most known characteristics are only based on surface observations. Most of the resources have not been subject to subsurface archaeological testing. The prehistoric sites fall into 4 types: Seasonal Residential Bases, Camps, Resource Procurement Locations, and Isolated Archaeological Finds. Historic Sites include 7 types: Trail/Road Corridors, Agricultural Sites, Livestock Enclosures, Residential Sites, Historic Buildings, Oilfield Related Sites, and Isolated Archaeological Finds.

4. Categories of Sensitivity of Cultural Resources

The three sensitivity categories for cultural resources described below are applied with caution to individual resources (Table 7). Because of the variable quantity and quality of information available for known resources, assignment of individual sites to a particular category should be viewed as tentative and subject to change as additional information, particularly that resulting from archaeological testing, becomes available. Furthermore, sensitivity does not always equate with importance or significance under CEQA. A resource rated as Class II (Medium Sensitivity) or Class III (Low Sensitivity), may be evaluated as an important or significant site under CEQA or the National Register of Historic Places Criteria. For instance, a lower sensitivity site, although not complex, may be an excellent or unique example of its type. It could also be associated with an important person or event. Some of the recorded sites within or near the Reserve have been evaluated and determined eligible for nomination to the National Register of Historic Places. Others have been evaluated as either important or not significant resources under CEQA (Table 7). However, most of the 53 resources have not been evaluated.

a) Class I: High Sensitivity Sites

Class I Sites are larger size, medium to high density surface manifestations of a variety of culturally derived materials normally consisting of some combination of shellfish remains, lithic waste, fire affected rock, charcoal, bone, asphaltum, formal artifacts, and a potential for human remains. Such prehistoric or protohistoric deposits usually have considerable depth and are referred to as middens (refuse deposits). Because the Reserve is a located a considerable distance from the coastline, shellfish remains may be absent or present in much lower densities than in coastal sites. Attributes such as those listed above are usually indicative of longer-term occupation and/or periodic reoccupation of a particular location. That is, they are usually characteristic of residential bases (villages) or campsites of various types. Class I Sites may exhibit surface features such as the remains of hearths or ovens, and are likely to contain buried features consisting of house or sweat lodge depressions and floors, dance floors, shrines, game fields, human

burials, earth ovens, hearths, discrete activity areas, etc. Class I Sites retain substantial areas of relatively undisturbed deposit. Some of these sites may have a high degree of religious or traditional value to modern Chumash Indian descendants. Early historical sites dating from the Spanish Mission, Mexican Rancho, and early American Periods that contain cultural remains and structures roughly equivalent to those listed above for prehistoric resources, are also included as Class I Sites.

b) Class II: Medium Sensitivity Sites

Class II Sites are generally low to medium density surface manifestations of cultural material consisting primarily of some combination of lithic waste, very small amounts of shellfish remains, bone, and occasional formal artifacts. There is some slight potential for associated buried deposits and features. Such resources are commonly referred to as "locations" and were used primarily for resource procurement, resource processing, or some other activities. The attributes of these sites suggest short-term use without overnight stays or more prolonged occupation. This class also includes some less important historic sites with surviving structural remains and associated cultural deposits greater than 50 years of age. Class II includes certain archaeological isolates with a higher potential for associated buried deposits. Isolates are defined here as fewer than three cultural items (shell, lithics, bone, artifacts, etc.) at a particular location physically separated from other such materials by a distance of at least 20 meters.

c) Class III: Low Sensitivity Sites

Class III Sites are generally smaller, low-density surface manifestations of uniformly distributed lithic waste, occasional formal artifacts, or sometimes shell. These types of materials are less likely to occur in combination with each other. Deposits do not ordinarily exhibit much depth, or they may be confined to the ground surface. Some rest directly on bedrock. They may represent the remains of a single episode of cultural activity. Such sites are often badly eroded or otherwise damaged to the point that they have lost most of their integrity and scientific value. Minor historic refuse scatters or accumulations are also included in this category along with archaeological isolates having little or no potential for associated buried deposits.

d) Other Areas: Potential for Buried Sites

Several other areas that have been adequately surveyed and are apparently devoid of cultural resources on the surface, may hold buried cultural sites. These areas are commonly depositional environments such as floodplains on the floors of major drainages. Buried sites are usually discovered through deep cultivation, construction related excavation, exposure by erosion, or deep archaeological testing.

5. Data Gaps in Cultural Resources

Several data gaps became apparent following review of existing records and literature in this study. First, only a relatively small portion of the Reserve has been subjected to cultural resource surveys that are up to current standards. Most of these surveys were linear and located along pipeline corridors at the periphery of the Reserve. An exception

is the Osland and Schuyler investigation (1993) who volunteered their time to the County Resource Management Department who was beginning to prepare a management plan for the Burton Mesa Management Area. This entailed an intensive survey of most of the cultivated fields, as well as other parts of the Reserve. Their report, while certainly very useful, is somewhat lacking because descriptions of resources are minimal and archaeological site records were apparently not filed with the State of California, Central Coast Information Center. A map of the locations of their surveys is on file with the Department of Fish and Game in Sacramento. They also reportedly discovered a number of archaeological isolates that were neither described nor mapped in the report. It is important that a larger sample of the Reserve, or preferably the entire area, be subjected to intensive archaeological survey in order to more effectively manage the entire assemblage of resources located there. This survey could be phased to cover high priority areas first: any areas proposed for new development or fuel breaks not previously surveyed. Medium priorities include somewhat elevated areas along the periphery of floodplains of major drainages, and areas around springs and other sources of fresh water.

A second data gap is the lack of key information on a majority of the sites due to an absence of subsurface archaeological testing. Without accurate data on the size, depth, cultural constituents, and age of the resources, the associated significance and sensitivity ratings are open to question. There is also a similar need to evaluate potential historic structures or structural ruins. Suitable management of these sites is difficult to accomplish without benefit of this information.

Another data gap involves uncertainty about the alignment of El Camino Real across the Reserve. We know that it led from La Purisima Mission northwestward to Matthew's Orchard and then probably westward to a spring near the boundary of the Reserve in the vicinity of an adobe ranch house located on Air Force property in Santa Lucia Canyon, as shown in Figure 15 as the "Anza Trail Corridor". Additional research is necessary to more precisely delineate the original alignment of this historic trail.

Both the nearby Vandenberg Air Force Base and Los Padres National Forest grant Chumash Indians and other Native Americans access to traditional resources located on their lands. Such resources include plants, animals, animal carcasses, rocks, minerals, and locations where ceremonial and other traditional activities can be carried out. Chumash hunters and fishermen have access to the same areas on Vandenberg as active duty military personnel. The possibility of allowing such access to the Reserve could be explored by the Department. Perhaps a plan modeled after the Vandenberg Air Force Base and Los Padres National Forest examples could be developed, with appropriate safeguards to prevent excessive harvest. Conversations with archaeologists of these two federal entities are recommended.

G. Historic Land Use

The cultural history and resources of the Reserve are described in detail in the above section. The historic land uses which occurred in the Reserve from the 1930s to present day are described here. In some instances these descriptions overlap, however, describing the changes in land uses and activities in recent times provides an understanding of the ecosystem and changes in habitat types and wildlife observations that have led to current conditions. This provides a basis for effective management and restoration. Four main

land uses have been identified in the project area, including agricultural operations, military operations, extractive industries and urban development. Each of these has impacted the natural environment to varying degrees. The history of this general region (Santa Maria Basin) is well documented in several reports (Palmer 1999; Hunt 1993). A brief description is provided here as it relates to the Reserve and its immediate surroundings.

1. Agricultural Operations

Agricultural operations have occurred in the area for over a century. This was and is one of the main land uses within the Reserve. Agricultural activities in the Burton Mesa region were originally established by the La Purisima Mission and have played an important role in the agricultural economy of Santa Barbara County.

Photo 2: Agricultural field on the Reserve being plowed in 2004; Burton Mesa Chaparral in background. *Photograph by Elihu Gevirtz.*

Historic records show that Mission La Purisima was established in 1787 in Miguelito Canyon and produced record harvest of wheat in 1799, and cattle herds in 1821 (Palmer, 1999). (In 1812 an earthquake destroyed the original Mission and it was rebuilt in Los Berros Canyon, its current location). Mission La Purisima had jurisdiction over the lands west of Gaviota to Point Conception, east towards Highway 101 and north to the Santa Maria River. It also was responsible for supplying the Santa Barbara Presidio with foodstuffs, such as grain and beef (Palmer 1999). Following the Mission period, numerous ranchos continued agricultural operations in the area. Rancho Mission de la Purisima was located on the present-day Reserve as well as several ungranted areas of land. (See Palmer 1999, for more detail).

From historic aerial photography (including Figure 16) observations can be made regarding the amount of agriculture occurring within the Reserve over the past 65 years. In 1938, approximately 16 agricultural fields are visible across the 5,000+ acre Reserve (Fairchild Aerial Survey 1938). These were spread across the entire Reserve, with additional agriculture fields visible outside the Reserve's boundary, to the west, east and south. Generally, agricultural activities have occurred in the loamy, clay soils of the valley floors and terraces of the Burton Mesa. Of special note is the presence of a large marsh area in the northern section of the Reserve in 1989, which was previously farmed in 1938 and 1970 and possibly at other times as well.

As urban development of the area continued, the extent of the cultivated fields gradually reduced. The most recent aerial photography (2002) shows these agricultural fields that were formerly farmed, now support grassland and coastal scrub vegetation. There are approximately 445 acres of land within the Reserve that are presently farmed, and an additional 165 acres that are allowed to be grazed by livestock pursuant to a lease between the lessees and the State Lands Commission (California State Lands Commission 2004).

Insert Figure 16 – 1938 aerial photograph

2. Military Operations

Vandenberg Air Force Base shares the western boundary of the Reserve and is currently operational. This base started operation in 1941 as an armor and infantry training camp known as Camp Cooke (Palmer 1999). The establishment of Camp Cooke curtailed the agricultural activities in this area, causing the evacuation of numerous sites by landowners and the demolition of several historic rancho buildings in the area (Palmer 1999). This area has an interesting history that is well detailed in Palmer 1999 - from artillery impact areas, a mock village, arms and infantry training facilities, maximum security army discipline barracks and naval missile facility to its current use as an air force base. North Camp Cooke (north of the Santa Ynez River) transferred to the U.S. Air Force in 1956 (it was renamed Vandenberg Air Force Base in 1958). South Camp Cooke (south of the river) was transferred to the U.S. Navy in 1958, then to the U.S. Air Force in 1964. Additional property was acquired in 1966 to form the current Vandenberg Air Force Base property (Palmer 1999). Military operations did not occur on the Reserve, which was held by Union Oil from early in the 1900s through 1991.

3. Oil Exploration

Oil drilling by Union Oil and other companies in the northern Santa Barbara County began in 1899. Exploration increased in the area in 1903, with exploration occurring near Lompoc and the former La Purisima Mission area. Union Oil aggressively drilled the Lompoc field, which had 33 producing wells by 1911. In 1913, 30 wells in this area produced a combined 100,000 barrels of crude oil annually (Palmer 1999). Oil extraction is still occurring on the oil field to the north of the Reserve, now operated by Plains Exploration and Production Company. Several remnant pipelines associated with oil production remain in several locations just outside of the Reserve's boundaries. The boundaries of the Reserve were drawn in 1991 to avoid transferring any land from Union Oil to the State that might contain contamination from oil exploration. Neither active drilling for oil nor oil extraction is known to have occurred on the Reserve.

Photo 3: Oakhill Fire on the Burton Mesa October 1994. *Photograph courtesy of Santa Barbara News Press.*

4. Fire History and Behavior

Fire is a natural process in the California environment. It plays a major role in natural ecosystems, returning nutrients to the soil, creating space for new seedlings and new foraging areas for wildlife. The long, dry season typically stretches

from April to November. The winter rains, summer droughts and moist prevailing northwesterly winds influence the frequency, intensity and behavior of fires. Of particular concern are the dry winds that come from the east (opposite of the prevailing winds), creating ideal fire conditions. Years of drought can exacerbate the fire risk. Climatic conditions, wind speed and direction influence the spread and intensity of a fire.

Many factors influence fire intensity and movement in this region, including age of vegetation, species composition, fuel load including dead fuels, topography and climatic conditions. The most flammable plant community in this region is chaparral, primarily because the dense vegetation includes plants that produce highly combustible oils; further, plants and leaf litter become dry during the dry summer months. Many chaparrals are thought to have evolved with fire and many plant species within the habitats observed in this region are well adapted to fire.

Many factors influence fire intensity and movement in this region, including age of vegetation, species composition, fuel load including dead fuels, topography and climatic conditions. The most flammable plant community in this region is chaparral, primarily because the dense vegetation includes plants that produce highly combustible oils; further, plants and leaf litter become dry during the dry summer months. Many chaparrals are thought to have evolved with fire and many plant species within the habitats observed in this region are well adapted to fire. Some species produce seeds that germinate only after a fire (e.g. *Ceanothus impressus* var. *impressus*) and others resprout from the base of the plant after fire (i.e. "stump sprouters") (for example, *Arctostaphylos rudis* and *Adenostoma fasciculatum,* that are able to sprout from a burl as well as from seed).

Very high numbers of herbaceous annuals and perennials appear after fire has cleared away the tall, dense shrubs. Diversity following fires on the Burton Mesa is extraordinarily high, perhaps higher than any other documented vegetation in California (Susan Harrison, UC Davis *pers. comm.* 2005, Dennis Odion, *pers. comm.* 2005). The discussion of chaparral (below) provides additional information on adaptations to fire. The effects of burning and changes in vegetation community dynamics on the Burton mesa and nearby maritime chaparral communities have been studied by a number of researchers (Hickson 1987, Davis et. al. 1988, Odion, Hickson and D'Antonio 1992, Odion et. al 1992, Tyler and D'Antonio 1995, Tyler and Odion 1996, Tyler 1996, Odion 2000).

a) Pre-European Fire History

The frequency of fire on the Burton Mesa in pre-European history is unknown. However, lightning is rare, and fog, cool temperatures, and cool winds blowing off the ocean are the norm. Weather conditions conducive to burning are relatively rare on the Burton Mesa and in other coastal chaparral environments north of the Transverse Ranges. Thus, historic fire intervals may have been on the

Photo 4: Chamise resprouting from base after fire on the Burton Mesa (1995). *Photograph by Elihu Gevirtz.*

order of 100 years (Timbrook et al. 1982, Greenlee and Langenheim 1990, Mensing et al. 1999, Odion and Tyler 2002). Like other indigenous peoples of California, the Chumash peoples, managed their food supply by regularly burning the land and thus maintaining grasslands to maintain production of seeds of particular species, such as chia (*Salvia columbariae*) that could be stored as a long-lasting food, and others that were used for ceremonial purposes, such as red maids (*Calandrinia ciliata*). Furthermore, the grassland fires also produced fresh herbs and forbs that provided food for desired game animals such as rabbit and deer. Chaparral does not appear to have been intentionally burned, but such fires did burn into chaparral areas (Timbrook et al. 1982). Diaries of the Spanish explorers that were part of the Portolá expedition of 1769 (Bolton 1927, Bolton 1933) document prescribed burns by the Chumash along the Santa Barbara County coastline. Whether this practice also occurred on the Burton Mesa is unknown, but is certainly possible (Jan Timbrook *pers. comm.* 2005, Larry Spanne *pers. comm.* 2005). The size of many human-caused and natural fires prior to European contact was probably much greater than fires of present day for several reasons, including continuity of fuels and lack of fire suppression practices (Timbrook et al. 1982, Odion et al. 1993). The Chumash practice of burning vegetation was stopped in the Spanish Mission Period in order to protect Mission and other Spanish buildings, livestock and agricultural crops (Englehardt 1932).

Later, after California joined the United States and its urban populations grew, water supply became a great concern, and in order to protect water supply, watersheds were protected from fire. Thus, fire suppression policies came into existence in the early 1900s (Blakely and Barnette 1985) and have continued to this day.

b) Recent Fire History and Behavior

GIS Feature Class(es):
Fire Ecology

CDF_fire_polys_2002
firehistory 1998
firehistory 2004
firehistory 2004_bmer
stand_age

The number of brush fires in Santa Barbara County has generally decreased over the past century. Between 1951 and and 1977 in Santa Barbara County, there were half as many brush fires as the number of fires that occurred between 1910 and 1950. Meanwhile, during this same interval, the mean size of shrub fires in the county increased from 1,622 hectares to 2,341 hectares (Keeley, Fotheringham and Morais 1999). Keeley et al (1999) documented the occurrence of this trend across the brush-dominated landscapes of central and southern California, and found that the occurrence of large fires is not dependent on old age classes of chaparral or coastal scrub. Instead they found that young fuels (11 to 20 years old) comprised 38 percent of vegetation consumed by wildfires in the past 30 years (Keeley, Fotheringham and Morais 1999).

A history of fires in the area was compiled in order to create a fire history map (Figure 17). Fire history data from 1950 to 2003 were obtained from the California Department of Forestry and Fire Protection, the USDA Forest Service, Santa Barbara County and previous research by Davis et al. (1988). Information and mapping obtained from the California Department of Forestry and Fire Protection and USDA

Forest Service is somewhat limited, as it only includes CDF fires recorded by CDF (only contains fires greater than 300 hectares (740 acres) in size) and fires recorded by the U.S. Forest Service greater than 10 hectares (25 acres) in size. This information is augmented by local information obtained from County Fire Department records and State Park records, which includes smaller fire areas and controlled burns.

On the Burton Mesa Ecological Reserve and adjacent La Purisima Mission State Historic Park, 28 fires have occurred over the past 53 years, not including fires entirely on Vandenberg Air Force Base (Figure 17). All of the fires since 1950 have been ignited as a result of human activity or elements. The most recent fire, the 'Harris Grade Fire', occurred in 2000 and was caused by a power line that may have sparked in high winds. This 11,000 acre fire was the largest fire since 1977 in the area (Darren Burton, VAFB Hot Shots, *pers. comm.* 2003) and it spread in a northwesterly direction from the vicinity of Harris Grade Road. This fire burned a portion of the Burton Mesa Ecological Reserve and the Plains Exploration and Production Company oil field on the Purisima Hills. Only limited temporal and climatic information is available for four fires (1972, 1994, 1997 and 2000). All of these fires occurred between late spring and early fall (May to October). Climatic conditions of the Oak Hill fire in 1994 consisted of high temperatures (mid 90s), low humidity, and wind speeds from 15 to 25 miles per hour from a west-northwesterly direction (Santa Barbara County Fire Department, 1994). Fire behavior on the Burton Mesa was also assessed based on a model developed by the U.S. Forest Service (USDA Forest Service 2002) and was found to represent a high intensity fire threat (Burton and Gevirtz 2003).

Based on an analysis of the fire history illustrated in Figure 16, 3,440 acres of the 5,186 acre Reserve has not burned since 1938. The 1938 aerial photograph (Figure 16) reveals large stands of chaparral that are less dense than today's stands, but there are no large recent fire scars evident. This suggests that much of the vegetation may actually be 80 years old or older.

Insert Figure 17: Fire History

5. Urban Development

Three suburban communities, Vandenberg Village, Mesa Oaks and Mission Hills, were constructed adjacent to the Reserve. Vandenberg Village was developed in the 1960s as a residential community for military personnel stationed at Vandenberg Air Force Base and has expanded over the years. It now includes about 2,450 homes and roughly 5,800 people (Vandenberg Village Community Services District *pers. comm.* 2005). The Vandenberg Village Golf Course, surrounded by the Reserve, was constructed in 1959 as a recreational facility for military personnel (Palmer, 1999). Mission Hills was developed in the 1960s as well, and Mesa Oaks was developed more recently, in the 1980s. Together, Mission Hills and Mesa Oaks encompass approximately 1,100 homes and roughly 3,270 people (Mission Hills Community Services District *pers. comm.* 2005). Three additional residential developments have been constructed in the past three years west of Mesa Oaks, and additional residential development (approximately 65 homes) is being considered by the City of Lompoc immediately south of the Reserve's Encina Management Unit, between Highway 1 and Harris Grade Road (Mission Hills Community Services District *pers. comm.* 2005).

Ownership of the disciplinary barracks to the south of the Reserve transferred from the U.S. Air Force to the U.S. Bureau of Prisons in 1959 and the facility is known today as the United States Penitentiary/Federal Correctional Institute at Lompoc.

6. Existing Structures and Other Development

The Reserve contains a limited number of existing structures, most of which are remnant from previous land use activities. No formal recreational structures or facilities exist within the Reserve. Nine areas containing existing structures were identified in the Reserve from site visits and aerial photography, and are depicted in Figure 18 and listed in Table 8.

GIS Feature Class(es):
Infrastructure

cities
Easement_lines
Easements
Existing_structures
Fencing points
Grazing Lease Area 2004
Historical Cultivation
Oil Pipeline
Open Space Easement
PG & E 115 Kv Line
State Water Pipeline
V V C S D Water Line

The Vandenberg Village Community Services District has several structures, including water tanks, a water processing plant, wells, and water lines and sewer lines located within the Reserve (Figure 18). These are required for servicing the surrounding community and will continue to be used.

The Mission Hills Community Services District has one water (?) line located between Rucker Road and Courtney Drive (Figure 18). This is also required to service the adjacent community and will continue to be used.

The Lompoc Valley Flyers Club previously operated a dirt take-off and landing strip for model airplanes, a race track for model cars and several picnic tables in the Vandenberg Management Unit of the Reserve, just south of Highway 1. This site was used from 1988 to 2000, when the California Department of Fish and Game took over management of the Reserve. The landing strip was roughly 500 feet long and 110 feet wide with an actual maintained area of 450 by 50 feet. Previous maintenance activities conducted routinely by the Flyers Club consisted of

grading of the landing strip and access road. The scar is still quite evident as seen in the aerial photograph (Figure 3). Erosion is a continuing problem at this site. Several structures are recommended for removal, such as the old picnic tables.

The Santa Barbara County Sheriff's Department has an equestrian training facility located behind its station on Burton Mesa Boulevard. The training facility, though not the station itself, is within the Reserve's boundary.

Several structures relating to commercial lease operations on the Reserve, such as barns and corrals, are concentrated in the La Purisima Management Unit. These agricultural operations will be discontinued in the future. The barns might be used as bat roosts, could be historically significant, and could also be useful for management and restoration activities within the Reserve. Prior to modification, these structures will be surveyed for bat roosts, assessed for their historical significance, and assessed for their potential to be reused. They could be used for restoration activities, such as storage of equipment or converted into a greenhouse or plant nursery. Careful monitoring and management of these structures should be implemented to ensure they are not vandalized. Housing for a Reserve Manager could be established in this area in a new structure near the barn.

Photo 5: Poles marking location of Point Pedernales pipeline 2004.
Photo by Mary Carroll.

The Point Pedernales Pipeline is located within the Vandenberg Air Force Base' 100 foot wide fire break next to the Reserve's western boundary. Northwest of the marsh in the Santa Lucia Management Unit, the pipeline turns east and is buried under ground all the way to Harris Grade Road. It crosses Harris Grade Road and terminates at the Lompoc Oil and Gas Plant. (Figures 2 and 18). The pipeline conveys oil from wells offshore of Point Pedernales. Its location is marked by a series of three vertical poles colored red, yellow and green (Photos 5 and 6).

Several oil pipelines are located within the Reserve.

The **State Water pipeline** also crosses the Reserve, lying within the Santa Lucia and Encina Management Units (as shown in Figure 18).

An exposed pipe, vulnerable to an eroding slope, is located in the Vandenberg Management Unit on the west side of the unnamed drainage next to South Vandenberg Village, shown in Figure 18 as point 9 (Gevirtz *pers. observation* 2004).

A network of **internal roads** exists within the Reserve, both dirt and asphalt, which were constructed as part of the previous oil field and agricultural activities. Many of these will remain in order to provide access to and within the Reserve for patrol, maintenance and habitat restoration activities. Since asphalt roads can be used as travel and dispersement corridors for Argentine ants that outcompete native ants, asphalt roads that are not needed for access, maintenance, and/or restoration will be considered for removal.

Photo 6: Point Pedernales pipeline corridor through the Reserve 2004. *Photo by Mary Carroll.*

Perimeter fencing, five-strand barb wire, was installed by the Department of Fish and Game in 2003 along a portion of the boundary in the Vandenberg Management Unit adjacent to Highway 1. Fencing is also present along the southern boundary of this Management Unit, which is shared with the Federal Penitentiary. Old fencing, which has fallen into disrepair, occurs in the southwest section of the Vandenberg Management Unit along the firebreak shared with Vandenberg Air Force Base. Additional barb wire fencing occurs alongside the agricultural fields in the Reserve. New fences along portions of the boundaries of the Vandenberg and Santa Lucia Management Units next to Highway 1 and the Little League fields were installed (and paid for by Capital Pacific Homes, as mitigation for impacts associated with the Providence Landing project in Vandenberg Village) in late 2004 and early 2005. Additional fencing of the Reserve's boundary is needed to protect habitat and prevent unauthorized access. Maintenance activity on any fencing with a barbed wire should include replacing the bottom wire with smooth wire to specifications needed for wildlife passage.

Table 8
Existing Structures within the Burton Mesa Ecological Reserve

Site Number	Mgmt Unit	Structure Description	Responsible Party	Potential Future Use or Action
1	V	Picnic tables remaining from Model Airplane Club	-	Remove
2	V	Five strand barb wire fencing adjacent to Highway 1	DFG	Retain
3	SL	Two Water Tanks	Vandenberg Village Community Services District	Retain
4	E	Water processing plant building, water tank and associated structures	Vandenberg Village Community Services District	Retain, pursuant to lease or easement
5	E	Water tank and associated structure	Vandenberg Village Community Services District	Retain, pursuant to lease or easement
6	E	Equestrian Training Facility Structures (Fencing and Corrals)	Lompoc Sheriff's Department	Retain, pursuant to lease or easement
7	LP	Three structures (two barns and a corral)	DFG	Assess for Historical Significance Short-term: Potential for use in restoration of agricultural fields (greenhouse, equipment storage)
8	LP	Numerous irrigation pipes, faucets, vegetation tubing and fencing for CCWA habitat restoration - mitigation	CCWA	Require CCWA to remove restoration infrastructure; recycle fencing, irrigation pipes and faucets for proposed restoration within the Reserve as appropriate.
9	V	Exposed pipe	Unknown	Retain
10	LP	Gate next to southern Oil Plant		
11	LP	Barn	DFG	Assess for Historical Significance Potential for use to meet operational needs (restoration of agricultural fields, greenhouse, equipment storage)
Several	Several	Oil pipes cross and traverse the Reserve in various locations.	Plains Exploration & Production Company	These need to be retained for operation of the Oil Field pursuant to lease or easement.
Several	Several	Boundary Fencing along Federal Penitentiary and agriculture fields	DFG U.S. Air Force Other adjacent land owners	Boundary fencing should be retained and repaired as necessary and their location recorded. Fencing along agricultural fields should be evaluated for potential use in restoration.

Insert Figure 18: Structures and Infrastructure

H. Existing Public Use Features

The Department of Fish and Game is managing the Reserve with the overall goal of protecting and enhancing unique biological resources and providing the public with compatible wildlife-dependent educational and recreational opportunities. Compatibility of recreation with resource protection is a critical element of the planning effort. The Reserve was designated as an Ecological Reserve as defined in Section 630, Title 14, California Code of Regulations and pursuant to Fish and Game Code Section 1580 et seq for the protection of the rare Burton Mesa chaparral and associated sensitive species, including Purisima manzanita, shagbark manzanita, silvery legless lizard and the San Diego desert wood rat.

One special regulation, specific to the Reserve, is included in Section 630, Title 14 to expressly prohibit an activity not addressed in the general regulations: to restrict motor vehicle use to Department authorized activities and public safety purposes to protect the rare chaparral vegetation community.

1. Public Facilities and Uses

There are no public facilities currently within the Reserve. No designated parking or restroom facilities are provided at present. Reserve users either live locally or park at several dead end streets to walk into the Reserve. In addition, there is no formal system of trails for accessing the Reserve from surrounding communities of Vandenberg Village and Mission Hills. The existing trails are a combination of oil and utility service roads, and an informal network of pathways from surrounding residential areas.

The Reserve is currently used by the surrounding community and visitors for a variety of permitted and unauthorized recreational purposes. Authorized uses include hiking, wildlife observation and leashed, dog walking. Unauthorized activities include paint ball shooting, motorcycling (OHVs) (Gevirtz and Burton *pers. observations* 2003-2004), and occasional use of the large marsh for fishing and canoeing (Smith *pers. comm.* 1994). Evidence of hunting has also been observed in years past (Gevirtz *pers. observation*). The Reserve has previously been used by scientists and land managers for research purposes. This management plan identifies public use and recreational opportunities within the Reserve that are compatible with conservation of the sensitive species and habitats it supports.

GIS Feature Class(es):
RoadsRoads and Trails

county_roads
Additional Management Roads
BM_Minor_Roads
county_roads
county_roads_Project
Existing_trails
local_roads
local_roads_clip
major_roads
Management_Roads
Minor_roads

Public Uses Allowed on the Reserve:

- Hiking on designated trails
- Wildlife watching (such as bird watching)
- Environmental education and Interpretation
- Research as permitted by the Department
- Walking with a pet on a leash less than 10 feet in length
- Other appropriate wildlife dependent uses

Public Uses Not Allowed on the Reserve:

Regulations for Burton Mesa Ecological Reserve prohibit the following activities:

- Visiting the Reserve between sunset and sunrise
- Entering areas of the Reserve closed to the public
- Walking off-trail
- Littering or leaving objects on the Reserve
- Allowing pets to enter off-leash or on a leash exceeding 10 feet in length
- Operating motorized vehicles, including ORVs and OHVs (Off Road Vehicles and Off Highway Vehicles)
- Horseback Riding
- Bicycling
- Camping
- Picnicking
- Lighting fires or devices such as fireworks
- Swimming, diving, use of diving equipment
- Boating
- Falconry
- Operation of aircraft or hovercraft
- Collecting plants or plant materials except by scientific collecting permit issued by the Department
- Collecting Animals except by scientific collecting permit issued by the Department
- Taking or disturbing any of the following: birds, nests, eggs, plants, mammals, fish, mollusks, crustaceans, amphibians, reptiles or any other form of plant or animal life
- Animal Husbandry including keeping honey bees, and grazing livestock
- Release or introduction of plant or animal species
- Feeding wildlife
- Applying pesticides
- Possession or use of firearms (including paintball and target shooting)
- Collection of or disturbance of archaeological artifacts
- Mining or disturbing geological formations
- Vandalism

a) Trails Plan

A trails plan has been developed (Figure 19) that shows existing trails within the Reserve and their recommended status – to be maintained or closed – as well as proposed new trail construction. Seasonal trail closures or restrictions may occur to protect sensitive resources such as breeding locations or rare plant assemblages that

vary from year to year. The plan (summarized in Table 9) was developed with the following considerations in mind:

- Utilize existing trails where possible.
- Minimize habitat fragmentation and avoid adverse impacts to biological and archaeological resources.
- Provide trails that will enhance wildlife-dependent public enjoyment.

Table 9
Trail Plan
Burton Mesa Ecological Reserve

Management Unit	Miles of Existing Trails	Miles of Trails to Remain Open**	Miles of Trails to be Closed	Miles of New Trails Proposed	Total Trail Miles after Implementation
Vandenberg	15.9	7.6	8.3	0	7.6
Santa Lucia	13.8	8.8	5.0	0	8.8
Purisima Hills	1.3	0.4	0.9	0	0.4
Encina	15.0	6.5	8.5	0.1	6.6
La Purisima	6.3	4.8	1.5	0.3	5.1
TOTAL	**52.3**	**28.1**	**24.2**	**0.4**	**28.5**

** Seasonal trail closures may occur in some locations that change from year to year in order to protect sensitive species such as breeding birds or threatened or endangered plants.

This page left blank intentionally.

Insert Figure 19: Proposed Trail Plan

I. Existing Commercial Lease Features

1. Lease Information

Prior to the 1991 acquisition of the Reserve by the State of California, Unocal maintained three separate farming and grazing leases covering approximately 6,225 acres (2,000, 2,225 and 2,000 acres, respectively) upon historic rancho tracts in the Purisima foothills. Approximately 40% of the land that was leased by Unocal is now owned by the State of California.

The current lessees lease approximately 445 acres of land for non-irrigated farming and 165 acres of grazing on a rotational basis (Figure 18). The term of the lease is two years beginning November 1, 2003 and ending October 31, 2005, unless terminated earlier. In consideration of the lease, the lessees pay 25% of the gross proceeds, less applicable trucking and warehouse charges, from the sale of crops grown on the Reserve, and $1,650 per year for cattle grazing. Payment for the crop is due within 65 days of sale to the State Lands Commission (California State Lands Commission 2004).

Based on a cursory assessment and Smith (*pers. comm.*) in 2003/04, cattle are present on the Reserve and on the adjacent Oil Company lands year round. They are brought in to graze in the fall of each year on the cultivated fields after the beans are harvested and then the cattle are allowed to disperse into the hills and range over a wide area. They are rotated throughout the Reserve or to adjacent land in early winter and are brought back to the cultivated fields the following fall.

The cattle are affecting the vegetation on the north facing slopes of the eastern section of the La Purisima Management Unit, particularly where the soils are sandy. Dispersal of seeds of non-native weeds occurs primarily through transport on hoof and fur, and fecal material may also be dispersing seeds of non-native weeds such as Russian thistle (*Salsola tragus*) and possibly Australasian fireweed (*Erechtites glomerata*) that are spreading and altering the native ecosystem (Junak, pers. comm. 2005). The cattle lease is planned to be phased out, as discussed in the Commercial Lease Element below.

Photo 7: Beans growing in large cultivated field without irrigation, Santa Lucia Management Unit, June 2004.

2. Current Cultivated Agriculture

The existing cultivated agricultural operations, including the location of the fields, crops, and methods of farming have essentially remained the same for over a century, with the exception of

several fields (as seen in the 1938 aerial photograph, (Figure 16) that are no longer in production.

Existing cultivated areas within the Reserve are located in the northern and far eastern sections of the Reserve. Crops that have been grown on the cultivated lands include large white lima beans, garbanzo beans, hay, and Sudan grass. In years of drought, barley is grown. The most successful crop on these fields is the large white lima beans. The cultivated fields are dry-farmed with no irrigation, and are not known to have ever been irrigated (Pat Smith, *pers. comm.* 2004). This suggests that ground water is, in most years, shallow enough to support these annual crops. This may portend well for future habitat restoration efforts. The fields leased for cultivated agriculture are shown in Figure 18; the triangular-shaped field at the intersection of Harris Grade Road and Rucker Road is farmed but not included in the lease.

3. Current Cattle Grazing

Cattle grazing lessees are operated on land owned by the State in combination with some land owed by the adjoining oil company, Plains Exploration and Production Company. The northern boundary of the Reserve is unfenced, facilitating continuous grazing. The ranchers are not involved in any of the agriculture on VAFB or on federal prison lands. The cattle operation on the Reserve and adjoining land north of the La Purisima Mission averages about 100 white face cattle and other breeds per year and typically consists of a combination of bulls, cows, calves and replacement heifers grazing on a rotation schedule among three grazing sites.

The grazing sites on the Reserve include 40+ acres of grassland and approximately 40 acres of oak woodland in the far eastern corner of the La Purisima Management Unit, and to a much lesser degree on the two sites in the northern section of the Reserve northeast of the golf course in Vandenberg Village. These sites, located in the Encina Management Unit, include the old horse stable site (approximately 22 acres) and the area north of Oak Hill Drive (approximately 65 acres) which was cultivated until the mid-1970s. In addition, all cultivated fields in the Reserve (with the exception of the Harris Grade/Rucker Road triangle) are also utilized for grazing following harvest (Alona Smith *pers. comm.* 2005). The commercial agricultural and grazing lease is scheduled to be phased out, and the leased areas restored.

4. Beekeeping

Beekeeping is occurring in the La Purisima Management Unit. Several bee boxes (approximately 10) were located on the Reserve in Spring 2004, visible from the oil access road along the northern boundary (Figure 18). Further beekeeping was observed next to the eastern edge of the Purisima Hills Management unit on an old oil well pad. The ownership and other circumstances of this activity are unknown. The Department will contact the owners regarding removal of the bee boxes.

5. Sheriff Equestrian Training Facility

The County Sheriff leases land on the Reserve from the State for an Equestrian Training Facility that is located directly behind the Sheriff Station on Burton Mesa Boulevard in the Encina Management Unit. One hay barn, one training ring/arena, one access road, a

parking area and associated facilities, including lighting and utility services are permitted. The lease includes an agreement by the Sheriff to have the mounted unit patrol the existing trails within the Reserve on a flexible schedule, to encourage off duty mounted members to use trails and report suspicious or unauthorized activities to on-duty officers, and to provide standard inmate labor crews for trail maintenance or other management such as weeding or planting on the Reserve, not less than two weekends per year, or the equivalent by members of the Sheriff's mounted unit. The lease will expire on May 2, 2010 (Mary Howe, State Lands Commission *pers. comm.* 2005).

6. CCWA Chaparral Restoration Site

In 1994, the State Lands Commission permitted the Central Coast Water Authority (CCWA) to construct its portion of the State Water Pipeline through the Reserve, then known as the "Burton Mesa Management Area" (State of California Lands Commission 1994). CCWA was required to mitigate its impacts to Maritime Chaparral both onsite and elsewhere (primarily on Vandenberg Air Force Base) and a small amount on the Nipomo Mesa, and was permitted to perform the mitigation on the Burton Mesa Management Area (SAIC 2004). The 25 acre restoration site is located in the southeastern portion of the La Purisima Management Unit of the Reserve, surrounded by double rows of barbed wire fence.

The mitigation effort began in 1998, and was deemed to have met its success criteria in 2003 (SAIC 2004). Tree shelters have not been removed from most of the oak tree plantings due to a lack of stem diameter and strength to keep them standing upright by themselves. The majority of waterlines are being removed, where minimal damage would occur. Vexar mesh cages are "photo-degradable" and will not be removed since they are breaking down into small pieces. The inner fence will be removed in 2008. If the area north of the mitigation site continues to be grazed under the lease (described above), the outer fencing will be left in place. If not, then the outer fence will be removed except for the fencing on its southern perimeter that was there prior to the mitigation effort. The only requirements remaining are annual monitoring, and to document conditions at year 10 of the mitigation (2008), and a final clean-up, consisting of removal of all remaining items such as fencing, tree shelters, and transect markers (SAIC 2004).

This page left blank intentionally.

III. HABITAT AND SPECIES DESCRIPTION

A. Introduction

1. Biological Setting

The diversity of plants and animals on the Burton Mesa is remarkably high. The Ecological Reserve supports at least 326 species of native plants and more than 200 species of native animals (Appendices 1 and 2). Among them, 39 animals and 22 plants are rare, threatened or endangered, including many species of flowering annuals. These include 14 species that are endemic to the region. Diversity following fires on the Burton Mesa is extraordinarily high, perhaps higher than any other documented vegetation in California (Susan Harrison, UC Davis *pers. comm.* 2005, Dennis Odion *pers. comm.* 2005). Due to the large areas of undeveloped and agricultural lands surrounding the Burton Mesa Ecological Reserve, including areas of Vandenberg Air Force Base, the Lompoc Oil Field, La Purisima Mission State Park, Los Padres National Forest, grazing lands, farmland and the Santa Ynez River, this reserve is located in one of the most rural areas in coastal California. The richness and diversity of the ecosystem on the Reserve reflect this. Migration and/or dispersal corridors for wildlife and plants extend from the Reserve west to the Pacific Ocean, northward through the Coast Ranges and eastward and southward through the Transverse Ranges (Figures 1 and 2). Locally, much of this surrounding open space occurs on Vandenberg Air Force Base, land owned or leased by oil companies, and large ranches.

Plants from the north and south. Because the Reserve is situated in a biological transition zone between southern and central California, several species reach the southern limits of their distributions near the Reserve (Ferren et al. 1994). Examples of plants occurring on the Reserve that primarily occur to the north include Pacific Wax-myrtle (*Morella californica*) and Straggly Gooseberry (*Ribes divaricatum*). Similarly, several plants reach the northern limits of their distributions near the Reserve. These include, for instance, *Encelia californica*, which occurs at the Reserve and reaches its northern limit near the mouth of the Santa Maria River, 21 miles to the north.

Animals from the north. The Reserve is in a transition zone for several bird species. For example, yellow warbler, northern harrier, loggerhead shrike, yellow breasted chat, and Swainson's thrush are all breeders here, yet live the rest of the year further north (M. Holmgren *pers. observations*). Another example is the western whiptail (*Cnemidophorus tigris*). Two subspecies of whiptail occur in the region: (the coastal subspecies: *C. tigris multiscutatus* that occurs in southern California and western Baja California; and the California subspecies *C. tigris mundus*) that occurs in northern California.

Plants from the desert. The Reserve also supports representatives of a much drier climate. For example, there are a few plants in the fast-draining sandy soils of the region whose nearest relatives occur in California's warm desert areas. For instance, there are only two varieties of the shrubby almond, *Prunus fasciculata*, in the world. Sand Almond (*Prunus fasciculata var. punctata*) is confined to portions of coastal dunes in Santa Barbara and San Luis Obispo Counties. It occurs on the Reserve, but is confined to the far eastern end (presumably drier) of the Reserve in the easterly portion of the La Purisima Management

Unit. Its close relative, the Desert Almond (*Prunus fasciculata* var. *fasciculata*), a more widespread subspecies, occurs in the Mojave and Colorado Deserts of California extending east to Utah and south to Baja California on arid slopes and in washes in Creosote Bush Scrub and Joshua Tree Woodland.

Animals from the dry interior. Some wildlife also exhibits this coastal-desert link, such as horned lizards. The California subspecies of the California horned lizard (*Phrynosoma coronatum frontale*) that occurs on the reserve ranges from west of the Sierra Nevada from the Sacramento Valley south to Ventura and western Los Angeles counties. The southern subspecies (San Diego horned lizard = *Phrynosoma coronatum blainvillii*) ranges from the Santa Barbara/Ventura County line southward into northwestern Baja California (Jennings and Hayes 1994, Stebbins 1985). Its close relative, the desert horned lizard (*Phrynosoma platyrhinos*) is associated with desert scrub vegetation of the Mojave and Great Basin deserts, barely making it into Baja California and Sonora, Mexico.

The Burton Mesa is at the westernmost extent of the known distribution of western whiptail (*Cnemidophorus tigris*). Other uncommon reptiles that have been found recently in the vicinity are long-nosed snake (Gevirtz 2004) and coast patch-nosed snake (*Salvadora hexalepis virgultea*) (Gevirtz et al. 2005). Similar to the western whiptail, these two species reach their western distributional limit in Santa Barbara County on the Burton Mesa. All three species are known from more inland, xeric environments. The fact that they are present in this area so close to the coast with abundant coastal fog and more moderate temperatures is an indication of the uniqueness of the Burton Mesa.

The long-nosed snake (*Rhinocheilus lecontei*) occurs in habitats ranging from the hot and dry Chihuahuan, Sonoran and Mojave deserts and the colder Great Basin desert to the tropical deserts in Mexico (Medica 1975). It was recently found on the Burton Mesa for the first time (Gevirtz 2004). Previously, the closest specimens had been collected from the more interior and much drier habitats near Figueroa Mountain (about 20 miles away) and of the upper Cuyama Valley (roughly 45 miles from the Burton Mesa) (Sweet pers. *comm.* unpublished data). Additionally, a Small Blue butterfly (*Philotiella speciosa*) is widespread in the deserts of California and Nevada. A new subspecies of the Small Blue butterfly (*Philotiella speciosa* ssp. *purisima*) has been suggested by Priestaf and Emmel (1998) and its' only known population is reported to be on the Reserve in the Encina Management Unit (Jack Levy *pers. comm.* 2004).

Possible explanation for desert-coastal link. These unique biotic distributions have been attributed to plant and animal migrations during the Xerothermic, a hot dry period approximately 2,500 to 5,000 years ago (Axelrod 1977, Raven and Axelrod 1978) when the distance between the sandy coastal habitats and the dry interior environments was reduced, perhaps facilitating dispersal. During this arid climatic period, it is thought that a number of desert species migrated toward the coast in southern California and that Mojave Desert species penetrated into the southern San Joaquin Valley and then into the inner Coast Ranges, including California juniper (*Juniperus californicus*), scale broom (*Lepidospartum squamatum*), and other plants and animals such as the desert kit fox (*Vulpes macrotis*).

Hybridization. Because the Reserve is in a transition zone, opportunities for natural hybridization exist among closely related species that are from different ecological zones of California. One such example was discovered at La Purisima State Park. Natural

hybrids of *Layia glandulosa* and *Layia hieracioides* were discovered by Ferren et al. (1984), published by Barry Tanowitz (Madrono, *date unknown*) and discussed by Mulroy (1990). This discovery illustrated, among other things, the uniqueness of the biogeographic location of the State Park and the Burton Mesa where species with different geographic affinities (north-south, coastal–interior, etc.) occur together and therefore provide unique opportunities for hybridization, introgression, speciation, etc (Ferren & Sandoval, 2001). Another example is a small population of a rare hybrid of *Arctostaphylos rudis* and *A. purisima* on the State Park near Rucker Road (Ferren et al 1984). Hybridization probably also occurs within the Reserve and offers educational opportunities regarding the Reserve's biogeographical uniqueness, as well as significant opportunities for scientific research (Ferren *pers. comm.* 2005).

An ecological island – regional endemics on the Burton Mesa. Plants and animals that survive in this area are exposed to air-borne salts that lead to loss of water, but the dunes on the Reserve have greater water-holding capacity and organic matter than dunes closer to the coast.

Photo 8: Lompoc Ceanothus and Coast Live Oak. *Photograph by Mary Carroll*

These sandy substrates, coupled with the cool temperatures and fog of the Central Coast, create a biological environment unlike that of the nearby South Coast that is generally warmer and drier south of the Santa Ynez Mountains, and the more extreme temperatures (both hotter in the summer and colder in the winter) of the San Rafael Mountains. As a result, many plants typical in the Santa Barbara area (between the ocean and the Santa Ynez mountains) are absent, for example, Lemonade Berry (*Rhus integrifolia*). Other widespread genera are represented on the Burton Mesa only by their relatives that are endemic to (restricted to) the Central Coast of California. (See Table 10 for a list of endemic species).

For example, in the chaparral community of the Santa Ynez Mountains, Bigpod Ceanothus (*Ceanothus megacarpus*), Greenbark Ceanothus (*C. spinosus*), Bigberry Manzanita (*Arctostaphylos glauca*), Eastwood Manzanita[3] (*A. glandulosa)*, scrub oak (*Quercus berberidifolia* or *Q. dumosa*), and Chaparral Yucca (*Yucca whipplei*) dominate; yet none of these species are found on Burton Mesa. In fact, there are four species of ceanothus and manzanita present at the Reserve; and all are endemic to the Central Coast of California. A partial list of regional endemics occurring on the Reserve is provided in Table 10.

[3] Eastwood Manzanita (*Arctostaphylos glandulosa*) does not occur at the Reserve, but Eastwood's Manzanita (*Arctostaphylos tomentosa* ssp. *eastwoodiana*) does.

Table 10
Regional Endemic Plants on the Reserve
(a partial list)

Hoover's bentgrass	*Agrostis hooveri*
Small-fruited seaside fiddleneck	*Amsinckia spectabilis var. microcarpa*
Purisima manzanita	*Arctostaphylos purissima*
Shagbark manzanita, Sand mesa manzanita	*Arctostaphylos rudis*
Santa Barbara Ceanothus	*Ceanothus impressus var. impressus*
Lompoc ceanothus	*Ceanothus cuneatus var. fascicularis*
Narrowleaf spineflower	*Chorizanthe angustifolia var. eastwoodiae*
Dune larkspur	*Delphinium parryi ssp. blochmaniae*
San Luis Obispo wallflower	*Erysimum capitatum ssp. lompocense*
Suffrutescent wallflower	*Erysimum insulare var. suffrutescens*
Lompoc bush monkey flower	*Mimulus aurantiacus ssp. lompocense*
Curly-leaved monardella	*Monardella undulata*
Sand almond	*Prunus fasciculata var. punctata*
Black-flowered figwort	*Scrophularia atrata*

B. Vegetation Communities, Habitats and Plant Species

GIS Feature Class(es):
Vegetation

all_veg_field_data
F&G Veg-types
Hickson_plot_locations
vegcomm1998
vegcomm2004_dissolve
vegcomm2004_reserve

The flora of the Burton Mesa and the Purisima Hills is rich and unique. The region has a high diversity of plant species and several narrowly-restricted endemic plants. The plants in the chaparral of the Burton Mesa and the Purisima Hills include at least 14 species of plants that occur in no other region of the world (Table 10). Furthermore, the high biological diversity is indicated by the 326 native plant species recorded on the Reserve (Appendix 1). The high diversity and incidence of endemic species has been attributed, in part, to the location of the Reserve in the transitional region between northern and southern California (Ferren et al. 1984).

The vegetation of the Burton Mesa and the lower slopes of the Purisima Hills has been described in a number of reports and scientific papers (Ferren et al. 1984; Odion and Philbrick, 1987; Davis et al. 1988, Hickson, 1987, Odion et al. 1992, and most recently, a study of adjacent La Purisima Mission State Historic Park, adjacent to the Reserve (Gevirtz et al. 2005).

1. Methods

a) Database Review

A database of sensitive botanical observations on and in the vicinity of the Reserve was compiled using a variety of sources. First, the California Natural Diversity Database (CNDDB) was queried for botanical records from several 7.5 minute

quads: Lompoc, Lompoc Hills, Santa Rosa Hills, Surf, Tranquillon Mountain, Orcutt, and Casmalia (California Department of Fish and Game [DFG] 2004). The results are provided in Appendix 5. This information was refined by selecting those species that have a reasonable probability of occurring on the Reserve using habitat affinities as the criteria in order to form the basis of the sensitive species database.

Records from the Santa Barbara Botanic Garden, County of Santa Barbara, and previous studies in the region were consulted to formulate a species list. Local biologists who have conducted surveys on or in the vicinity of the Reserve were also contacted about their observations.

b) Interviews and Consultations

Limited interviews regarding vegetation at Reserve were conducted with several experts including Frank Davis (UCSB Geography Department), Diana Hickson, Mary Meyer, and Todd Keeler-Wolf (California Department of Fish and Game) and Wayne Ferren (former Director of UCSB Museum of Systematics and Ecology).

c) Vegetation Surveys

A digital, orthorectified 2002 aerial photograph of the Reserve (AirPhoto USA 2002) was used to map broad vegetation communities. Condor digitized the boundaries of uniform stands of vegetation (as they appear in the aerial photo) directly from the photograph. Six broad vegetation types (chaparral, coastal scrub, oak woodland, grassland, riparian and wetland) were identified from background research, including the work by the County of Santa Barbara (1998), Gevirtz et al. (2005), and aerial photo interpretation. A preliminary field visit was conducted by Condor biologists in October 2003 to observe general patterns of vegetation and to identify sample field plots and to test the sampling technique. The sampling method and classification were refined in the field in February 2004 with the guidance and assistance of Department botanists and biologists Todd Keeler-Wolf, Diana Hickson, Mary Meyer and Kari Lewis.

Photo 9: Refining the vegetation sampling technique in the Vandenberg Management Unit of the Reserve. Chaparral had burned here in 1997. *Photo taken February 2004.*

General locations to conduct vegetation surveys were selected using aerial photographs, soil and fire history maps and an initial site visit to enable comparisons to be made between different environmental and physical conditions. These preliminary survey locations served as a guide to conduct and coordinate field surveys for vegetation and wildlife; however exact locations were determined in the field later in the season, and depended on topography, aspect, vegetation, and accessibility.

The California Native Plant Society Rapid Assessment method (Sawyer and Keeler-Wolf 1995) was used to conduct the vegetation surveys. This vegetation sampling method is consistent with Department of Fish and Game protocol. The methodology for assessing vegetation is briefly described here.

Within each selected stand of vegetation, a Rapid Assessment was conducted by botanists Mary Carroll and Katrina Burton once in each Condor plot shown in Figure 20. The location of each plot was recorded with a hand-held Garmin GPS MAP 76 unit.

Vegetation Classification. Within each stand the following variables were recorded:

Environmental Description

- GPS waypoint and location;
- Topography and elevation;
- Soil type and texture;
- Slope steepness and exposure;
- Percentage of bare ground;
- Disturbance (site history, stand age, type and level of disturbance);
- Depth of leaf litter; (not measured at all sites)
- Depth of soil probe; (not measured at all sites)
- Other Comments (i.e. presence of lichen or cryptogrammic crust, weed species, rare plants).

Vegetation Description

- Dominant species;
- Habit, % cover, maximum height, age class distribution (i.e. seedlings or mature) of dominant woody species;
- Associated species (including annuals and herbaceous perennials);
- Weed species and approximate abundance.

The Reserve vegetation was surveyed on seven separate occasions from October 2003 to July 2004 by Condor and Department botanists. Table 11 lists the survey dates and observers for the 2003-04 surveys. A total of 32 Rapid Assessments were conducted. The 32 Rapid Assessments were divided among the broad vegetation communities (chaparral, coastal scrub, oak woodland, grassland, pine forest, riparian, and wetland) and were roughly proportional to the acreage of each community within the Reserve in order to attempt to capture differences in communities across the Reserve. Therefore, eleven plots were located in chaparral, five in coastal scrub, four in oak woodland and forest, three in grassland (one native and two non-native), two in pine forest, and ten in riparian and wetland areas (Figure 20). Table 12 describes the attributes of each survey location. The raw data sheets were scanned in and are now part of the GIS. The tabulated data are included in Appendix 7b.

Department of Fish and Game botanists and biologists Todd Keeler-Wolf, Diana Hickson, Mary Meyer, Kari Lewis and Terri Stewart assisted with the Rapid Assessments in February 2004. In addition to these Rapid Assessments, several reconnaissance level surveys were conducted independently by Mary Carroll,

Katrina Burton and/or Elihu Gevirtz over the course of the study. These were conducted by walking through an area and making notes regarding species presence and absence, distributions, and patterns. Additional assessments on individual dominant species, such as *Ceanothus impressus* were done by windshield survey.

Table 11.1 and Figure 19.1 summarize the proportions of the different habitat areas. Figure 20 also shows the locations of vegetation surveys that were conducted by Diana Hickson (1987) and Rapid Assessments conducted independently by the Department of Fish and Game in 2004. These data were not analyzed by Condor, but now that they are in the GIS, future researchers may be able to conduct comparative studies.

Table 11
Rapid Assessment Dates and Observers 2003-2004

Habitat	Dates	Observers
PLANT COMMUNITIES		
Chaparral	Oct 8, 2003	Carroll, Burton, and Gevirtz
	Feb 12, 2004	Carroll, Burton, Gevirtz, & DFG
	April 6, 2004	Carroll and Burton
	April 27, 2004	Carroll and Burton
	May 13, 2004	Carroll and Burton
Coastal Scrub	April 6, 2004	Carroll and Burton
Oak Woodland and Forest	Feb 12, 2004	Burton, Gevirtz, & DFG
	May 13, 2004	Carroll and Burton
	May 24, 2004	Carroll and Burton
Grassland	April 27, 2004	Carroll and Burton
	May 13, 2004	Carroll and Burton
	May 24, 2004	Carroll and Burton
Wetlands	Feb 12, 2004	Burton, Gevirtz, & DFG
	May 13, 2004	Carroll and Burton
	May 24, 2004	Carroll, Burton, and Gevirtz
	June 7, 2004	Carroll and Burton
Bishop Pine Forest	April 6, 2004	Carroll and Burton
	May 24, 2004	Carroll, Burton, and Gevirtz
EXOTIC PLANTS		
	As above	Carroll and Burton
RARE PLANTS		
Variable	Spring	Carroll and Burton

Table 11.1
BMER Habitat Areas

Habitat Type	Area (acres)
Maritime Chaparral	2,923
Coastal Scrub	677
Oak Woodland	452
Agriculture	429
Non-Native Grassland	240
Bishop Pine	151
Riparian Woodland	104
Oak Forest	101
Open Area	49
Freshwater Marsh	22
Eucalyptus Woodlands	16
Buildings and Structures	7
Vernal Wetland	4
Native Grassland	1
TOTAL	**5,175**

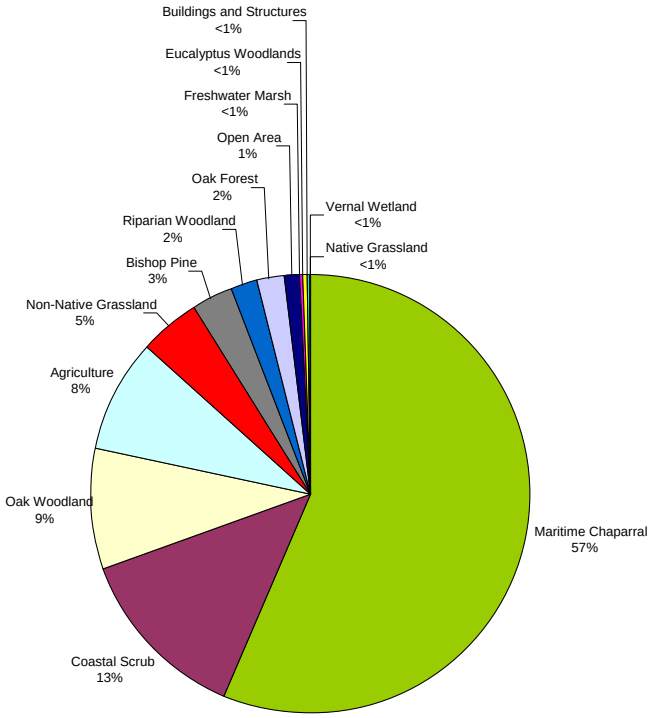


Figure 19.1: Proportions of Habitat Area at BMER.

Insert Figure 20: Survey Locations: Vegetation

This page left blank intentionally.

Table 12
Rapid Assessment Locations and Environmental Attributes 2003-2004

Broad Vegetation	Site No.	Soil Type	Stand Age	CNPS Series/Association
Chaparral	1	Arnold sand	0-10 yrs	Santa Barbara Ceanothus-Lompoc Ceanothus/Rush-rose Association
Chaparral	2	Marina sand	>65 yrs	Coast Live Oak/Chamise-Purisima Manzanita-Shagbark Manzanita Association
Chaparral	3	Narlon sand, hardpan variant	30-40 yrs	Coast Live Oak/Chamise-Lompoc Ceanothus Association
Chaparral	4	Narlon sand, hardpan variant	30-40 yrs	Chamise-Black Sage-Lompoc Ceanothus Association
Chaparral	5	Marina sand	30-40 yrs	Purisima Manzanita-Shagbark Manzanita-Chamise Association
Chaparral	6	Tangair sand	>65 yrs	Shagbark Manzanita Series
Chaparral	7	Narlon sand, hardpan variant	>65 yrs	Chamise-Black Sage Association
Chaparral	8	Arnold sand	>65 yrs	Purisima Manzanita Series
Chaparral	9	San Andreas - Tierra complex	0-10 yrs	Chamise-Coyote Bush-Black Sage/Lompoc Monkeyflower Association
Chaparral	10	Marina sand	>65 yrs	Purisima Manzanita Series
Chaparral	11	Marina sand	>65 yrs	Lompoc Ceanothus-Coffeeberry-California Sagebrush Association
Coastal Scrub	12	Elder sandy loam	0-10 yrs	Giant Rye-Poison Oak Association
Coastal Scrub	13	Elder sandy loam	0-10 yrs	Coyote Brush-California Sagebrush-Mock Heather Association
Coastal Scrub	14	Tierra sandy loam	0-10 yrs	California Sagebrush-Coyote Bush/Deerweed Association
Coastal Scrub	15	San Andreas - Tierra complex	0-10 yrs	Black Sage/Juncus textilis Association
Coastal Scrub	16	Sedimentary rock land	0-10 yrs	Giant Rye-Poison Oak Association
Oak Woodland	17	Botella clay loam	>65 yrs	Coast Live Oak/Poison Oak Association
Oak Woodland	18	Marina sand	>65 yrs	Coast Live Oak/Coffee Berry/Poison Oak-Bracken Fern Association
Oak Woodland	19	Terrace escarpments, loamy	0-10 yrs	Coast Live Oak/Poison Oak Association
Bishop Pine Forest	20	Marina sand	30-40 yrs	Bishop Pine/Purisima Manzanita Association
Bishop Pine Forest	21	Sedimentary rock land	0-10 yrs	Bishop Pine/Chamise Association
Grassland	22	Marina sand	>65 yrs	Coyote Bush/Alkali Rye-Slender Needlegrass Association
Grassland	23	Arnold sand	>65 yrs	Broad-leaved Filaree-Soft Chess Non-Native Grass Association

Grassland	24	Narlon sand, hardpan variant	>65 yrs	Deer Grass Series
Riparian	25	Terrace escarpments, loamy	>65 yrs	Arroyo Willow/Elderberry Riparian Association
Riparian	26	Elder sandy loam	>65 yrs	Black Cottonwood/Poison Oak-California Blackberry Association
Riparian	27	Marina sand	>65 yrs	Arroyo Willow/Poison Oak-California Blackberry Association
Wetland Habitats	28	Narlon sand, hardpan variant	>65 yrs	Brown-headed Rush Vernal Pool
Wetland Habitats	29	Arnold sand	0-10 yrs	Sticky Baccharis/Brown-headed Rush Vernal Pool
Wetland Habitats	30	Arnold sand	0-10 yrs	Alkali Mallow/Mexican Rush-Common Spikerush Vernal Pool
Wetland Habitats	31	Arnold sand	0-10 yrs	Brown-headed Rush Vernal Pool
Wetland Habitats	32	Elder sandy loam	>65 yrs	Common Monkey Flower-Common Willow Herb Association
Wetland Habitats	33	Elder sandy loam	>65 yrs	Small-fruited Bulrush Series

Vegetation data throughout the text are classified using the CNDDB community classification system (Holland, 1986). Corresponding classifications to the association level using naming conventions contained in *A Manual of California Vegetation* (MCV) (Sawyer and Keeler-Wolf 1995) are also suggested for the 17 plots where detailed sampling (CNPS Rapid Assessment Protocol) was conducted. The community descriptions and associated tables herein provide both nomenclatures. The CNDDB community classification system is used because additional survey data is needed for analysis and classification of Burton Mesa chaparral to the series or association level using CNPS methodology. Therefore, the vegetation map for the entire 5,200+ acre Reserve uses the CNDDB (Holland 1986) classification system.

Overlain on the vegetation map are the 17 Rapid Assessment surveys conducted by Condor, 4 by the Department of Fish and Game and 19 by Diana Hickson (1987). Future surveys of the vegetation are recommended as they are likely to yield greater understanding of the ecosystem.

The raw field data forms were scanned in and included in the GIS. The data are also organized into Excel and GIS databases provided in Appendix 6. This provides the raw plot data so they may be compared to future surveys in the same areas, enabling detection of changes in vegetation over time. The data include species composition, cover, age class estimates and frequency (species occurrence among plots).

d) Distribution of Non-Native Species

General vegetation surveys on the ground, assisted by aerial photography were conducted to identify populations of non-native plants. The species were noted and the size of the weed infestations were marked with a GPS waypoint and later mapped, where time permitted. It is likely that additional populations of non-native plants occur on the Reserve.

e) Rare Plants

GIS Feature Class(es):
Rare Plants

rare_plants_pts2
Vernal wetland

After reviewing the literature on special status species potentially occurring in the area, Condor conducted focused surveys to locate rare plant species. These surveys were timed to coincide with flowering, although rare plants were noted at any time of year that they were observed with confident identification. Because the survey effort for the land management plan was conducted in a year with only half the normal rainfall, there are probably many species that were not observed.

Photo 10: San Luis Obispo Wallflower

Some of the surveys focused on habitat types or locations, such as open sandy areas in coastal scrub, in order to locate rare plant species. These surveys were timed to coincide with flowering, although rare plants were noted at any time of year that they were observed with confident identification. Because the survey effort for the land management plan was conducted in a year with only half the normal rainfall, there are probably many species that were not observed. Some of the surveys focused on habitat types or locations likely to support rare plants, such as open sandy areas in coastal scrub. Additional populations of rare plants are likely. If a special status species was observed, the GPS location, abundance, phenological state and habitat were recorded. These locations were mapped in the GIS, illustrated in Figure 21.

This page left blank intentionally.

Insert Figure 21: Plant Communities

This page left blank intentionally.

C. Upland Communities

1. Maritime Chaparral

a) Variations in Community Composition

Central Maritime Chaparral is an unusual vegetation found on mostly sandy substrates in a few coastal locations in Santa Barbara, San Luis Obispo, Monterey, and Santa Cruz Counties. Each of these maritime chaparral associations are dominated by local endemic species of ceanothus and manzanita mixed with other

Photo 11: Maritime chaparral on Burton Mesa (2002). *Photograph by Elihu Gevirtz.*

widespread and endemic species (Holland 1986, Holland and Keil 1995, Davis and Borchert *in press*).

Central Maritime chaparral, as it is called by Holland (1986), is considered to be a rare community in Santa Barbara County by the Department of Fish and Game Natural Diversity Database, with a Global Rank of G2 (6-20 element occurrences) and a State Rank of S2.2 (threatened) (California Department of Fish and Game 1999).

"Burton Mesa Chaparral" (the form of Central Maritime Chaparral found on the Reserve) is primarily found in northern Santa Barbara County in aeolian sands of the Orcutt formation (Ferren et al. 1984); these sands are underlain at varying depths by bedrock from the Monterey and Paso Robles formations and can include cemented rock and clay lenses (Shipman 1972). (See Geology and Soils Sections for further discussion.)

On the Burton Mesa, the chaparral is dominated by evergreen shrubs and scattered multi-trunked coast live oaks (*Quercus agrifolia*) that form open stands to almost impenetrable thickets over large areas of Burton Mesa. The woody chaparral

vegetation ranges from 1 to 4 meters in height, although low-growing annuals and herbaceous perennials flourish in sunny openings.

The moderating influence of regular summer fog in maritime chaparral environments ameliorates temperature extremes, increases relative humidity (and therefore slows the evapotranspiration rate), and adds moisture that can decrease drought stress, especially in comparison with inland chaparral. No figures for fog input to annual precipitation rates are available for Burton Mesa, but it is probably significant, as it is in other coastal communities, such as the redwood forests further north (Weathers 1999, Dawson 1998).

Photo 12: Maritime Chaparral on the Reserve in 2004, looking south from near the northeastern property corner. Large grassland in the La Purisima Management Unit is in middle of photo. Western Santa Ynez Mountains are in background.

Burton Mesa chaparral is dominated by endemic species of ceanothus (Santa Barbara ceanothus - *C. impressus* var. *impressus* - and Lompoc ceanothus - *C. cuneatus* var. *fascicularis*) and manzanita (Purisima manzanita - *Arctostaphylos purissima* - and shagbark manzanita - *A. rudis*), along with the more widespread chamise (*Adenostoma fasciculatum*), toyon (*Heteromeles arbutifolia*), birchleaf mountain-mahogany (*Cercocarpus betuloides*), black sage (*Salvia mellifera*), and California coffeeberry (*Rhamnus californica*). Coast live oak (*Quercus agrifolia*) is also an important dominant in many places. Dune-heather (*Ericameria ericoides*), with its wind-dispersed seeds, is most often observed at trail edges in dense chaparral, but appears in greater numbers in large open areas and coastal scrub.

Absent from maritime chaparral on the Burton Mesa are several widespread chaparral species, including greenbark Ceanothus (*Ceanothus spinosus*), scrub oak

(*Quercus berberidifolia* or *Q. dumosa*), chaparral yucca (*Yucca whipplei*), and Eastwood manzanita (*Arctostaphylos glandulosa*).

Patterns of species distribution in chaparral at the Reserve: Species composition varies from place to place but some generalities may be made about vegetation composition as a whole. In general, within a given substrate chaparral composition is a reflection of disturbance history, whether the area has been cleared of vegetation in the past, non-native vegetation has been planted, or fires have occurred. The imprints of these activities, some of them decades old, are still visible today.

Adjacent to several intermittent streams, including Los Berros Creek and its tributaries, and Santa Lucia Creek and its tributaries, cleared swaths almost devoid of plant life are visible in the 1938 aerial photograph. These areas appear to have been used for farming in each aerial photograph from 1938 to present. We do not know the type of vegetation that occurred on these lands prior to cultivation that probably began by the 1870s (Hunt 1993, Gevirtz et al. 2005). However, we do know that they are situated on alluvium rather than Orcutt Formation and that ephemeral streams flow through the two largest fields (Figure 11). In the past, these streams probably meandered and dense willow thickets and riparian scrub, or palustrine wetland occurred on either side of these streams, as with Los Berros Creek in La Purisima State Park (Gevirtz et al. 2005). Beyond the edges of the wetlands the vegetation may have been a complex of trees and shrubs that were tolerant of a relatively high ground water table.

Most of these areas are still in agricultural use; however, a careful comparison of maps between 1938 and the present, supplemented with field surveys, indicate that non-native grasses and forbs, along with native dune-heather (*Ericameria ericoides*), silver bush lupine (*Lupinus chamissonis*), coast horkelia (*Horkelia cuneata*), California croton (*Croton californicus*), and others have partially reinvaded cleared areas no longer being farmed. Chaparral and coastal scrub species that reproduce by seed (Table 13) become established in cleared areas more readily than those that recolonize burned sites primarily by stump-sprouting (Davis *pers. comm.* 2004). Davis et al. (1988) report that the primary variables effecting species composition in Burton Mesa chaparral appear to be stand age, distance from the coast, depth to hardpan, soil pH, and soil texture.

Species Composition Correlated with Stand Age: Stand age is strongly correlated with species composition in chaparral habitats, including Burton Mesa chaparral (Davis et al. 1988; Odion et al. 1992; Van Dyke, Holl, and Griffin 2001). Cover by coast live oak and manzanitas (*Arctostaphylos purissima* and *A. rudis*) increases with stand age, and cover by the two ceanothus species (*C. impressus* and *C. cuneatus* var. *fascicular*is) decrease after peaking a decade or two after a fire (Davis et al. 1988; Odion et al. 1992).

Chamise, a stump-sprouting species (Photo 4), increases in cover as shrubs grow in size through time (Photo 9) and can continue to dominate chaparral sites decades following a fire (Frank Davis *pers. comm.* 2004). Odion et al. (1992) report that chamise attains significant cover up to 25 years after a fire (up to 60%), and then declines slightly; however, at stand ages of 50 years, cover by chamise can still be

40% or more (Odion et al. 1992). In general, fire frequency intervals shorter than 25 years will favor the two endemic Ceanothus species, which are both obligate seeders, while longer fire-free intervals favor manzanitas and coast live oak along with chamise.

Species richness declines with stand age (Davis et al. 1988), a pattern that has been documented for chaparral stands in many locations in California (Christensen and Muller 1975, Keeley et al. 1981, Schlesinger et al. 1982). With time, nitrogen and other nutrients decline, and as the canopy closes, light decreases, and shorter species are sometimes overtopped (Photo 11).

Santa Barbara Ceanothus: The presence of Santa Barbara ceanothus (*C. impressus* var. *impressus)* on Burton Mesa has been correlated with stands that are less than 10 years old and that have shallow soils (Davis et al. 1988). Odion et al. (1992) report the occasional presence of Santa Barbara ceanothus in stands up to 25 years old, but not older. Within the Reserve, Santa Barbara ceanothus is most abundant south of Highway 1 to the west of Constellation Avenue where a fire occurred in 1997 (Figure 17. In this locality, Santa Barbara ceanothus is common, with 25% cover (Figure 22 and Appendix 6). In contrast, Santa Barbara ceanothus is uncommonly scattered in older stands in the Reserve, often adjacent to roadways.

In order to gain a better understanding of the distribution of this rare ceanothus, the distribution of Santa Barbara ceanothus was documented by taking a GPS waypoint each time the species was encountered (Figure 30). It was found that the current distribution of Santa Barbara ceanothus strongly corresponds with stand age; that is, most observations were recorded in stands that were less than 15 years old. A few were located in areas that had not burned for 30 to 50 years, almost exclusively along roadsides where human disturbance (i.e. clearing) may have played a role in scarifying seeds.

Although most or all of the *Ceanothus impressus* shrubs may disappear from older stands, the seeds of this species are undoubtedly located in this area and may germinate after the next fire. Odion et al. (1992) conducted seed bank studies of chaparral on Vandenberg Air Force Base and found significant presence of *Ceanothus impressus* seeds in chaparral soil then dominated by *Arctostaphlos purissima*; they predicted that both chaparral species would be abundant after a fire in that location. However, if the fire-free interval exceeds 40 years, seed mortality of *Ceanothus impressus* may result in a decline in abundance once a fire does occur (Odion et. al 1992).

Lompoc Ceanothus: Cover by Lompoc ceanothus (*Ceanothus cuneatus* var. *fascicularis)* peaked in plots that were 10 to 25 years of age in the study by Davis et al. (1988), especially in deep sand. Lompoc ceanothus cover peaked at 25 years on Vandenberg Air Force Base as well, declining to less than 5 % in 50 year old stands (Odion et al. 1992).

In the Reserve, two areas have burned in the past ten years, two areas have burned in the past twenty years, and several more have burned in the past 20-50 years (Figure 17). Lompoc ceanothus appears in most chaparral stands less than 40 years old, varying in cover from 1% to 20%. Chaparral stand age exceeds 65 years in many

areas, and Lompoc ceanothus is absent from many of these locations; it is abundant (63% cover) in just one unburned stand, near the Department of Prisons on the southwest end of the Reserve in the Vandenberg Management Unit (Figure 3). This area is adjacent to the 1997 burn site, but did not burn itself. The abundance of Lompoc ceanothus at this site is unexplained, although charred wood may have drifted onto the plots as the fires were raging. Charred wood has been shown to stimulate germination, even in the absence of heating (Keeley et al. 1985, Odion and Davis 2000).

Lompoc ceanothus has 16% cover at Site 1, which burned in 1997; this same site supports 25% cover by Santa Barbara ceanothus. With the exception of the unburned site mentioned above, vegetation sampling indicates that Lompoc ceanothus is uncommon in older unburned chaparral.

Chamise: Chamise is a stump-sprouting shrub that recolonizes a site after fire by growing new shoots from its lignotuber. It also produces seedlings, although survival of chamise seedlings can be low (Odion and Davis 2000). Little understory grows beneath its canopy, in large part due to allelopathic chemicals produced by the leaves. Chamise increases in cover for the first few decades after a fire and then declines, although it can continue to maintain dominance 50 or more years after a fire (Odion et al. 1992, Odion and Davis 2000). At the Reserve, chamise occurs as a regular dominant in many chaparral environments in stands over 50 years in age, and only really appears to decline in stands with high cover by manzanitas and coast live oak. However, it tends to be completely absent from any site in which the vegetation has been mechanically cleared, even decades after the clearing has taken place (Frank Davis *pers. comm.* 2004).

Photo 13: Chamise (arrow) being overtopped by Purisima Manzanita in 2004.

Manzanitas and Oaks. Cover by Purisima manzanita, shagbark manzanita, and coast live oak increases with stand age (Davis et al. 1988, Odion et al. 1992), a pattern that has also been documented in maritime chaparral in Monterey County (Van Dyke, Holl, and Griffin 2001). Dead *Salvia, Ceanothus*, and *Adenostoma* were observed under dense canopy of manzanitas and coast live oak, in stands that were older than 70 years, which has also been documented by McPherson and Muller (1967), and Van Dyke, Holl, and Griffin (2001).

Changes in Oak Canopy Coverage. Cover by coast live oaks gradually increases with time during fire free periods, due to the spreading canopy of existing trees and germination of oak seedlings in the accumulated leaf litter under the canopy of shrubs and other oak trees. Acorns are killed by fire but live acorns from trees outside of the burn area are often dispersed by birds such as scrub jays and acorn

woodpeckers. Density of seedlings under the canopy of shrubs and trees was found to increase through time on the California islands (Carroll et al. 2004).

In order to gain an understanding of long-term trends in the chaparral, Gevirtz and Burton conducted an analysis of four 3-acre sites in the chaparral within La Purisima State Park using aerial photographs from 1938 and 2002. They found that oak cover increased in all four sites and that the number of oaks nearly doubled in three out of the four locations (Gevirtz et al. 2005). Thus, cover by ceanothus is favored in the first few decades after fire, whereas cover by manzanitas and coast live oak gradually increases during long fire-free intervals.

Distance from coast. Distance from the coast has a significant effect on plant distribution (Davis et al. 1988), and as such, is of particular importance at the Reserve. To the immediate west of Rucker Road, Burton Mesa consists of a broad marine terrace covered with Aeolian sand that is relatively flat. Burton Mesa and its associated communities extend onto Vandenberg Air Force Base, transitioning to coastal dune vegetation near the Pacific Ocean. To the east of the La Purisima Management Unit, soils become less sandy and contain more clay particles and/or loam with distance from the coast (Shipman 1972). Thus the eastern perimeter of the Reserve is located in a transition zone, is more topographically diverse than Burton Mesa to the immediate west, and represents the edge of Aeolian sand deposition (Frank Davis and Wayne Ferren *pers. comms.*).

The density of Santa Barbara ceanothus decreases with distance from the coast, although this distribution may reflect the greater frequency of fires to the west. The density of silver dune lupine (*Lupinus chamissonis*) also decreases with distance from the coast. In the eastern portion of the Reserve both silver bush lupine and the more interior silver lupine (*L. albifrons*) occasionally form mixed stands, reflecting its transitional location (Wayne Ferren *pers. comm.*).

In contrast, sand almond (*Prunus fasciculata* var. *punctata*) only occurs on the Reserve in the far eastern portion of the Reserve, on the La Purisima Management Unit. There it occupies a large swath of Marina sand and a smaller area of Corralitos sand. This is its only population on the Reserve. In contrast, it occurs within the La Purisima Mission State Park to the south, but at a much higher density (Gevirtz et al. 2005). It also occurs in Graciosa Canyon on the northern flanks of the Purisima Hills south of Orcutt and northwest of Los Alamos, on San Antonio Terrace (Smith 1998), in the Solomon Hills (Gevirtz *pers. observations*), on San Antonio Terrace in mixed chaparral and in disturbed areas surrounded by grasses, as well as in the Casmalia Hills north of Barka Slough (Keil and Holland 1998). One outlying population of sand almond lies far to the east of these more coastal populations on the eastern most extent of the Purisima Hills, west of Ballard Canyon (Smith 1998, Philbrick 1992a, b). Sand almond also extends north into San Luis Obispo County on Nipomo Mesa and in maritime chaparral south of Morro Bay. However, unlike the more inland Santa Barbara County populations, the sand almond population at Morro Bay occurs right near the coast.

Depth to hardpan. Aeolian sand varies in depth across Burton Mesa. Underlying the sand layers is poorly drained hardpan or bedrock from the Monterey and Paso Robles formations, as well as occasional clay lenses and cemented rock in the soil

(See Geology Section for further discussion). Thus, drainage patterns and moisture retention varies with depth to hardpan or bedrock. Shallow soils tend to be poorly drained and provide little physical space for development of deep root systems; vegetation may be stunted and a perched water table may form. Deep sandy soils may be well-drained and, depending on slope and local drainage patterns, may exhibit either little moisture retaining capacity, or the inverse; sand accumulations on ridge tops may provide deep reservoirs of water that collect during winter rains but are only slowly depleted. These deep sandy layers may provide ample space for root development as well as for root "mining," with enhanced root development in moist pockets.

Thus, intriguing patterns of plant distribution may be observed and potentially correlated with depth to hardpan on Burton Mesa. At one extreme, where hardpan is very close to the surface, vernal pool and/or swale vegetation may form, often encircled by chaparral, as can be seen south of Highway 1. Adjacent to the large vernal pool on the Reserve, wetland indicator species such as Mexican rush (*Juncus mexicanus*), brown-headed rush *(Juncus phaeocephalus*), Indian rush (*Juncus textilis*), and others form understory cover beneath chaparral shrubs that normally occur in dry sites, including chamise, Purisima manzanita, and ceanothus. Similarly, in a few places at the Reserve, Indian rush, Santa Barbara sedge (*Carex barbarae*), and other wetland species occur associated with coastal scrub, chaparral, and coast live oak. (See, for example, Sites 15 and 17.)

On recently burned sites, Davis et al. (1988) report that Santa Barbara ceanothus and rush-rose (*Helianthemum scoparium*) increase in cover on shallow soil, whereas cover by deerweed (*Lotus scoparius*) declines in shallow soil. Lompoc ceanothus and chamise peak in cover on deep sand (Davis et al. 1988). The data from the Davis et al. study (1988) indicate high cover values for Purisima manzanita on very shallow soils in stands greater than 50 years of age, and an almost complete absence of coast live oaks in shallow soils, even in very old stands.

Although Condor did not do exhaustive studies of soil depth, Condor did use a soil probe to test the depth of soil at most of the rapid assessment plots and in various other locations. Because the soil was probed during a dry spring of a relatively dry year, the data are useful primarily for comparisons between sites. Condor found high canopy cover values for Purisima manzanita and coast live oak in deep sand at the tops of dune ridges. This is in contrast to the nearby Santa Ynez Mountains where coast live oaks are usually more common in mesic habitats such as north-facing slopes and in drainages and along streambanks where there are deeper alluvial soils and a higher water table than upslope. Coast live oaks are characterized by extensive root systems that penetrate deep into soil horizons and reach moisture at depth; they also have well developed lateral roots. In shallow soils with little room for root development, coast live oaks may be replaced by more drought-tolerant chaparral, coastal sage scrub, and grassland plants with smaller root systems. In discussing correlations between soil depth and the distribution of Burton Mesa chaparral and coast live oak with Frank Davis (*pers. comm.*), he reported the following:

> *"In our studies we found the abundance of oaks was related to 3 factors: time since fire (oak cover increases with time since burning), topography (oak cover increases on north facing slopes), and soil depth (oak cover increases as the depth of sand to bedrock or indurated soil pans increases). We know that rainwater can percolate to considerable depths in unconsolidated sands (the Marina formation) and the presence of oaks on some ridges could conceivably reflec*t reserves of water in the deep sands underlying those ridges."

Fire: Fire plays a significant role in maintaining chaparral community heterogeneity and in nutrient cycling, and its role has been extensively documented (Christensen and Muller 1975, Keeley 1987, Hanes 1988, Keeley and Keeley 1988). The resinous stems and leaves of dominants such as chamise, coupled with retention of intricate branches, many of which are dead below the canopy, result in extremely flammable vegetation.

Photo 14:. Burned *Manzanita* and ash after a fire in 1994 on the Burton Mesa. *Photograph by Elihu Gevirtz.*

Adaptations to Fire. Many chaparral plants have characteristics that promote reestablishment after fires. Some, such as chamise and shagbark manzanita, produce burls or lignotubers that resprout following fire. Lompoc ceanothus, Santa Barbara ceanothus, and Purisima manzanita are obligate seeders that reproduce only by seed following a fire. These plants typically produce quantities of seeds each year that accumulate into the thousands at depth in the seed bank, and many germinate primarily after fire. Table 13 below lists some of the dominant chaparral species and their primary mode of recolonizing a site after fire.

Table 13
Adaptations to Fire of Dominant Maritime Chaparral Species

Regrowth from seeds only	*Arctostaphylos purissima*
	Ceanothus impressus var. impressus
	Ceanothus cuneatus var. fascicularis
Crown sprouting (primarily from lignotubers or burls) after fire, with subsequent seedling recruitment via fruits dispersed by animals or wind.	*Cercocarpus betuloides*
	Heteromeles arbutifolia
	Rhamnus californica
	Rhamnus crocea
	Quercus agrifolia
Regrowth from seeds and/or lignotubers or burls	*Arctostaphylos rudis*
	Adenostoma fasciculatum
	Salvia mellifera
	Artemisia californica

Fire clears out above-ground living vegetation as well as dead wood, depositing nutrient-rich ash in its wake. Among these nutrients are ammonium and nitrogen that facilitate regrowth (Grogan, Burns and Chapin 2000). Meanwhile, allelopathic compounds are removed from the soil and space and sunlight are available for seedling establishment. The first year after a fire often produces a flush of growth that includes seedlings of chaparral dominants as well as "fire followers," annual and perennial species that germinate primarily after fires and grow rapidly and often luxuriously in the first several years after fire. This growth serves as a protective layer over the soil, retaining moisture, reducing erosion, and converting ash into organic matter that then can serve as a "mulch" to nourish the developing chaparral seedlings.

Photo 15: Regenerating chaparral after 1994 fire on Burton Mesa. *Photograph by Elihu Gevirtz.*

The seral replacement of one group of dominants immediately after a fire with another is a defining feature of chaparral. In the first few years following fire, the ground is covered by flowering herbaceous annuals and perennials. In general, there is higher species diversity and presence of annual and herbaceous perennial associates of chaparral in the years immediately following a fire (Davis et al. 1988, Odion et al. 1992, Odion and Davis 2000). Grogan, Burns and Chapin (2000) have suggested that some of the patchiness in vegetation regrowth following fire is related to variable deposition of nutrient-rich ash. Simultaneously to the herbaceous growth, stump sprouting chaparral shrubs begin to regrow, including shagbark manzanita and chamise. Others sprout from seed lying in the soil, and other seed transported by birds and other animals (Table 13). Subsequent years result in a decline of the fire followers, although herbaceous perennials such as deerweed and rush-rose (*Helianthemum scoparium*) can persist in small numbers for decades from their peak post-fire densities. As the vegetation matures, it gets taller and more dense, becoming more a shrub community, and less a herbaceous community. In the first ten or so years it may appear as coastal scrub rather than chaparral, both in structure and in the species present (black sage, California sagebrush, coffee berry, coyote brush, poison oak). Gradually though, the manzanitas, Ceanothus, chamise, and others overtop the other species and come to dominate the landscape. Chaparral shrubs such as Santa Barbara ceanothus are found primarily in the first decade after a fire; Lompoc ceanothus peaks at 25 years after a fire and then gradually declines. Chamise continues to be stable for decades after a fire, with a decline in cover after the first

few decades. Shrubs that are bird distributed (toyon, coffee berry, coast live oak, holly leaf cherry, and others) can come in at any time. In contrast, manzanita and coast live oak coverage increases in the years after a fire. In the past, mature chaparral has been characterized as a stable "climax" community, but recent evidence suggests that maritime chaparral, including that on the Burton Mesa, may be being replaced by oak woodland, at least on soils with greater depth (Davis et al. 1988, Odion et al. 1992, Van Dyke, Holl, and Griffin 2001, Gevirtz et al. 2005).

Of particular relevance for the Reserve is the correlation between stand age and dominance by a given species, as well as the importance of gaps in the chaparral canopy for maintaining species diversity. Gaps form years later when obligate seeding shrubs such as Lompoc ceanothus and Santa Barbara ceanothus die and decompose, leaving openings between shrubs. Gaps provide adequate sunlight for seed germination, decreased competition for moisture and nutrients from the large root systems of chaparral shrubs, decreased allelopathic toxins, and space above-ground and below-ground for the growth of smaller annual and perennial herbs such as *Horkelia cuneata* ssp. *cuneata, Camissonia micrantha,* and others. The presence of understory species and other associates in sunny gaps in chaparral at the Reserve varies considerably across the site. Other common species in the gaps between the shrubs include San Luis Obispo wallflower (*Erysimum capitatum* ssp. *lompocense*), Lompoc monkeyflower (*Mimulus aurantiacus* ssp. *lompocense*), deerweed, and round-fruited sedge (*Carex globosa*). Annuals are also found in sandy openings, including California spineflower (*Mucronea californica*) and curly-leaved monardella (*Monardella undulata*) and many others.

Herbivory may also be lower in gaps (Davis et al. 1989). Even without a fire, temperatures at soil surfaces in shaded canopy gaps may be as much as 23°C higher than under the surrounding shrub canopy at certain times (Christensen and Muller 1975), which may be high enough to stimulate seed germination in some species such as rush-rose and *Camissonia micrantha* (Davis et al. 1989).

Significant fire-induced seed mortality in the top 2.5 cm of soil under the canopy of shrubs has been documented for many chaparral shrubs and fire-followers in Burton Mesa chaparral. Smoldering combustion from canopy vegetation that heats the soil for several hours decreases survival not only of seeds but of buried bulbs and tubers as well as lignotubers, especially of smaller (i.e. younger) individuals of chamise (Odion and Davis 2000). In contrast, seed banks in sunny gaps have a diversity of seeds at different depths, and because these gaps do not reach such high temperatures during a fire, seed survival is favored, especially below 2 cm. (Davis et al. 1989, Odion et al. 1992, Odion and Davis 2000, Odion and Tyler 2002).

In a study of microscale vegetation patterns before and following a controlled burn at La Purisima Mission State Park in 1986, seed and seedling densities for several chaparral species were higher in gaps both before and after a controlled burn (Davis et al. 1989). Seeds of such species may accumulate through time, and although a number of plants found in gaps exhibit fire-enhanced germination (such as *Camissonia micrantha,* chamise, rush-rose, and *Calyptridium monandrum*), others such as Lompoc monkeyflower and *Chorizanthe diffusa* do not. For species with fire-enhanced germination, higher seedling densities were recorded in gaps the spring

following the fire and, in some cases, the subsequent year as well. Even chamise, which dominated the site prior to the controlled burn and presumably dispersed seeds throughout the site, showed readily germinable seeds primarily in the gaps following the burn (Davis et al. 1989). In contrast, seedlings of Lompoc monkeyflower and *Chorizanthe* declined dramatically in the years immediately following the burn.

Burton Mesa Chaparral Surveys at the Reserve

Data from 2004 vegetation sampling in eleven chaparral sites are shown in Figure 22 and Appendix 6.

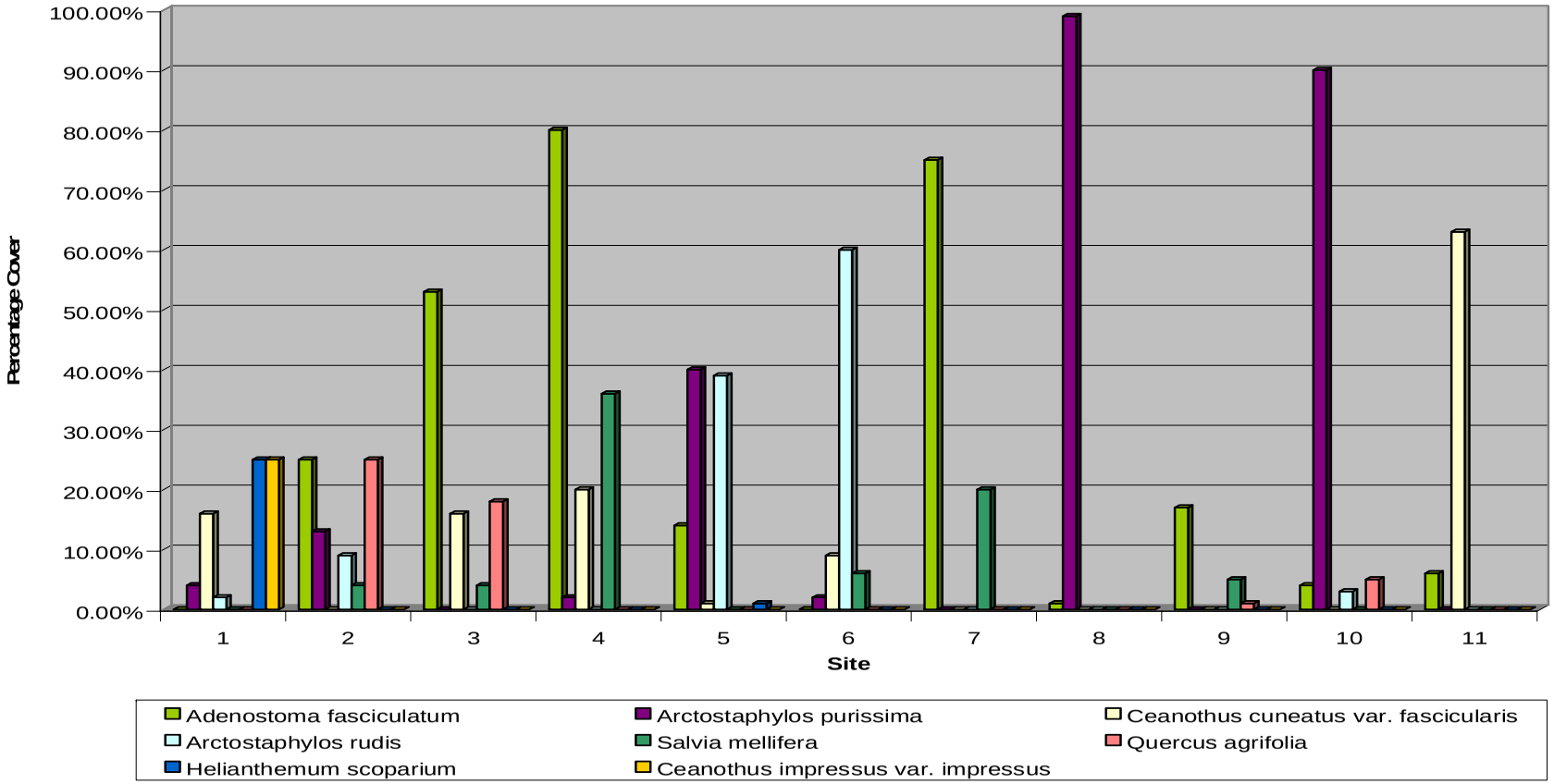


Figure 22: Percent Cover of Dominant Species in Maritime Chaparral in Eleven Rapid Assessment Sites in 2004.

Chamise and Purisima Manzanita. Chamise is present at 9 of 11 chaparral sampling sites with varying degrees of cover. Chamise exhibits strong dominance (53% to 80% cover) at the three sites underlain by Narlan hardpan, a shallow soil type that leaves little room for root development. An extraordinarily drought-tolerant species, chamise may be most tolerant of the low water availability found in such soils during the long, dry summer months. At these three sites, cover by other chaparral shrubs, with the exception of black sage, is lower than at most other sites.

At sites with higher cover by Purisima manzanita, cover by chamise is markedly lower. Purisima manzanita occurs on both Marina and Arnold sands, and is almost completely lacking from plots underlain by Narlan hardpan soils, as well as by San Andreas-Tierra soils. The greatest cover by Purisima manzanita is at the highest elevation sampled (626 feet), a pattern also reflected in vegetation sampling at La Purisima Mission State Park (Gevirtz et al. 2005); as previously mentioned, Purisima manzanita, along with coast live oak, forms dense cover on the taller sandy ridges with the Reserve and at La Purisima Mission State Park, which may reflect deep reservoirs of moisture at depth (Frank Davis *pers. comm.* 2004). Purisima manzanita exhibits the highest cover in stands that have remained unburned for many decades (Appendix 6). Purisima manzanita appeared in 9 of 11 chaparral plots, the same frequency as chamise.

Shagbark Manzanita. Like Purisima manzanita, shagbark manzanita is almost completely absent from plots underlain by Narlan hardpan and San Andreas-Tierra soils. Shagbark manzanita exhibits the highest cover at the single site with Tangair sand (60%), in contrast to 2% cover by Purisima manzanita at the same site. Shagbark manzanita is found in low numbers (2% to 9% cover) at 3 of 4 sites with either Marina or Arnold sands. At one site (Site 5), shagbark and Purisima manzanitas share dominance, with lesser cover by chamise. Shagbark manzanita is

Species Observed in Chaparral Rapid Assessment Plots	
Achillea borealis	
Adenostoma fasciculatum	
Anagallis arvensis	
Arctostaphylos purissima	
Arctostaphylos rudis	
Artemisia californica	
Baccharis pilularis	
Carex globosa	
Ceanothus cuneatus var. fascicularis	
Ceanothus impressus var. impressus	
Chorizanthe diffusa	
Crassula connata	
Croton californicus	
Cryptantha clevlandii	
Daucus pusillus	
Dendromecon rigida	
Distichlis spicata	
Ehrharta calycina	
Eriastrum densiflorum	
Ericameria ericoides	
Eriogonum parvifolium	
Eriophyllum confertiflorum	
Erodium botrys	
Erodium cicutarium	
Galium andrewsii	
Galium nuttallii	
Gnaphalium californicum	
Gnaphalium ramosissima	
Helianthemum scoparium	
Heliotropium curassavicum	
Horkelia cuneata ssp. cuneata	
Hypochaeris glabra	
Juncus textilis	
Leptodactylon californicum	
Lotus scoparius	
Lupinus chamissonis	
Mimulus aurantiacus ssp. lompocense	
Mucronea californica	
Nassella lepida	
Navarretia atractyloides	
Paeonia californica	
Pteridium aquilinum	
Quercus agrifolia	
Rhamnus californica	
Salvia mellifera	
Toxicodendron diversilobum	
Vulpia octoflora	***TOTAL: 47***

present at 8 of the 11 chaparral sampling sites.

Lompoc Ceanothus. Lompoc ceanothus is also found at 8 of the 11 chaparral sampling sites. Of the five sites that have burned in the past 40 years, it is found in each with varying cover. Unlike Santa Barbara ceanothus, which is absent on Narlon hardpan, cover by Lompoc ceanothus ranges from 16 to 20 % at two of the Narlon hardpan sites; it is absent from the third. Cover by Lompoc ceanothus approaches 65% at one unburned site adjacent to the Department of Prisons, a surprising anomaly that suggests some type of unusual disturbance or the presence of ash from nearby fires. Charred wood has been shown to stimulate germination of chaparral shrubs, even in the absence of heating (Keeley et al. 1985, Odion and Davis 2000). There is also standing dead wood of Lompoc ceanothus at that plot, in some areas approaching 5% cover. Standing dead Lompoc ceanothus was also observed at Site 10, along with dead chamise.

Coast Live Oak in Chaparral. Coast live oak is present at 8 of 11 chaparral sites in varying densities on most soil types, although it is absent in the shallowest soils, such as those at Site 7 adjacent to a large grassland and vernal wetland.

As discussed previously, coast live oak is a regular codominant in maritime chaparral vegetation and increases in cover during long fire-free intervals (Van Dyke, Holl, and Griffin 2001). In places, large oaks within old stands of maritime chaparral shade out other shrubs, including ceanothus, chamise, and even manzanita, becoming coast live oak woodland. These mosaics of coast live oak and chaparral shrubs are dominated by coast live oak, with scattered Purisima manzanita, shagbark manzanita, toyon, poison-oak, and other chaparral species at the margins, sometimes lacking an understory. Where coast live oaks occur within chaparral stands, they produce multiple trunks that vary from horizontal to vertical in orientation. In the first few decades following fire, the density of oaks declines, despite the stump-sprouting ability of many of the multiple-trunked oaks. This trend is reversed when the trunks and canopy of surviving trees recover and new recruits have become established.

At the Reserve, the chaparral stand with the greatest coast live oak cover (Site 2) is an unburned site underlain with Marina sand. However, unlike the chaparral sampled at La Purisima Mission State Park, there is no clear correlation between stand age and cover by coast live oak at most other sites. The understory beneath coast live oak is typically perennial and recovers to pre-fire densities quickly after fire (Carroll *pers. observations*).

Lompoc Monkey Flower. Besides chamise and Purisima manzanita (with a frequency of 82% among the sampled sites), five plants occur in sampled areas with a 73% frequency - shagbark manzanita, Lompoc ceanothus, coast live oak, black sage, and Lompoc monkey flower. Lompoc monkeyflower along with other subshrubs and herbaceous perennials are common associates in sandy openings in Burton Mesa chaparral, including coast Horkelia, golden yarrow, prickly phlox, California croton, and deer weed.

Black Sage, Dune-Heather, and Sagebrush. Coastal scrub dominants such as black sage, dune-heather, and California sagebrush appear in low densities at a few sites,

and, along with coyote bush, are able to invade disturbed sites. Black sage is found with highest cover in association with chamise in two of three sites underlain by Narlon hardpan.

Classification of Chaparral. The dominant community at the Reserve is described as Central Maritime Chaparral in the CNDDB community classification system (Holland 1986), as well as in Holland and Keil (1995). Using CNPS classification naming conventions (Sawyer and Keeler-Wolf 1995), the eleven chaparral Rapid Assessment Protocol surveys conducted by Condor are characterized in the following suggested "informal groupings" and "series": Manzanita Chaparral (Shagbark Manzanita Series and Purisima Manzanita Series), Ceanothus Chaparral (Santa Barbara Ceanothus Series and Lomopoc Ceanothus Series), Chamise Chaparral (Chamise Series), and Evergreen Woodland (Coast Live Oak Series), with several associations as listed in Table 14. This vegetation type may also be categorized as Burton Mesa Chaparral Unique Stand (Sawyer and Keeler–Wolf, in press). Table 14 shows the common name of the chaparral observed within the Reserve, the name used by Holland (1986) that best describes the community, as well as the CNPS informal grouping, series and association. The names of the associations follow the naming conventions, and association. We have assigned the name of the associations, following the protocol established by Sawyer and Keeler-Wolf (1995) and guidance by Todd Keeler-Wolf and Diana Hickson at the Reserve in spring 2004.

Table 14
Classification of Maritime Chaparral at the Reserve

Common Name	Holland	California Native Plant Society		
		Informal Grouping	Series	Association
Burton Mesa Chaparral	Central Maritime Chaparral	Manzanita Chaparral	Shagbark Manzanita Series	Shagbark Manzanita Series
			Purisima Manzanita Series	Purisima Manzanita-Shagbark Manzanita-Chamise Association
				Purisima Manzanita Series
		Ceanothus Chaparral	Santa Barbara Ceanothus Series	Santa Barbara Ceanothus-Lompoc Ceanothus/Rush-rose Association
			Lompoc Ceanothus Series	Lompoc Ceanothus-Coffeeberry-California Sagebrush Association
		Ceanothus Chaparral	Ceanothus Series	Santa Barbara Ceanothus-Lompoc Ceanothus/Rush-rose Chaparral
				Lompoc Ceanothus-Coffee berry-California Sagebrush Chaparral
		Evergreen Woodland	Coast Live Oak Series	Coast Live Oak/Chamise-Lompoc Ceanothus Association
				Coast Live Oak/Chamise-Purisima Manzanita-Shagbark Manzanita Association
		Chamise Chaparral	Chamise Series	Chamise-Black Sage-Lompoc Ceanothus Association
				Chamise-Black Sage Association
				Chamise-Coyote Bush-Black Sage/Lompoc Monkeyflower Association

Sources:
Holland, R. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.
Sawyer, J. and Keeler-Wolf, T. 1995. A Manual of California Vegetation. California Native Plant Society.
* Several of the *Series* and *Associations* shown in this table are proposed by Condor, using CNPS naming methodology. This is necessary because the many subtleties of plant communities at the Reserve are not entirely reflected in the descriptions of Series and Associations in the CNPS 1995 Manual.

2. Coast Live Oak Woodland and Forest

Photo 16: Coast Live Oak Woodland on the Reserve in 2004. *Photograph by Katrina Burton*

Coast live oak woodlands and forests at the Reserve are dominated by a single tree: coast live oak. Coast live oak is an evergreen tree ranging from 40 to 75 feet in height, with a spreading crown, many massive branches, a dense canopy of thick waxy leaves, and a massive root system consisting of both deeply penetrating roots and widely spreading lateral roots (Pavlik 1991, Hickman 1993, Carroll 1989). These trees can live for 300 years or more. Most healthy stands contain mixed age classes of oak trees, saplings, and seedlings. Although considered drought-tolerant due to its ability to survive the hot dry summer months without rain, coast live oak tends to occur in areas that receive at least 15 or more inches of rain or has suitable microenvironments with water available to its roots at depth. Recent studies describe the water-acquiring capacity of mycorrhizae associated with the roots of coast live oak, especially in non-clay soils, greatly facilitating moisture uptake during dry summer months (Bunyas, Graham, and Allen 2001); mycorrhizal fungi also aid in nutrient uptake (Pavlik 1991).

A number of authors have also commented on the positive correlation between oak tree density and deep soils that foster root growth and water uptake year-round (Barbour and Major 1977, Holland and Keil 1995). On Burton Mesa, oaks may be observed growing in mesic, non-saturated environments: north-facing slopes, drainage bottoms, and on the tops of slopes and ridges of sandy hills.

Coast live oak woodlands and forests are not currently considered rare communities by the California Department of Fish and Game.

a) Variation in Community Composition

As is common elsewhere, stands of coast live oak trees form dense woodlands and forests at the Reserve, especially on north-facing slopes and in moist valley bottoms, but unlike other locations, coast live oak woodlands on the Reserve also occur on ridges and tops of old dunes and even south-facing slopes in places where there is adequate moisture (Figure 21). The dunes often serve as deep reservoirs for water storage (Frank Davis *pers. comm.*)

In mesic locations, oak tree density may be so high that a closed canopy of overlapping trees forms; these oak stands are called coast live oak forest. In slightly drier situations, trees may be more widely spaced, forming coast live oak woodland (Ferren et al. 1984).

Coast live oak woodlands and forests on north-facing slopes:
In dense coast live oak woodlands and forests at the Reserve, the environment under the oak canopy is very shady. Shade-tolerant shrubs such as poison-oak (*Toxicodendron diversilobum*), California coffeeberry (*Rhamnus californica*), toyon (*Heteromeles arbutifolia*), and snowberry (*Symphoricarpos mollis*) predominate in the understory, along with vines such as California blackberry (*Rubus ursinus*), and herbaceous perennials such as coastal wood fern (*Dryopteris arguta*), bracken fern (*Pteridium aquilinum*), hummingbird sage (*Salvia spathacea*), wood mint (*Stachys bullata*), California goosefoot (*Chenopodium californicum*), and others. In a few locations, the native creeping thingrass (*Agrostis pallens*) and California brome (*Bromus carinatus*) have been observed in the understory as well. Annuals are infrequent but include fiesta flower (*Pholistoma auritum*), miner's lettuce (*Claytonia perfoliata*), and bedstraw (*Galium aparine*).

Photo 17: Coast live oaks cleared of understory vegetation in 2004. *Photograph by Mary Carroll*

In several locations at the Reserve, the understory of coast live oak woodland has been cleared of native vegetation and replaced with non-native annual grasses, forbs, or garden ornamentals, producing a related decline in plant and wildlife biodiversity. In these disturbed oak woodlands, the most common plants under the oak canopy are ripgut brome (*Bromus diandrus*), Italian thistle (*Carduus pycnocephalus*), and milk thistle (*Silybum marianum*). Oak woodland that has been cleared of native perennial vegetation provides shade for cattle during hot weather in areas that are subject to livestock grazing. Livestock grazing is generally associated with replacement of native woodland species by annual weedy exotics and a decline in oak regeneration (Holland and Keil 1995). The coast live oak forests located in the La Purisima Management Unit are characterized by understories dominated by non-natives in many areas.

Coast live oak woodlands and forests in moist canyon bottoms and ravines: In moist canyon bottoms, oak woodland or forest may integrate with wetland vegetation, including Central Coast riparian forest and scrub. Wetland indicator species such as arroyo willow (*Salix lasiolepis*), red willow (*S. laevigata*), Santa Barbara sedge (*Carex barbarae*), and rush (*Juncus textilis*) may occur under the oak canopy along with other understory species. Such transitional plant associations may be observed in coast live oak forests adjacent to Davis Creek and other intermittent drainages in the Reserve, especially where human disturbance is minimal. Coast live oaks are also found scattered

along intermittent drainages, often in low densities and surrounded by other upland vegetation such as non-native grassland or coastal scrub.

Coast live oak woodland in Corralitos sand: In the La Purisima Management Unit, the broad alluvial plain comprised of Corralitos sand supports many stands of oaks on the edges of the grassland, which is dominated by non-native weedy exotics. This area has been cleared at various times. In places, clearing has extended under the oak canopy. Elsewhere, "islands" of individual oaks or small oak clusters retain intact native understory but are surrounded by non-native grassland. Understory species in these oak islands include California coffeeberry, mountain-mahogany, Purisima manzanita, poison-oak, and others.

Photo 18: "Islands" of coast live oak with native understory surrounded by weedy exotics in La Purisima State Park in 2004. *Photograph by Mary Carroll.*

Species Observed in Oak Woodland & Forest Rapid Assessment Plots
Adenostoma fasciculatum
Artemisia douglasiana
Artemisia californica
Avena barbata
Baccharis pilularis
Bromus diandrus
Carex barbarae
Carex globosa
Carpobrotus edulis
Cerastium glomeratum
Cercocarpus betuloides
Chenopodium californicum
Claytonia perfoliata
Galium andrewsii
Galium aparine
Heteromeles arbutifolia
Juncus phaeocephalus
Juncus textilis
Leymus condensatus
Leymus triticoides
Lonicera involucrata
Marah fabaceus
Mimulus aurantiacus ssp. lompocense
Oxalis pes-caprae
Pteridium aquilinum
Quercus agrifolia
Rhamnus californica
Rhamnus crocea
Rosa californica
Salvia mellifera
Salvia spathacea
Sanicula crassicaulis
Scrophularia californica
Solanum douglasii
Sonchus oleraceus
Stachys bullata
Toxicodendron diversilobum
Total: 29

b) Oak Forest Surveys at the Reserve

Three oak forest sites were sampled in the Reserve (Figure 23). All three sites have a canopy of coast live oak that exceeds 95% cover. Data from 2004 vegetation sampling in these oak forest associations are shown in Appendix 6.

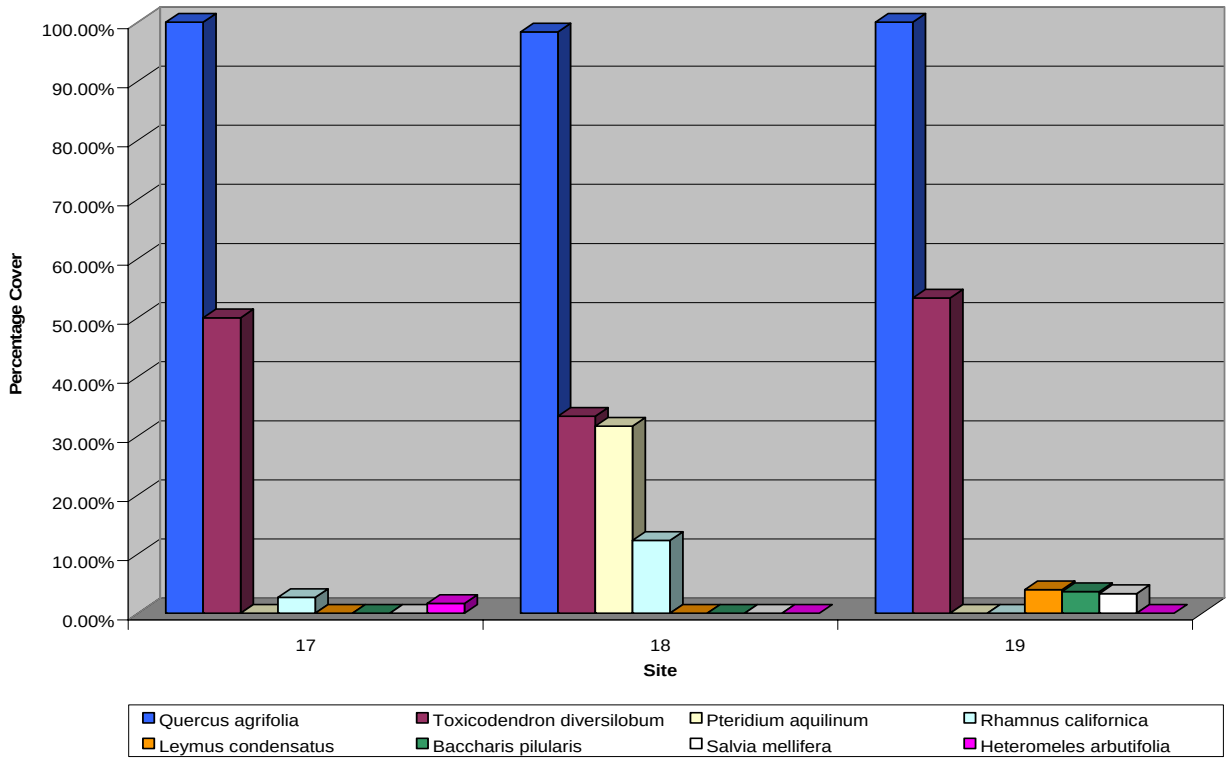


Figure 23: Percent Cover of Species in Coast Live Oak Forests in Three Rapid Assessment Sites in 2004.

Understory. Poison oak is the most common associate at all three oak woodland sites, and each site has over 12 native species in the understory. Many native species are found in low numbers at each site but greatly add to ecosystem function and diversity. Although Site 18, adjacent to the large freshwater marsh in the Santa Lucia Management Unit exhibited high cover by such associates as California coffeeberry and bracken fern, Site 17 along Davis Creek had the greatest species diversity, with over 15 native understory associates, including twinberry (*Lonicera involucrata*), Santa Barbara sedge, and others. At all sites, cover by native perennial understory species exceeds 50% and often 70%.

Classification of Oak Woodland and Forest. Coast live oak woodlands and forests are categorized as coast live oak woodland and coast live oak forest in the CNDDB community classification system (Holland, 1986), coastal live oak woodland by Holland and Keil (1995), the coast live oak phase of southern oak woodland by Barbour and Major (1977), and the coast live oak series by Sawyer and Keeler-Wolf in *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995) (Table 15).

Table 15
Classifications of Oak Woodland and Oak Forest at the Reserve

Common Name	Holland	California Native Plant Society		
		Informal Grouping	Series*	Association*
Oak Woodland	Coast Live Oak Woodland and Forest	Evergreen Woodland	Coast Live Oak Series	Coast Live Oak/Poison Oak Association
				Coast Live Oak/Coffee Berry/Poison Oak-Bracken Fern Association

Sources:
Holland, R. 1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.
Sawyer , J. and Keeler-Wolf, T. 1995 A Manual of California Vegetation. California Native Plant Society.

3. Central Coastal Scrub

a) Variations in Community Composition

Central coastal scrub is dominated by drought-tolerant, soft-leaved shrubs from 3 to 6 feet tall that are often summer dormant and winter active, exhibiting a huge burst of growth in the winter and spring months. Many species are partially or completely summer deciduous and/or dormant, unlike the more commonly evergreen shrubby dominants of Burton Mesa chaparral. Coastal scrub dominants have shallower root systems than chaparral dominants, as well, and these roots may not reach moisture at depth during the dry summer months (Holland and Keil 1995).

Photo 19: *Mucronea* (pink), *Monardella* (purple), and *Horkelia* (green). *Photograph by Mary Carroll*

Central Coastal Scrub includes several forms, as discussed below. Among them, Central Dune Scrub is considered to be a rare community in Santa Barbara County by the Department of Fish and Game Natural Diversity Database, with a Global Rank of G2 (6-20 element occurrences) and a State Rank of S2.2 (threatened) (California Department of Fish and Game 1999).

Central coastal scrub occurs most abundantly on south-facing slopes on a variety of substrates on the Reserve, from well-drained sands such as the Marina formation to shallow soils associated with impervious strata. Often coastal scrub vegetation occurs in areas where the root zone dries out in late spring and early summer but is moist during the winter and spring months. Although well-drained

sands and hardpans may seem to have little in common, they can both be exceedingly dry during summer and early fall months.

Deep well-drained sands may gradually become desiccated after the winter rains case and plants utilize much of the moisture in the upper soil horizons. Often, however, Aeolian sand deposits overlie the parent Monterey and Paso Robles formations, which have low moisture retention capacity. Thus, shallow soils and soils with clay lenses impede root penetration and also foster runoff, especially on slopes, contributing to seasonal dryness.

Overall species composition of central coastal scrub varies dramatically from place to place, although several dominants are common throughout the Reserve, including shrubs such as black sage, California sagebrush (*Artemisia californica*), dune-heather, coyote bush (*Baccharis pilularis* ssp.. *consanguinea*), California coffeeberry (*Rhamnus californicus*), red berry (*Rhamnus crocea*), and poison-oak (*Toxicodendron diversilobum*); the suffrutescent dune buckwheat (*Eriogonum parvifolium*), golden yarrow (*Eriophyllum confertiflorum*), deerweed (*Lotus scoparius*), Lompoc monkeyflower (*Mimulus aurantiacus* ssp. *lompocense*) and bush groundsel (*Senecio flaccidus* ssp.. *douglasii*) are also common. In the Purisima Hills, large stands of giant-rye (*Leymus condensatus*) are an important component of coastal scrub.

Photo 20: Curly-leaved monardella.

In sandy openings between the shrubs, a great diversity of native annual and perennial herbs and grasses flourish. San Luis Obispo wallflower (*Erysimum capitatum* ssp. *lompocense)* and suffrutescent wallflower (*E. insulare* ssp. *suffrutescens*), curly-leaved monardella (*Monardella undulata*), California spineflower (*Mucronea californica*), and annual buckwheat (*Eriogonum gracile* var. *gracile*) are widely scattered, along with California-aster (*Lessingia filaginifolia*).

Photo 21: San Luis Obispo Wallflower

Herbaceous perennials such as green everlasting (*Gnaphalium californicum*), snakeroot (*Sanicula arguta, S. crassicaulis*), amole (*Chlorogalum pomeridianum)*, golden stars (*Bloomeria crocea*), and others are

common, as well as annuals such as doveweed (*Eremocarpus setigerus*), miniature suncups (*Camissonia micrantha*), navarretia (*Navarretia atractyloides*), California malacothrix (*Malacothrix californica*) and others. Fairy mist (*Pterostegia drymarioides*) and California goosefoot (*Chenopodium californicum*) are tucked in the understory of the shrubs.

Woody dominants of coastal scrub vegetation vary in species composition and density in different locations at the Reserve, from dense scrub dominated primarily by several shrub species to mosaics of dune scrub intermixed with species characteristic of Burton Mesa chaparral, oak woodland, and non-native grassland. These varying shrub densities may reflect a history of disturbance by fire as well as clearing, since several shrubby species characteristic of coastal scrub habitats readily colonize disturbed sites and are gradually crowded out and overtopped by chaparral or woodland vegetation over time (Christensen and Muller 1975).

Absent from coastal scrub vegetation at the Reserve are characteristic species of coastal scrub more common south of the Santa Ynez River: lemonade berry (*Rhus integrifolia*), laurel sumac (*Malosma laurina*), and white sage (*Salvia apiana*). Purple sage (*Salvia leucophylla*) is also absent. Several variants of coastal scrub vegetation were observed during our study, as described below.

Chamise-coastal scrub association is dominated by chamise, black sage, coyote bush, California sagebrush, Lompoc monkeyflower, California coffeeberry, and other coastal scrub associates. In shallow soils, species richness within the association may drop to just a few associates – most often, chamise, black sage, coyote bush, California sagebrush, and one or two others. This association consistently appears adjacent to maritime chaparral, especially on shallow soils and in drier sites, such as at Sites 6 and 9 (listed under chaparral sites).

Coastal dune scrub is restricted to locations where bush lupines (*Lupinus chamissonis, L. albifrons,* and *L. arboreus*), as well as dune-heather, California sagebrush, black sage, dune buckwheat (*Eriogonum parvifolium*), and other coastal scrub species dominate sandy soils. This vegetation was mapped by Ferren et al. (1984) at nearby La Purisima Mission State Park as northern coastal dune scrub**.** This association is most prevalent in areas that have been mechanically cleared, but it appears in a few other areas that show other disturbance as well. At the western end of the Reserve, both the more coastal *Lupinus chamissonis* and the more interior *L. albifrons* occur in mixed stands, a reflection of the transitional location of the eastern edge of Burton Mesa (Wayne Ferren *pers. comm.*).

A ***sand almond-coastal scrub association*** occurs in the La Purisima Management Unit**,** almost exclusively on Corralitos sand. The sand almond-coastal scrub association is a rich assemblage of coastal scrub and dune species, including California sagebrush, dune-heather, black sage, golden yarrow, California coffeeberry, deerweed (*Lotus scoparius*), California croton (*Croton californicus*), coast horkelia (*Horkelia cuneata* ssp. *cuneata*), San Luis Obispo wallflower (*Erysimum capitatum* ssp.. *lompocense*) and annual species such as California spineflower (*Mucronea californica*) and *Cryptantha* species. As mentioned previously, sand almond also occurs in association with dominants of maritime chaparral.

The sand almond population abruptly terminates in the northeastern corner of the Reserve at about 625 feet elevation in soils characterized as San Andreas-Tierra Complex. The contact zones are visible in the field due to differences in soil color and texture; the San Andreas-Tierra Complex is characterized as being very low in soil fertility (Shipman 1972). Sand almond extends south to lower elevations in La

Purisima Mission State Park and forms extensive populations in Marina and Corralitos sand.

A ***coast live oak-coastal scrub association*** is particularly common in the La Purisima Management Unit on Arnold, Marina, and Corralitos sands (Dibblee, 1959). It seems plausible that these sands are well-drained for several meters but overlay moisture at depth. Coastal scrub species in this environment gradually become dehydrated during the summer months, in contrast to the deep-rooted coast live oaks that draw moisture from deeper sources.

Photo 22: Open coastal scrub at La Purisima State Park (2004).

Open scrub predominates in areas that had been previously cleared (see discussion in Maritime Chaparral section above). In these areas of previous disturbance, unvegetated sandy openings are particularly common and species richness is low. This is unlike open areas or gaps in the scrub that have not been previously cleared, that are high in species richness. Instead, at these previously disturbed sites, coyote bush, California sagebrush, and dune-heather are fairly common; each of these species exhibits a wide tolerance of disturbed sandy substrates, and with small and/or wind-dispersed seeds rapidly reinvade sites that have been previously cleared of scrub vegetation. Silver bush lupine is also found more commonly in disturbed sites on Burton Mesa. Reinvasion by other native scrub species sometimes requires replenishment of the seed bank, a subject not adequately researched for these habitats.

b) Coastal Scrub surveys at the Reserve

Data from 2004 vegetation sampling in five coastal scrub associations are shown in Appendix 6 and Figure 24 below. All sites have burned in the last 10 yrs, none are on Marina sand, and all except one site exceeds 250 feet elevation.

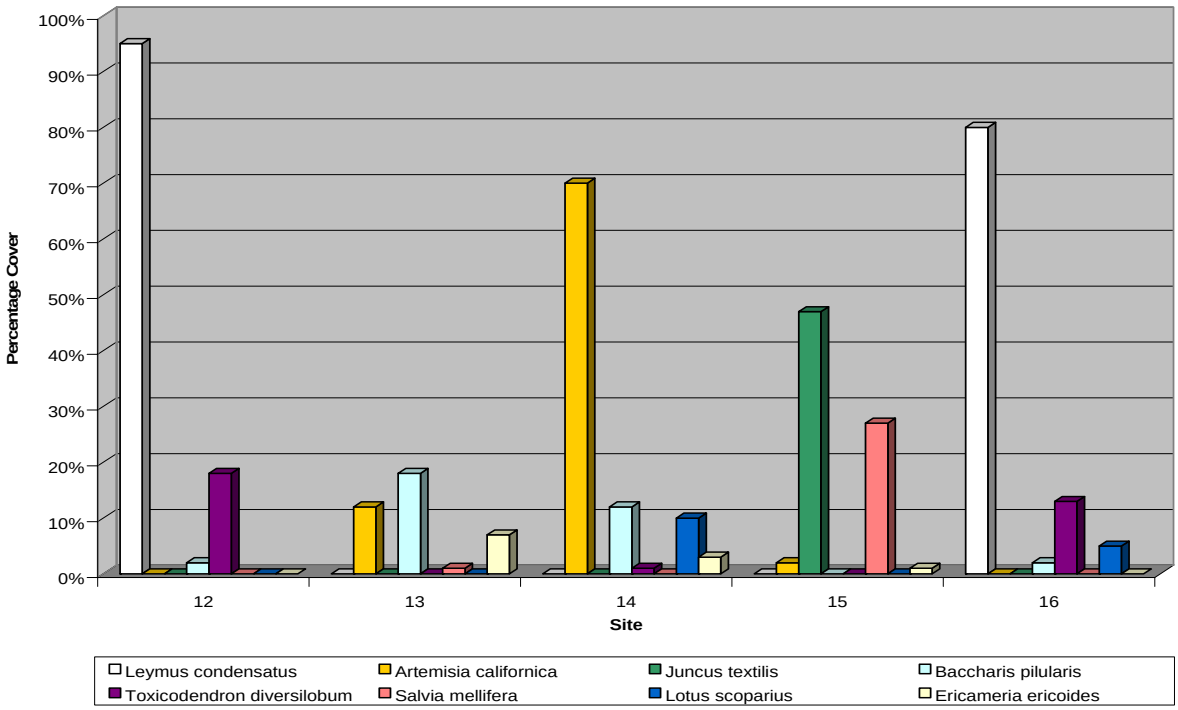


Figure 24: Percent Cover of Dominant Species in Coastal Scrub in Five Rapid Assessment Sites in 2004.

All five sites have burned in the past ten years, and support differing shrub dominants and species composition. No one plant is found in all five coastal scrub sites, although California sagebrush, coyote bush, black sage, deerweed, poison-oak, and Lompoc monkeyflower are found in four of five samples. Dune heather is found in three of four sites.

Coastal scrub dominated by giant-rye associations (2 sites) consistently includes poison-oak, deerweed, and coyote bush as associates, but the high cover by this large rhizomatous grass precludes cover by most other associates (Figure 24). These sites are located in the Purisima Hills at about 700 feet elevation on steep south-draining slopes. Cover by California sagebrush is minimal to absent. Chaparral currant, a shrub occasionally found in coastal scrub and chaparral habitats, is present in the vicinity of these sites and is not found at the lower elevation sites.

At the three lower elevation sites on Burton Mesa, coastal scrub is characterized by black sage, coyote bush, Lompoc monkeyflower, and dune heather. Each of these species exhibits a wide tolerance of disturbed sandy substrates, and with small and/or wind-dispersed seeds, rapidly reinvade sites that have been previously cleared of scrub vegetation. Coast horkelia is also found in low numbers in two of three sites, as is coast live oak. Bishop pine occurs at Site 14 along a small ravine.

Bare ground varies from 0% at the two giant-rye sites up to 58% at Site 13. Although vegetative cover is low at Site 13, the sandy openings between shrubs support a number of annuals and herbaceous perennials such as California croton, fairy mist,

Cryptantha, and spine-flower (*Chorizanthe diffusa*). Other coastal scrub sites support few annuals, which may be a reflection of disturbance history, soil type, and/or the paucity of rain during the 2003-2004 seasons. One site is located near a drainage and is characterized by black sage, with large areas (47%) covered by the rhizomatous Indian rush and a small amount of brown-headed rush. Shallow soils with perched water tables are found in a number of locations on Burton Mesa and support vegetation that ranges from grassland to coastal scrub, chaparral, oak woodland, and wetland associations, often with at least one rhizomatous monocot as a dominant.

Classification of Coastal Scrub. Coastal scrub communities would be classified as the Central (Lucian) Coastal Scrub, *and* Central Dune Scrub, *and* Coastal Sage – Chaparral Scrub in the CNDDB community classification system (Holland 1986). Areas where California sagebrush is dominant are best described by the California Sagebrush Series within the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf 1995). Other Coastal Scrub series include the Coyote Brush Series, Black Sage Series, and Giant Rye Series (Table 16). Although giant rye is a grass, it is most commonly associated with chaparral and coastal scrub vegetation and not grassland (Barbour and Major 1977, Holland and Keil 1995), and at the Reserve this is also true, with associates including coyote brush, poison oak, black sage, deerweed, etc.

Wildflowers

A rich assemblage of annuals and herbaceous perennials are present in sunny openings in coastal scrub habitats and in some of the grasslands. Annuals include seaside fiddleneck (*Amsinckia spectabilis* var. *microcarpa*), owl's-clover (*Castilleja densiflora*), annual buckwheat (*Eriogonum gracile* var. *gracile*), California spineflower (*Mucronea californica*), miniature suncups (*Camissonia micrantha*), lupine (*Lupinus bicolor*), white forget-me-not (*Cryptantha clevelandii)* and Doveweed (*Croton (Eremocarpus) setigerus*). Among the many herbaceous perennials are San Luis Obispo wallflower (*Erysimum capitatum* ssp. *lompocense),* California croton (*Croton californicus*), coast horkelia (*Horkelia cuneata* ssp. *cuneata*), California-aster (*Lessingia filaginifolia*), green everlasting (*Gnaphalium californicum*), golden stars (*Bloomeria crocea*), and many others.

Vernon Human (2004) writes: "*Burton Mesa is one of the few remaining places in California where such massive and varied wildflower displays still occur. This fact has not been, to my knowledge, added to the scale in the current debate over the mesa's future. There's more to its plant community than endemic and endangered species. We are fortunate to have it on our doorstep.*"

Table 16
Classifications of Coastal Scrub at the Reserve

Common Name	Holland	California Native Plant Society		
		Informal Grouping	Series*	Association*
Coastal Scrub	Central Coastal Scrub and Central Dune Scrub	Coastal Scrub	California Sagebrush Series	Coyote Brush-California Sagebrush-Mock Heather Association
				California Sagebrush-Coyote Bush/Deerweed Association
			Coyote Brush Series	Coyote Bush/Alkali Rye-Nasella lepida Association
			Giant Rye Series	Giant Rye-Poison Oak Association
			Black Sage Series	Black Sage/Indian Rush Association

Sources:
Holland, R. 1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.
Sawyer, J. and Keeler-Wolf, T. 1995 A Manual of California Vegetation. California Native Plant Society.

Several of the *Series* and *Associations* shown in this table are proposed by Condor, using the CNPS naming conventions. This is necessary because the many subtleties of plant communities at the Reserve are not entirely reflected in the descriptions of Series and Associations in the CNPS 1995 Manual.

4. Grassland

a) Variations in Community Composition

Native grassland: Vast expanses of grasslands may have covered many of California's valleys and lowlands in pre-European times, from coastal terraces in Santa Barbara County to portions of the Great Central Valley. Unlike the ubiquitous non-native annual grasslands of today, native grasslands prior to 1769 were dominated by clumps of perennial grasses ranging from one to four feet in height interspersed with wildflowers and patches of shrubs and trees. These grasslands included needle-grass (*Nassella* species), native fescues (*Festuca* species), native blue grass (*Poa* species), three-awn (*Aristida* species), melic grass (*Melica* species), wild-rye (*Leymus* species), june grass (*Koeleria* species), deer grass (*Muhlenbergia rigens* and related species), Hoover's bent grass (*Agrostis hooveri*) and others (Barbour and Major 1977, Barbour et al. 1993, Holland and Kiel 1995). These native perennial grasses do not die in summer; a well-developed root system up to seven or more feet deep (Stromberg et al. 2001) allows them to persist during the hot dry months and to continue to occupy the same site from year to year.

In patches between the bunchgrasses and woody plants, annual wildflowers such as California poppy (*Eschscholzia californica* and other species), lupines (*Lupinus* species), owl's clover (*Castilleja* species), and a host of other species would grow lush in spring and fade in summer. Herbaceous perennials, including bulbs, would bloom in spring or summer, depending on the species. Summer-active annuals and herbaceous perennials such as tarweeds (*Madia* and *Deinandra* species) would also be present among the grasses, along with patches of coastal scrub.

Several environmental factors favor grassland formation under natural conditions, the most important of which may be soil and climate. In the past, native grasslands would have been most abundant on soils underlain with clays or hardpans, although patches of native grasses sometimes form on sands and loams

as well. Native grasslands prior to 1769 also experienced infrequent grazing by native herbivores such as elk, pronghorn and deer that grazed seasonally and then moved on. Wildfires and human-set fires were also a regular component of native grassland ecosystems, reinvigorating a site by providing nutrient-rich ash and clearing out thatch and woody plants. Hence, optimum conditions for herbaceous growth were provided for the following season.

On Burton Mesa, native grasslands have probably always been localized due to the predominance of sandy substrates. At the Reserve native grasses grow primarily among chaparral and coastal scrub vegetation on sandy substrates instead of forming distinctive grassy expanses; native grasses include purple needlegrass (*Nassella pulchra*), foothill needlegrass (*N. lepida*), nodding needlegrass (*N. cernua*), junegrass (*Koeleria macrantha*), Hoover's bent grass (*Agrostis hooveri*) and coast range melic (*Melica imperfecta*). In oak woodland habitats California brome (*Bromus carinatus*) is scattered in openings and in understory vegetation as well. In places where impervious soils impede drainage, alkali rye (*Leymus triticoides*) and salt grass (*Distichlis spicata*) form patches, especially adjacent to moist drainages. The largest known patch of deer grass (*Muhlenbergia rigens*) in the area occurs in the Santa Lucia Management Unit and is discussed below.

Classification of Grassland. This community on the Reserve would be classified as Valley Needlgrass Grassland in the CNDDB community classification system (Holland 1986).

Species Observed in Native and Non-Native Grassland Rapid Assessment Plots
Anagallis arvensis
Arctostaphylos purissima
Arctostaphylos rudis
Avena barbata
Baccharis pilularis
Bromus diandrus
Bromus hordeaceus
Bromus madritensis
Castilleja densiflora
Ceanothus cuneatus var. fascicularis
Clarkia sp
Crassula connata
Croton californicus
Cryptantha sp
Ericameria ericoides
Erodium botrys
Gnaphalium californicum
Hazardia squarrosa
Horkelia cuneata
Hypochaeris glabra
Isocoma menziesii
Juncus patens
Juncus phaeocephalus
Juncus textilis
Leymus triticoides
Lupinus albifrons
Lupinus bicolor
Lupinus truncatus
Mimulus aurantiacus ssp. lompocense
Muhlenbergia rigens
Nassella lepida
Plantago lanceolata
Quercus agrifolia
Rumex acetosella
Salvia mellifera
Silene gallica
Toxicodendron diversilobum
Vulpia myuros
Total: 38

Areas where *Nassella lepida* and *Melica* are found are best described by the Foothill Needlegrass Series within the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf, 1995).

The Natural Diversity Database ranks native grassland as a rare community, with a Global Rank of G3 (21-100 element occurrences) and a State Rank of S3.1 (very threatened) (California Department of Fish and Game 1999).

Non-native grassland: The largest non-native grassland found at the Reserve occurs in the far eastern La Purisima Management Unit. Other patches are found throughout the Reserve, especially in association with areas that were farmed previously and in association with small drainages and/or wetlands.

These areas are dominated by introduced annual grasses such as slender wild oats

(*Avena barbata*), common wild oats (*Avena fatua*), rip-gut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), red brome (*Bromus madritensis* ssp.. *rubens*), foxtail barley (*Hordeum murinum*), veldt grass (*Ehrharta calycina*), annual ryegrass (*Lolium multiflorum*), and annual fescues (*Vulpia* species). Associated with these grasses are weedy mustards (*Brassica rapa, B. nigra, B. tournefortii* and *Hirschfeldia incana*) and filaree (*Erodium cicutarium, E. botrys*) along with patches of common vetch (*Vicia sativa*), Italian thistle (*Carduus pycnocephalus*), milk thistle (*Silybum marianum*), and others.

b) Grassland surveys at the Reserve

Data from 2004 vegetation sampling in two native and one non-native grassland association are shown in Appendix 7b (Table 17). Each grassland site differs from the others in some fundamental ways. The two native grassland sites occur on Narlon hardpan and are surrounded by chaparral and oak woodland vegetation in adjacent sandier and deeper soils. The non-native grassland occurs on Arnold sand in an area that has been obviously cleared of native vegetation. None of the sites have burned in the past 65 years or more.

Drainages lined with alkali rye are relatively common in the Central Coast region. Site 22 is a small drainage near Site 24 that supports alkali rye and coyote bush, with foothill needlegrass (on the upper banks). Coyote bush is tolerant of a broad range of conditions, including arid sites and saturated soils. Hence, its presence in this area is expected.

In contrast, deer grass is uncommon in the Central Coast region as a whole, forming only occasional colonies, especially in areas with perched water tables. Hence the 2.1 acre site (Site 24) dominated by deer grass (82%) is a significant native grassland resource within the Reserve. Again, coyote bush is also present, along with brown-headed rush, common rush (*Juncus patens*), alkali rye, Lompoc monkeyflower, and several other species. The adjacent vegetation includes both species of manzanita (*A. purisima* and *A. rudis*), Lompoc ceanothus, coast live oak, coast horkelia, and other Burton Mesa chaparral associates.

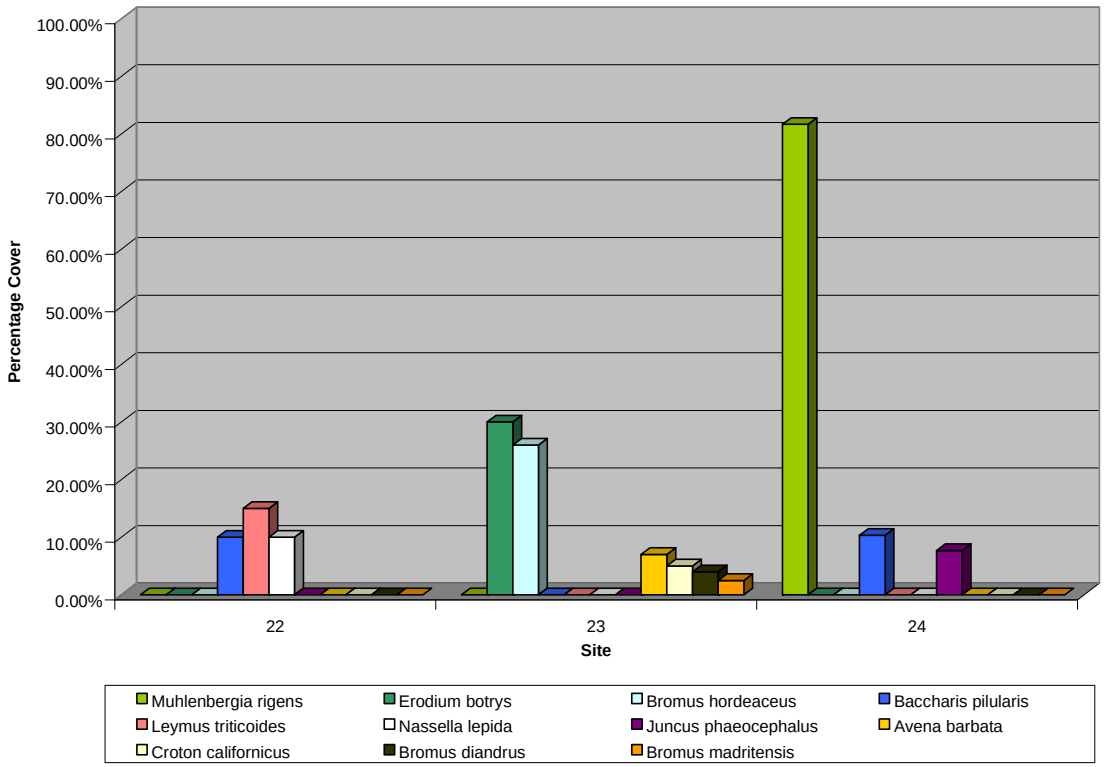


Figure 25: Percent Cover of Dominant Species in Three Grassland Rapid Assessment Sites in 2004.

The non-native grassland site (Site 23) is dominated by soft chess (50%), wild oats (7%), ripgut brome (6%), and red brome (3%), four of the most widespread weedy grasses in coastal and central California; all are allelopathic. California croton is the only native species with significant cover (5%); all other native species are found in low densities. The non-native filaree (*Erodium botrys*) is also common (30%), observed throughout Burton Mesa in sandy openings as well as non-native grasslands.

Photo 23: Grassland on the Reserve in 2004.

The non-native community would be classified as Non-native Grassland in the CNDDB community classification system (Holland 1986) and as the California Annual Grassland Series in the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf, 1995). The native grasslands would be classified as Native Grassland in the CNDDB community classification system (Holland 1986) and as the Deer

Grass and Coyote Brush Series in the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf 1995) (Table 17).

Table 17
Classifications of Grassland at the Reserve

Common Name	Holland	California Native Plant Society		
		Informal Grouping	Series*	Association*
Herbaceous	Non-Native Grassland	Grasslands Dominated by Non-Native Species	California Annual Grassland Series	Broad-leaved Filaree-Soft Chess-Slender Wild Oat Non-Native Association
	Native Grassland	Native Grassland	Deer Grass Series	Deer Grass Series
			Coyote Brush Series	Coyote Brush/Alkali Rye-Nasella *lepida* Association

Sources:
Holland, R. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.
Sawyer, J. and Keeler-Wolf, T. 1995. A Manual of California Vegetation. California Native Plant Society.

* Some of the *Series* and *Associations* shown in this table are proposed by Condor, using CNPS naming conventions. This is necessary because the subtleties of plant communities at the Reserve are not entirely reflected in the descriptions of Series and Associations in the CNPS 1995 Manual.

5. Bishop Pine Forest

a) Variations in Community Composition

Dense stands of the bishop pines (*Pinus muricata*) form a distinctive community in the Purisima Hills in several locations in the northern portions of the Reserve. These closed-cone pines comprise a fire-dependent community that begins to decline as stand ages exceed 60 years (Barbour and Major 1977). Bishop pines predominate on north-facing slopes in shallow, acidic and poorly drained soils; they are distributed in disjunct populations along coastal California from Humboldt County south to Santa Barbara County, with two outlying stands in Baja California (Griffin and Critchfield 1972, Barbour and Major 1977).

Photo 24: Bishop pine on Purisima Hills 1993. *Photo by Elihu Gevirtz.*

A small tree, bishop pines reach about 50 feet in height and bear thick-scaled spiny cones that are often closed at maturity. Stands often consist of 60 to 90% density of bishop pine individuals, along with associated species such as chaparral dominants, California huckleberry (*Vaccinium ovatum*), and various regional endemics. Bishop pine cones are keratinous, that is, sealed at

A small tree, bishop pines reach about 50 feet in height and bear thick-scaled spiny cones that are often closed at maturity. Stands often approach 60% to 90% cover, along with associated species such as chaparral dominants, California huckleberry (*Vaccinium ovatum*), and various regional endemics. Bishop pine cones are serotinous, that is, sealed at maturity by cone resins. Fire melts the resins and releases seeds from the cones, often resulting in dense carpets of seedlings and saplings in years immediately following a fire. Cones of old trees, especially those with dead branches, also occasionally open. Stands of bishop pine are even-aged and fires tend to occur an average of every 60 years in these stands. Senescence and disease exert heavy tolls on populations that exceed 80 years in age (Barbour and Major 1977). Following the Oakhill Fire of 1994, bishop pines at the top of Harris

Grade Road north of the Reserve regenerated quickly and with a very high density (photo 26) (Gevirtz *personal observations* 1994-2004). The bishop pine forest in the Purisima Hills Management Unit burned in in 2000 (Figure 17). The bishop pine forest off the property north of the Santa Lucia Management Unit was so dense in 2004 (four years after fire) that Condor investigators found that it was nearly impenetrable.

Locally, bishop pine forms dense stands in diatomaceous shale (pH 4.7) in the Purisima Hills, where it occurs with Santa Cruz Island scrub oak (*Quercus parvula* ssp. *parvula*), Eastwood's manzanita (*Arctostaphylos tomentosa* ssp. *eastwoodiana*),

black-flowered figwort (*Scrophularia atrata*), and other species. It also occurs in the Solomon Hills to the immediate north (Gevirtz *unpublished data*). In the Purisima Hills, bishop pine density is the highest on north-facing slopes, but narrow patches of bishop pines also descend the south-facing slopes, eventually forming isolated pockets on Burton Mesa, including those on Vandenberg Air Force Base in Oak and Pine Canyons, in the Purisima Hills Management Unit of the Reserve as well as in outlying clusters downslope from the main population in the Purisima Hills. Barbour and Major (1977) describe these pockets occurring on "white quartz sand pockets [that] also support reduced plant growth and apparently mimic the edaphic conditions produced on the diatomaceous shale."

Photo 25: Survey in regenerating Bishop Pine Forest on top of Purisima Hills 1997, 3 years after fire. *Photo by Elihu Gevirtz.*

Species Observed in Bishop Pine Rapid Assessment Plots
Adenostoma fasciculatum
Arctostaphylos purissima
Arctostaphylos rudis
Arctostaphylos tomentosa ssp. *eastwoodiana*
Artemisia californica
Baccharis pilularis
Bromus madritensis
Carduus pycnocephalus
Ceanothus cuneatus var. fascicularis
Conyza canadensis
Ehrharta calycina
Erechtites glomerata
Ericameria ericoides
Hazardia squarrosa
Helianthemum scoparium
Heteromeles arbutifolia
Hypochaeris radicata
Lotus junceus
Mimulus aurantiacus ssp. lompocense
Nassella pulchra
Pinus muricata
Pteridium aquilinum
Quercus agrifolia
Quercus parvula
Salvia mellifera
Solanum umbelliferum
Stephanomeria virgata
Vulpia myuros
Total: 28

b) *Bishop pine surveys at the Reserve*

Data from 2004 vegetation sampling in two

Bishop pine stands are shown in Appendix 6 (Table 18). The two sites are distinctive in several ways. Site 20 is a very small, low elevation relatively flat site in the Encina Management Unit at 433 feet elevation near Harris Grade Road. This site is underlain by Marina sand and is dominated by Purisima manzanita and other chaparral species. The presence of *Quercus parvula* suggests that the stand is natural, rather than planted. This site last burned in 1972.

Site 21 is located at 762 feet elevation in the Purisima Hills on a south-facing slope comprised of diatomaceous shale. Unlike Site 20 which is densely vegetated, this site burned in the Harris Grade fire in 2000 and has 90% bare ground.

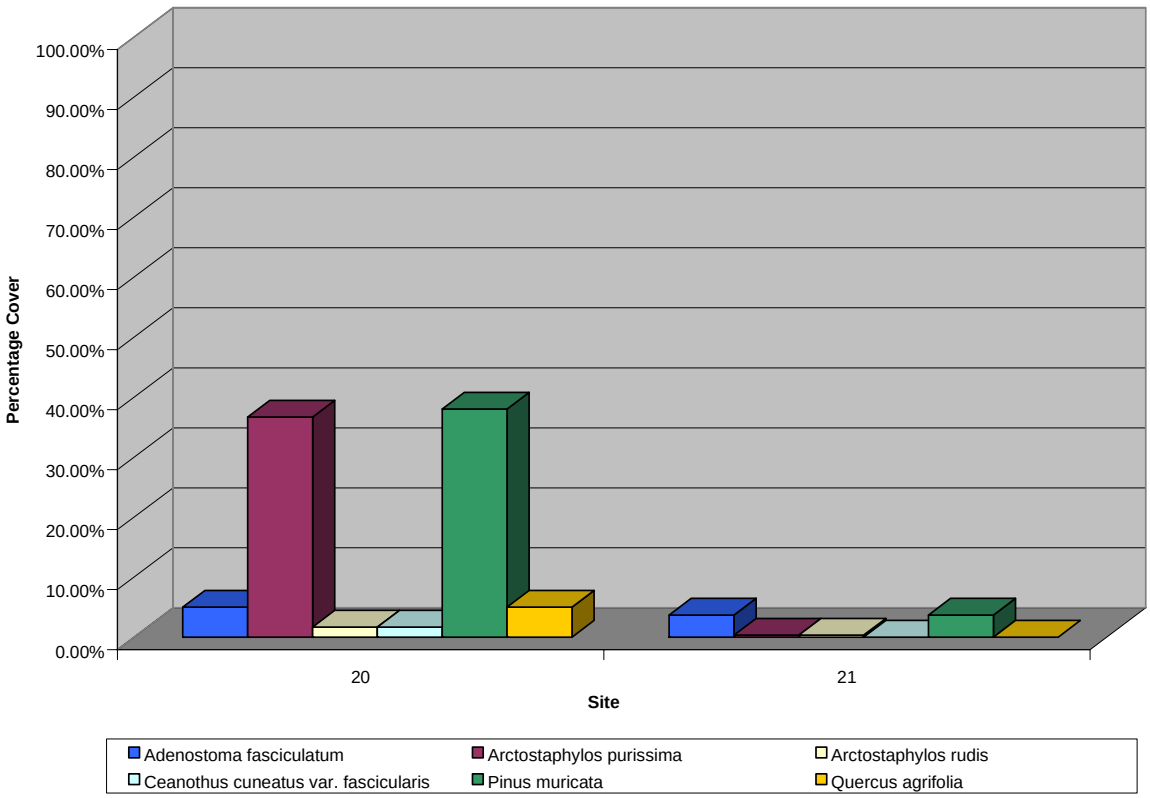


Figure 26. Percent Cover of Dominant Species in Bishop Pine Forest in Two Rapid Assessment Sites in 2004.

Bishop pine and Purisima manzanita are codominants at Site 20 with approximately 38% cover each; cover by the two species in this 33-year-old stand is dense and overtops other woody shrubs. Several woody species are present at the margins of the manzanita-pine stand, including coast live oak, Santa Cruz Island scrub oak, Lompoc ceanothus, chamise, and shagbark manzanita. A number of standing dead chamise and Lompoc ceanothus skeletons are visible under the canopy of the pines and manzanitas.

In contrast, expanses of bare ground typify the recently-burned Site 21. Bishop pine seedlings and saplings, along with Purisima and Eastwood's manzanita, chamise, coyote bush, and the fire-following rush broom (*Lotus junceus*) are common at this site. In places, dense patches of weeds are present as well, including Italian thistle (*Carduus pycnocephalus*), veldt grass (*Ehrharta calycina*), and Australasian fireweed (*Erechtites glomerata*).

Photo 26: Chamise near Bishop Pine Woodland recovering from a fire in 2000 in the Purisima Hills Management Unit *Photograph by Katrina Burton.*

Site 14, which was discussed in the coastal scrub vegetation section, also contains Bishop pine. Although Bishop pine cover is low at this site, it is found dotting the margins of an eroded drainage that bisects the site and originates in the Purisima Hills. Site 14 burned in 1994 and is characterized by coastal scrub vegetation on Tierra sandy loam soil.

Classification of Bishop Pine Forest. This community would be classified as Southern Bishop Pine Forest in the CNDDB community classification system (Holland, 1986). Areas where Bishop pine is dominant are best described by the Bishop Pine Series in the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf, 1995).

Bishop Pine Forest is considered a rare community in Santa Barbara County by the Department of Fish and Game Natural Diversity Database, with a Global Rank of G2 (6-20 element occurrences) and a State Rank of S2.2 (threatened) (California Department of Fish and Game, 1999).

Table 18
Classifications of Bishop Pine Plots at the Reserve

Common Name	Holland	California Native Plant Society		
		Informal Grouping	Series*	Association*
Woodland and Forests	Southern Bishop Pine Woodland and Forest	Closed-cone Pine Woodland	Bishop Pine Series	Bishop Pine/Purisima Manzanita Association
Woodland and Forests	Southern Bishop Pine Woodland and Forest	Closed-cone Pine Woodland	Bishop Pine Series	Bishop Pine/Chamise Association

Sources:
Holland, R. 1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.
Sawyer , J. and Keeler-Wolf, T. 1995 A Manual of California Vegetation. California Native Plant Society.

* Some of the *Series* and *Associations* shown in this table are proposed by Condor, using CNPS naming conventions. This is necessary because the subtleties of plant communities at the Reserve are not entirely reflected in the descriptions of Series and Associations in the CNPS 1995 Manual.

D. Wetland Communities

1. Riparian Woodland

a) Variation in Community Composition

Many streams, lakes, ponds, and springs throughout California, as well as in the Lompoc Valley, are bordered by clumps or forests of deciduous trees and large swaths of perennial and shrubby species that thrive in soils that are seasonally to permanently wet. The extent and type of wetland vegetation adjacent to the water source depend on the extent and flow of water over time, the size and nature of banks and flood plains, the amount of water carried on a seasonal and annual basis, soil type and permeability, availability of oxygen in the soil, and the depth and lateral extent of subterranean aquifers.

Photo 27.: Riparian Forest including Black Cottonwood in Santa Lucia Management Unit 2004. *Photo by Elihu Gevirtz.*

Substrates in riparian habitats vary, from large boulders and course particles where water movement is swift, to fine-grained particles in areas with slower water movement. Meandering stream channels reduce the speed of water flow, redistribute sediments, and trap organic matter from upstream as well as onsite, contributing to high nutrient levels.

The environmental conditions of riparian habitats often contrast with those of surrounding vegetation. In winter, the riparian trees and shrubs are largely dormant and leafless, whereas plants in surrounding grasslands and shrublands are often growing or even flowering during the winter period. Direct light can reach the ground, enabling understory and nearby wetland plants that are winter-active to receive a boost in photosynthetic potential. Most woody plants in the riparian zone are wind pollinated and flower before they leaf out.

Once a green canopy has formed, dense shade is produced. Temperatures are moderated and are often significantly cooler than readings in full sunlight. Humidity is higher than in full sun due to evaporation from soil and transpiration from trees, shrubs, and herbs. Wind velocities are reduced under the canopy. Thus, the riparian habitat is more mesic than surrounding areas and attracts wildlife. Further, by summer much of the surrounding vegetation may be transitioning into a dormant state due to drought stress whereas plants in the riparian habitat receive ample moisture and are fully active.

One of the characteristics of healthy Riparian Woodland is the development of multiple layers of vegetation – an overstory of large trees; smaller trees and large shrubs underneath or in openings; shrubs, vines, ferns, and herbaceous perennials lining banks or occupying sandbars or pockets of stable sediments in the stream channel; colonies of herbaceous perennials in favorable sites; and smaller herbs on sandbars and in sunny openings. Plants vary in their ability to tolerate periodic flooding and changing water levels, and their distribution within a riparian habitat will fluctuate accordingly. Riparian areas support the most diverse and densest aggregations of wildlife in the region due to the diversity of plant species they support, multilayered vegetation, and water. These features provide essential habitat and food for many wildlife species.

In the Lompoc Valley, many water courses originating from the surrounding Santa Ynez Mountains and the Purisima Hills feed into the Santa Ynez River. Extensive Riparian Woodlands have developed along these streams and the Santa Ynez River, dominated by various associations of winter deciduous trees such as arroyo willow (*Salix lasiolepis*), red willow (*S. laevigata*), yellow willow (*S. lucida* ssp. *lasiandra*), western sycamore (*Platanus racemosa*), white alder (*Alnus rhombifolia*), black cottonwood (*Populus balsamifera* ssp... *trichocarpa)*, and California box elder (*Acer negundo* var. *californicum)*.

Shrubs include mule-fat (*Baccharis salicifolia*), Mexican elderberry (*Sambucus mexicana*), poison-oak (*Toxicodendron diversilobum*), California wild rose (*Rosa californica*) and the viny creek clematis (*Clematis ligusticifolia*) and California blackberry *(Rubus ursinus*). Perennial wetland monocots such as cattail (*Typha domingensis, T. latifolia*), California bulrush (*Scirpus californicus*), common spikerush (*Eleocharis macrostachya*) and rush (*Juncus* species) may form colonies in sunny openings in slow-moving water and in backwater areas. Individuals of giant chain fern (*Woodwardia fimbriata*) may be scattered up and down the corridor in partly sunny environments. A wide variety of plants will grow in the exposed stream channels, including water cress (*Rorippa nasturtium-aquatica),* speedwell (*Veronica anagallis-aquatica*), common monkeyflower (*Mimulus guttatus*), willow-herb (*Epilobium* species), and others.

The nearby Santa Ynez River and drainages descending into Lompoc from the south and east, such as Miguelito and El Jaro - Salsipuedes Creeks, support scattered populations of western sycamore, California box elder, white alder, black cottonwood, and several species of willow. Thus, it is particularly noteworthy that the creeks draining out of the Purisima Hills are dominated primarily by willow and black cottonwoods; no alders, box elders, or sycamores are present, except for sycamores adjacent to La Purisima Mission that may have been planted by the California Conservation Corps in the 1930s (Gevirtz et. al 2005). The hydrology of the drainages flowing into the Reserve, with the relative lack of flowing surface water and rocky debris in stream bottoms, may preclude the natural establishment of sycamores or clusters of California box elder characteristic of nearby riparian woodlands.

The smaller of these creeks flowing from the Purisima Hills support a mosaic of oak woodland and arroyo willow scrub vegetation, including coast live oak, arroyo

willow, mule-fat, Mexican elderberry, poison-oak, coyote bush, and other shrubs. Herbaceous associates include bracken fern (*Pteridium aquilinum*), Santa Barbara sedge (*Carex barbarae*), Indian rush (*Juncus textilis*), alkali rye (*Leymus triticoides*), and hedge-nettle (*Stachys bullata*). California wild rose (*Rosa californica*), creek clematis (*Clematis ligusticifolia*), and California blackberry *(Rubus ursinus*) may also form colonies in moist pockets. Willow scrub vegetation occurs in places along the unnamed drainages of the Vandenberg Management Unit as well as southwest of Cabrillo High School in the Santa Lucia Management Unit in an area fed by seeping water from an underground culvert.

In marked contrast, lush riparian forest can be found along Davis Creek dominated by deciduous willows and, in patches, black cottonwoods in association with the shrubs and herbaceous associates mentioned above. Also found in this drainage is twinberry (*Lonicera involucrata* var. *ledebourii*), a honeysuckle that is common in Barka Slough at the mouth of San Antonio Creek but not known from the Reserve or nearby areas.

Riparian forest also grows at the springs northwest of the agricultural field in the Santa Lucia Management Unit and rings much of the marsh to the south. In this area arroyo willow (*Salix lasiolepis*) predominates, although some yellow willow (*S. lucida* ssp.. *lasiandra*) and red willow (*S. laevigata*) are also present. On the western border of the Reserve, California wax-myrtle (*Morella californica*) is found in association with willows. The arroyo willows in this area have distinctive leaves that are quite pubescent on the under surface; this was also noted by Smith (1998) who commented that it suggests *var. bigelovii* of the San Francisco area and areas to the north. Freshwater marsh vegetation is also found in both areas and will be discussed below (see Photo 37).

It is noteworthy that lush riparian vegetation dominated by black cottonwoods and willows is found in Los Berros Creek on oil company property immediately north of the cleared channel that bisects the La Purisima Management Unit; both species reappear in Los Berros Creek south of this agricultural field in Mission Hills and at La Purisima Mission State Park. Los Berros Creek on the Reserve is surrounded by cultivated fields and largely devoid of riparian vegetation, undoubtedly as a result of clearing in earlier decades and continued agricultural use, as was done to the south at La Purisima Mission State Park (Gevirtz et al. 2005).

Central Coast Riparian Scrub is considered to be a rare community by the Department of Fish and Game Natural Diversity Database, with a Global Rank of G2 (6-20 element occurrences) and a State Rank of S2.2 (threatened) (California Department of Fish and Game 1999).

b) Riparian vegetation surveys at the Reserve

Data from 2004 vegetation sampling in three riparian associations are shown in Appendix 8 (Table 19). Site 25 occurs in an unnamed drainage in the Vandenberg Management Unit to the west of Providence Landing in a sandy creek bed that was dry at the surface at the time of sampling. This site is dominated by arroyo willow (100% cover) with Mexican elderberry contributing 17% to the shrubby understory. Understory species are scant and include California blackberry, seep baccharis

(*Baccharis douglasii*), and coyote bush. Much of the drainage consists of bare sand in the vicinity of the site.

Although this drainage does not have flowing water and isn't even honored with a name, it supports several distinctive vegetation types. The head of the drainage, north of Highway 1, coincides with the remarkable stand of deer grass in the vernal wetland area in the Santa Lucia Management Unit (Site 24). Two upland sites also sampled in this drainage contain wetland species mixed with upland species. Site 19, dominated by coast live oak woodland, also supports small areas of alkali rye (*Leymus triticoides*) and brown-headed rush (*Juncus phaeocephalus*). Santa Barbara sedge (*Carex barbarae*), western rush (*Juncus occidentalis*), and mexican rush (*J. mexicanus*) are found nearby. Site 15, up-Data from 2004 vegetation sampling in three riparian associations are shown in Appendix 6 (Table 19). Site 25 occurs in an unnamed drainage from the oak woodland site, contains an unusual mix of Indian rush dominating the site at 47%, intermixed with the black sage (27%), Purisima manzanita (3%), and other woody species with 2% cover or less of coyote bush, coast live oak, and dune-heather.

Species Observed in Riparian Woodland Rapid Assessment Plots
Baccharis douglasii
Baccharis pilularis
Bromus hordeaceus
Carduus pycnocephalus
Carex barbarae
Conium maculatum
Cynara cardunculus
Juncus patens
Juncus textilis
Leymus triticoides
Piptatherum miliaceum
Populus balsamifera ssp. trichocarpa
Rhamnus californica
Rubus ursinus
Salix lasiolepis
Sambucus mexicanus
Scrophularia californica
Toxicodendron diversilobum
Urtica holosericea
Total: 19

The other two riparian sites occur in the Santa Lucia Management Unit at the northwestern end of the largest agricultural field. Black cottonwood (97%) towers over the other vegetation at Site 26, with dense poison-oak (67%) and California blackberry (16%) in the understory (Photo 24). Seep baccharis, California coffeeberry, and arroyo willow are present in low numbers along with weedy poison-hemlock (*Conium maculatum*) at the margins of the stand. Nearby, black cottonwood drops out and arroyo willow becomes dominant (91%) at Site 27 (Photo 27). California blackberry (43%) and poison-oak (25%) are also common at this site, with alkali rye (8%) and Indian rush (0.33%) also present.

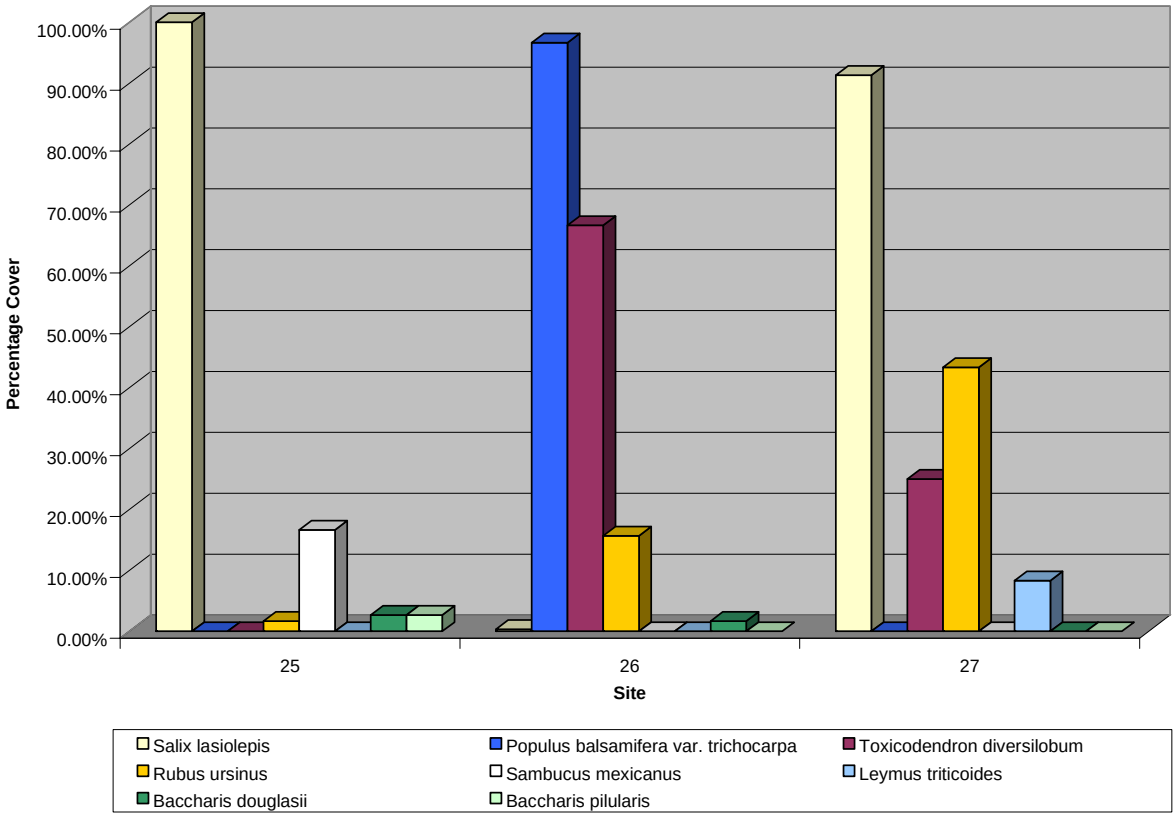


Figure 27. Percent Cover of Dominant Species in Riparian Forest and Scrub in Three Rapid Assessment Sites in 2004.

These communities would be classified Central Coast Arroyo Willow Riparian Forest, Southern Cottonwood Riparian Forest, and Central Coast Riparian Scrub in the CNDDB community classification system (Holland, 1986), and the Arroyo Willow Series and the Black Cottonwood Series in the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf, 1995) would characterize these communities (Table 19).

Table 19
Classifications of Riparian Woodland at the Reserve

Common Name	Holland	California Native Plant Society		
		Informal Grouping	Series*	Association*
Riparian	Central Coast Arroyo Willow Riparian Forest and Scrub	Deciduous Forests and Woodlands	Arroyo Willow Series	Arroyo Willow/Elderberry Riparian Association
				Arroyo Willow/Poison Oak-California Blackberry Association
	Southern Cottonwood Riparian Forest		Black Cottonwood Series	Black Cottonwood/Poison Oak-California Blackberry Association

Sources:
Holland, R. 1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.
Sawyer , J. and Keeler-Wolf, T. 1995 A Manual of California Vegetation. California Native Plant Society.

* Some of the *Series* and *Associations* shown in this table are proposed by Condor, using CNPS naming conventions. This is necessary because the subtleties of plant communities at the Reserve are not entirely reflected in the descriptions of Series and Associations in the CNPS 1995 Manual.

2. Freshwater Marsh

a) Variations in Community Composition

Freshwater wetlands are extremely complex and variable, and their species composition and overall structure are dependent on a number of factors. Water depth, seasonal fluctuations in water levels, rate of water movement, water and sediment chemistry (including salinity, pH, quantity and quality of organic matter), depth and texture of bottom sediments, amount of sunlight, and water and air temperatures are among the most important variables affecting overall wetland dynamics.

Water depth has a profound affect on species composition. In deep open water, especially if there is some flow, only floating aquatic plants may occur, such as duckweed (*Lemna minuscula*) and mosquito fern (*Azolla filiculoides*); Ferren et al. (1996) characterized this deepwater habitat as Aquatic Bed. As water diminishes in depth towards shore, submersed or emergent rooted aquatic species may become established; emergent plants are rooted in substrates below the water with leaves, stems, and flowers above the water.

In shallow water near shore, emergent vegetation may flourish (Emergent Wetland). Colonies of perennial wetland monocots such as cattail (*Typha latifolia*), bulrush or tule (*Scirpus acutus* var. *occidentalis, S. californicus*), small-fruited bulrush (*S. microcarpus*), and rush (*Juncus* species) may form, becoming especially dense in sunny habitats. Shrubs, especially willows (*Salix* species), may be common along with an array of annuals and herbaceous perennials, including Common

Monkeyflower (*Mimulus guttatus*), Willow-herb (*Epilobium ciliatum*), and others. In places where willows and other woody shrubs and trees are dense, cover by emergent aquatics will decline, especially the colonial monocots.

Fluctuations in water level have a major impact on wetland plants and may inhibit establishment of some wetland species. At the large marsh in the Santa Lucia Management Unit, for example, willows that grew on the northern edge of the marsh ten years ago, are now dead, completely flooded year-round

Photo 28: Northern edge of large marsh in the Santa Lucia Management Unit in 2004. Photo taken looking southwest. The line of willows marked the edge of the marsh in the mid-1990s. *Photo by Elihu Gevirtz.*

Water flow rates produce differing conditions that affect species composition as well. Swift-moving water is well aerated and can inhibit the establishment of many plants; only those that are anchored in the ground and are flexible enough to endure torrents of rushing water during flooding conditions survive. Such flows sweep the stream bottom clean of organic matter and fine sediments. In contrast, slowly moving or standing water may be poorly aerated or anaerobic unless there is a continual source of fresh aerated water. Organic matter settles on the bottom and nourishes a range of wetland species that tolerate anaerobic conditions.

Nutrient cycling in freshwater wetlands depends on many factors, including pH, temperature, and interactions of various organisms. Excessive nutrients, especially phosphorus and nitrogen, can promote algal blooms that reduce light availability to submerged aquatics and deplete oxygen. At the same time, some wetland species are extremely effective at filtering and removing excess nutrients and pollutants from the surrounding water and can serve as biological filters (Barbour and Major 1977, Barbour et al. 1993, Holland and Kiel 1995).

Freshwater marsh vegetation may be found along pond and lake margins, as well as in smaller bodies of water, as long as there is standing water all year. In addition, freshwater marsh vegetation may become established along level stretches of rivers and creeks where water flow is sluggish. Marsh vegetation does not tend to be limited by altitude; rather it flourishes in nutrient-rich soils that are saturated year-round. Because marsh soils are often anaerobic, marsh species have adaptations such as hollow stems or special porous tissue that conducts air to the root zone.

Photo 29: Freshwater marsh at the Reserve in 2004. *Photo by Elihu Gevirtz.*

The center of the large freshwater marsh on the Santa Lucia Management Unit supports persistent, ponded water in a small, shallow basin covering approximately 11.5 acres. It is presumably fed by one or more underground sources of water since the local watershed is small. The size of the marsh has apparently fluctuated considerably in recent years and has been increasing lately. For example, the pond is almost non-existent in aerial photography in the 1970s, and is labeled as 'intermittent' in 1972 (USDA Soil Conservation Service 1972).

Photo 30: Emergent Wetland at the Reserve in Santa Lucia Management Unit in 2004. *Photo by Mary Carroll.*

The deeper water of the marsh supports duckweed (*Lemna* species), duckweed fern (*Azolla filiculoides*), and fennel-leaved pondweed, while the margins of the marsh are colonized by California bulrush (*Scirpus californicus*) and broad-leaved cattail (*Typha latifolia*). Bog rush (*Juncus effusus* var. *brunneus*), Indian rush (*Juncus textilis*), small-fruited bulrush (*S. microcarpus*), western goldenrod (*Euthamia*

occidentalis), Santa Barbara sedge (*Carex barbarae*), common rush (*J. patens*), giant nettle (*Urtica dioica* ssp.. *holosericea*) ring the margins of the marsh, along with willows and many other associates. Most of the marsh's open water areas of the marsh were shallow enough to wade through by investigators in 2004. The marsh abruptly gives way to sandy slopes with dense coast live oak forest on its western, eastern, and southern margins. The marsh and oak forest "form an exceptional biotic system with superlative ecosystem values" (Odion et al. 1993) and constitutes one of the most significant wildlife resources in the Reserve.

A system of small springs is located on the other side of the large cultivated field. In addition to the riparian vegetation found at Sites 26 and 27, a small stream channel originating from one of the springs sustains measurable surface flow year-round. In addition to willows and cottonwoods, this stream channel supports a number of perennial emergent monocots, including broad-leaved cattail, California bulrush, bog rush, Mexican rush, and small-fruited bulrush. Giant nettle and common monkeyflower (*Mimulus guttatus*) are also common, along with many other hydrophytic plants.

3. Emergent wetland vegetation surveys at the Reserve

Data from 2004 vegetation sampling in sites dominated by emergent wetland plants are shown in Appendix 6 (Table 20). Both sites (28 and 29) are located at the springs adjacent to Sites 26 and 27. Site 32 is dominated by common monkeyflower (55%) along the stream channel, with additional cover by common willow-herb (*Epilobium ciliatum*), bog rush, coyote bush, the non-native hyssop loosestrife (*Lythrum hyssopifolium*), small-fruited bulrush, and others. Nearby, a quiet pool at Site 33 is dominated by small-fruited bulrush (92%), with occasional individuals of bog rush, common willow-herb, broad-leaved cattail, common monkeyflower, and others.

Species Observed in Emergent Wetland Rapid Assessment Plots
Anagallis arvensis
Baccharis pilularis
Epilobium ciliatum?
Juncus balticus
Juncus bufonius
Juncus effusus
Lythrum hyssopifolium
Mimulus guttatus
Polypogon monspeliensis
Rumex conglomeratus
Scirpus microcarpus
Typha latifolia
Urtica dioica ssp.. *holosericea*
Total: 13

This community may be classified as Freshwater Seep or Coastal and Valley Freshwater Marsh in the CNDDB community classification system (Holland 1986). The Emergent Aquatics informal grouping in the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf 1995) includes this association (Table 20).

Table 20
Classifications of Emergent Wetland at the Reserve

Common Name	Holland	California Native Plant Society		
		Informal Grouping	Series*	Association*
Emergent Wetland	Emergent Wetland	Emergent Aquatics	Common Monkey Flower-Common Willow Herb Series	Common Monkey Flower-Common Willow Herb Series
			Bulrush Series	Small-fruited Bulrush Association

Sources:
Holland, R. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.
Sawyer , J. and Keeler-Wolf, T. 1995. A Manual of California Vegetation. California Native Plant Society.

Some of the *Series* and *Associations* shown in this table are proposed by Condor, using CNPS naming conventions. This is necessary because the subtleties of plant communities at the Reserve are not entirely reflected in the descriptions of Series and Associations in the CNPS 1995 Manual.

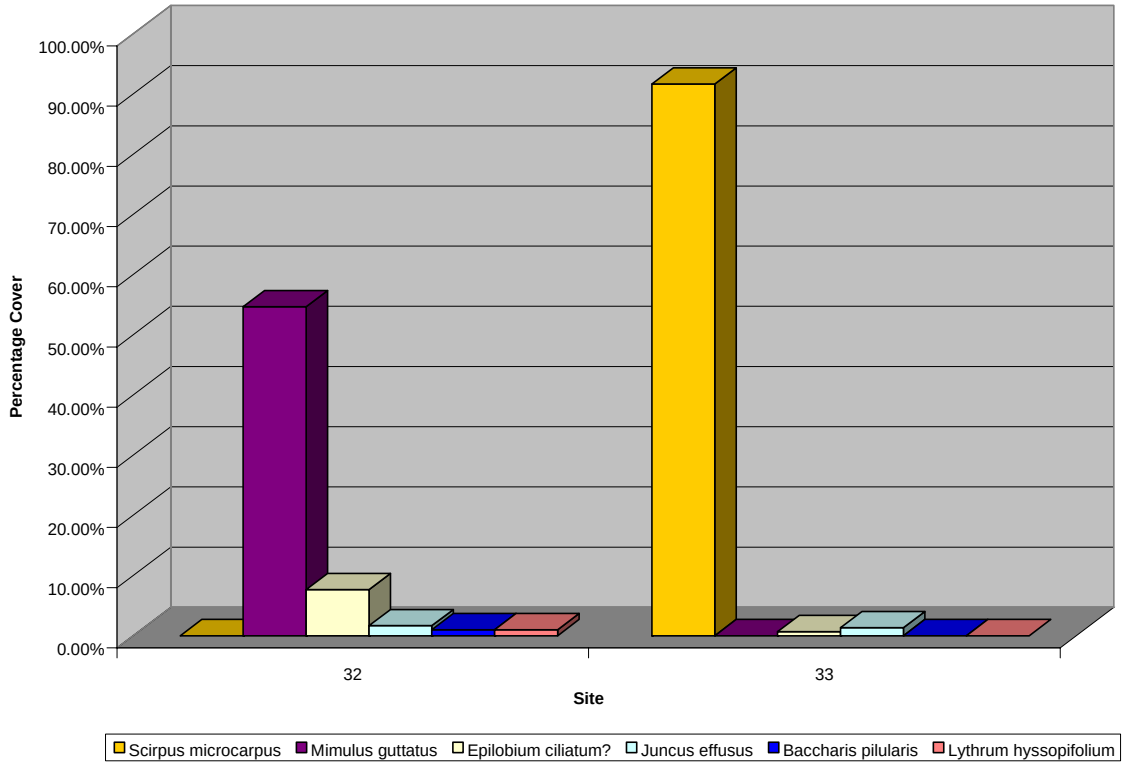


Figure 28. Percent Cover of Dominant Species in Emergent Wetland in Two Rapid Assessment Sites in 2004.

4. Vernal Pool surveys at the Reserve

Vernal pools are seasonal wetlands that occupy depressions underlain by hardpan or other impermeable layers, usually in grassland and woodland areas. Fall and winter precipitation fills the pools with water, which stimulates herbaceous aquatic or emergent plants to germinate and/or emerge from dormancy and begin to grow. As water begins to evaporate, flowering is stimulated, and seed set is usually made in caked, hard mud. Many vernal pool species are annuals, although perennial herbs are also common. Shrubs and trees are typically absent. Species composition varies markedly from pool to pool and region to region, and each pool acts effectively as an island. Like the grasslands they often occur in, vernal pools are disappearing at a rapid rate, often due to agricultural activities and urbanization.

Photo 31: Large vernal pond at the Reserve onin Vandenberg Unit. March 2005. *Photo by Mary Carroll.*

There are two vernal wetland areas at the Reserve, both on the west side of the Reserve. The northern vernal wetland area is located southwest of Cabrillo High School in the Santa Lucia Management Unit. It occurs on a gently sloping drainage (nearly flat) that was farmed in previous years (Figure 55), with many weeds in the area. Nonetheless, Brown-headed rush (*Juncus phaeocephalus*) predominates in places, as can be seen at Site 28 (97%). Associates of the rush are evidence of previous disturbance, however; ripgut brome (*Bromus diandrus*), soft chess (*B. hordeaceus*), curly dock (*Rumex crispus*), sheep sorrel (*R. acetosella*), broad-leaved filaree (*Erodium botrys*), Mediterranean rye-grass (*Lolium multiflorum*), and many other weeds are found in the area. A few natives such as chaffweed (*Centunculus minimus*), slender woollyheads (*Psilocarphus tenellus*) and California blackberry persist in small isolated patches (in 2004), and chanchalagua (*Centaurium venustum*), flowering quillwort (*Lilaea scilloides*), popcorn flower (*Plagiobothrys undulatus)*, and hairy speedwell (*Veronica peregrena* ssp. *xalapensis*) have been reported in moister years (Olson 1993). Although dry during Condor's surveys in the spring of 2004, the winter rains of 2005 filled the vernal wetland near the high school (in the Santa Lucia Management Unit) with a series of ponds estimated to be 500 feet long by 150 feet wide (Larry Spanne *pers. comm.* 2005, Dieter Wilken *pers. comm.* 2005). This wetland has been present in this location for at least ten years (L. Spanne and E. Gevirtz *pers. observations*).

To the south of Highway 1, in the Vandenberg Management Unit, several vernal pools occur and support a number of unusual species. The rare Hoover's bentgrass (*Agrostis hooveri*) occurs on the southern side of the large vernal pond in hard ground with brown-headed rush, tall flatsedge (*Cyperus eragrostis*), saltgrass (*Distichlis spicata*), and others. Winter rains in most years fill this large pond (Gevirtz, *pers. observations*), and it was filled by the winter rains of 2005 (Photos 26 and 27). The pond itself was dry in 2004, but supports a variety of vernal wetland plants including seep baccharis (*Baccharis douglasii*), Indian rush, brown-headed rush, alkali mallow (*Malvella leprosa*), common spikerush

(*Eleocharis macrostachya*), slender woollyheads, popcorn flower, water pygmyweed (*Crassula aquatica*), Pacific foxtail (*Alopecurus saccatus*), short-seeded waterwort (*Elatine brachysperma*), and others. Other vernal pool species reported from these pools include Lemmon's canarygrass

(*Phalaris lemmonii*), water starwort (*Callitriche marginata*), and from the center of the pool, Howell's quillwort (*Isoetes howellii*) and flowering quillwort (*Lilaea scilloides*) (Olson 1993). This pool is the only known location in Santa Barbara County for Howell's quillwort. Similarly, the only known location of flowering quillwort in the region is Vandenberg Air Force Base and the Burton Mesa. Gumplant (*Grindelia camporum*), brass buttons (*Cotula coronopifolia*), rabbits-foot grass (*Polypogon monspeliensis*), western marsh cudweed (*Gnaphalium palustre*), and many other species also occur in these pools. Among the noxious weeds in this area are veldt grass (*Ehrharta calycina*), iceplant (*Carpobrothus edulis*), Italian thistle (*Carduus pycnocephalus*), Australasian fireweed (*Erechtites glomerata*) and several others.

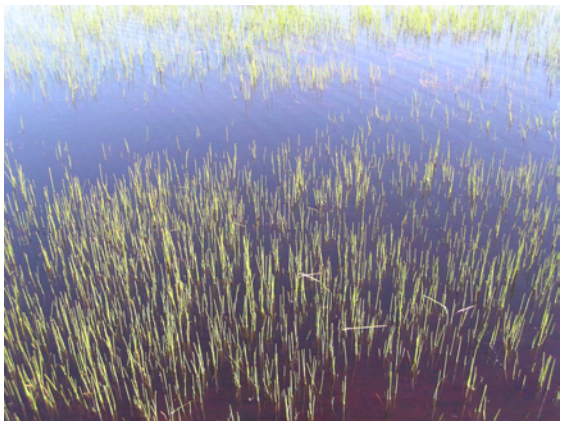


Photo 32: Emergent vegetation in large vernal pond at the Reserve in Vandenberg Unit. March 2005. *Photo by Mary Carroll.*

There are two vernal wetland areas at the Reserve, both on the west side of the Reserve. The northern vernal wetland area is located southwest of Cabrillo High School in the Santa Lucia Management Unit. It occurs on a gently sloping drainage (nearly flat) that was farmed in previous years (Figure 55), with many weeds in the area. Nonetheless, Brown-headed rush (*Juncus phaeocephalus*) predominates in places, as can be seen at Site 28 (97%). Associates of the rush are evidence of previous disturbance, however; ripgut brome (*Bromus diandrus*), soft chess (*B. hordeaceus*), curly dock (*Rumex crispus*), sheep sorrel (*R. acetosella*), broad-leaved filaree (*Erodium botrys*), Mediterranean rye-grass (*Lolium multiflorum*), and many other weeds are found in the area. A few natives such as chaffweed (*Centunculus minimus*), slender woollyheads (*Psilocarphus tenellus*) and California blackberry persist in small isolated patches (in 2004), and chanchalagua (*Centaurium venustum*), flowering quillwort (*Lilaea scilloides*), popcorn flower (*Plagiobothrys undulatus)*, and hairy speedwell (*Veronica peregrina* ssp. *xalapensis*) have been reported in moister years (Olson 1993). Although dry during Condor's surveys in the spring of 2004, the winter rains of 2005 filled the vernal wetland near the high school (in the Santa Lucia Management Unit) with a series of ponds estimated to be 500 feet long by 150 feet wide (Larry Spanne *pers. comm.* 2005, Dieter Wilken *pers. comm.* 2005). This wetland has been present in this location for at least ten years (L. Spanne and E. Gevirtz *pers. observations*).

To the south of Highway 1, in the Vandenberg Management Unit, several vernal pools occur and support a number of unusual species. The rare Hoover's bentgrass (*Agrostis hooveri*) occurs on the southern side of the large vernal pond in hard ground with brown-headed rush, tall flatsedge (*Cyperus eragrostis*), saltgrass (*Distichlis spicata*), and others. Winter rains in most years fill this large pond (Gevirtz, *pers. observations*), and it was filled by the winter rains of 2005 (Photos 26 and 27). The pond itself was dry in 2004, but

supports a variety of vernal wetland plants including seep baccharis (*Baccharis douglasii*), Indian rush, brown-headed rush, alkali mallow (*Malvella leprosa*), common spikerush (*Eleocharis macrostachya*), slender woollyheads, popcorn flower, water pygmyweed (*Crassula aquatica*), Pacific foxtail (*Alopecurus saccatus*), short-seeded waterwort (*Elatine brachysperma*), and others. Other vernal pool species reported from these pools include Lemmon's canarygrass (*Phalaris lemmonii*), water starwort (*Callitriche marginata*), and from the center of the pool, Howell's quillwort (*Isoetes howellii*) and flowering quillwort (Olson 1993). This pool is the only known location in Santa Barbara County for Howell's quillwort. Similarly, the only known location of flowering quillwort in the region is Vandenberg Air Force Base and the Burton Mesa. Gumplant (*Grindelia camporum*), brass buttons (*Cotula coronopifolia*), rabbits-foot grass (*Polypogon monspeliensis*), western marsh cudweed (*Gnaphalium palustre*), and many other species also occur in these pools. Among the noxious weeds in this area, veldt grass (*Ehrharta calycina*), iceplant (*Carpobrotus edulis*), Italian thistle (*Carduus pycnocephalus*), Australasian fireweed (*Erechtites glomerata*), and several others should be removed as soon as feasible.

a) Vernal wetlands vegetation surveys at the Reserve

Data from 2004 vegetation sampling in sites dominated by vernal wetland plants are shown in Appendix 83a. It should be noted that rainfall was significantly below normal in 2004. One site (Site 28) is located in the north vernal wetland in the Santa Lucia Management Unit, while Sites 29, 30, and 31 consist of outer and inner "rings" of the large vernal pond in the Vandenberg Management Unit. All sites are dominated by one species of rhizomatous rush, in most cases brown-headed rush (Figure 28a). Site 28 is covered almost exclusively by brown-headed rush (97%), with a few scattered vernal pool species such as chaffweed (*Centunculus minimus*) and slender woollyheads (*Psilocarphus tenellus*), and many non-natives in association with the rush.

The large vernal pond south of Highway 1 on the Vandenberg Management Unit has a large patch of seep baccharis (29%) at one end (Site 29), along with brown headed rush (33%), alkali rye (8%), and a mixture of native annuals such as coast tarweed (Madia sativa) and weedy annuals and perennials, including sheep sorrel, broad-leaved filaree, soft chess, rattail fescue (Vulpia myuros), hyssop loosestrife, and others. Chaffweed is present nearby. Uniform stands of vegetation within the inner area of the pond were sampled in two different locations. In places such as Site 30, Mexican rush predominates (58%), along with scattered alkali mallow (15%) and common spikerush (13%). Site 31, on the other hand, supports brown-headed rush (93%), with some alkali mallow, western marsh cudweed, rabbits-foot grass, brass buttons and others.

This community is not classified in detail beyond the general classification Vernal Pool in the CNDDB community classification system (Holland 1986) or in the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf 1995) (Table 20a The Department describes vernal pools occurring on the Burton Mesa within the Santa Barbara Vernal Pool Region of California (Keeler-Wolf, et al. 1998).

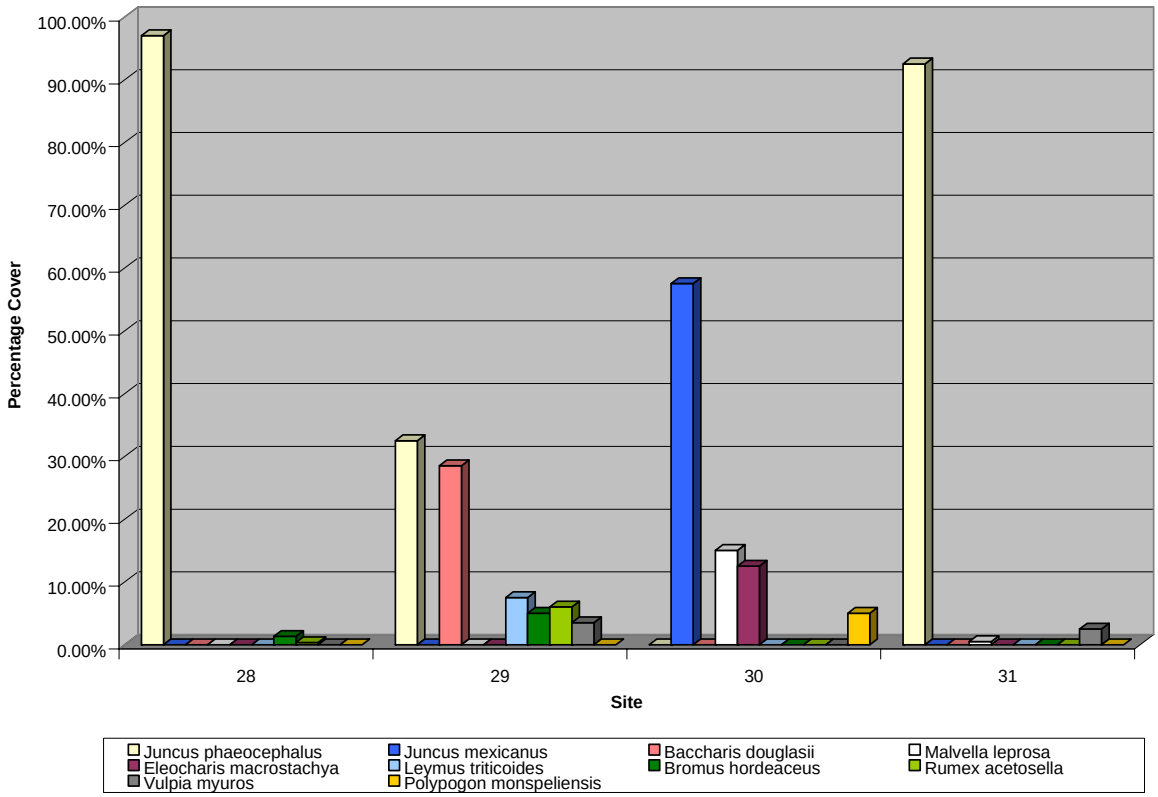


Figure 28a. Percent Cover of Dominant Species in Four Vernal Wetland Rapid Assessment Sites in 2004.

Table 20a

Clasification of Vernal Pool at the Reserve

Common Name	Holland	California Native Plant Society		
		Informal Grouping	Series	Association
Vernal Pool	Vernal Pool	Vernal Pool	Brown Headed Rush Series	Brown-headed Rush Series
				Brown-headed Rush/Sticky Baccharis/Alkalai Mallow/Mexican Rush Association
		Notes:		Brown-headed Rush Vernal Pool= Wetland 2, Site 31 AND Wetland 1, Site 28
				Sticky Baccharis/Brown-headed Rush Vernal Pool= Wetland 2, Site 29 (outer ring)
				Alkali Mallow/Mexican Rush-Common Spikerush Vernal Pool= Wetland 2, Site 30 (inner ring)
		Overview:		
		Wetland 1:		Northern- Santa Lucia Mang. Unit
				Site 28: Brown-headed rush vernal pool
		Wetland 2:		Southern- Vandenberg Mang. Unit
				Site 29: (outer ring) sticky Bacc./ Brown-headed rush
				Site 30: (inner ring) Alkali Mallow/ Mexican Rush, etc.
				Site 31: Brown-headed rush vernal pool

Sources:
Holland, R. 1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.
Sawyer , J. and Keeler-Wolf, T. 1995 A Manual of California Vegetation. California Native Plant Society.

E. Non-Native Communities

1. Eucalyptus Woodland (Non-Native)

Eucalyptus were brought to California from Australia in the 1850s for use in the railroads, as windbreaks, and as firewood. The most widely planted Eucalyptus, blue gum (*Eucalyptus globulus*), has spread throughout much of California along the coast and in wetland environments. Due to its allelopathic properties, chemicals toxic to seedlings are introduced to the understory, inhibiting growth of many other plants. A grove can spread three to six meters in diameter a year, displacing native species as it colonizes areas (Keil and Holland, 1998). The California Invasive Plant Council (Cal-IPC) lists blue gum eucalyptus on its List A-1, for the most invasive wildland pest plants (Cal-IPC 1999).

On the Reserve, Eucalyptus groves occur primarily at the southwestern corner of the Vandenberg Management Unit, the northern Santa Lucia Management Unit, and the

southern edge of the Purisima Hills Unit (Figure 21). Additional Eucalyptus groves occur along the northern access road, outside of the Reserve.

Eucalyptus woodland was not surveyed in the development of this management plan. Plantings of Eucalyptus are best described by the Eucalyptus Series within the CNPS Manual of California Vegetation (Sawyer and Keeler-Wolf 1995). There is no corresponding CNDDB classification.

2. Open ("Ruderal") Areas

This category includes areas of the Reserve that have very little or no native vegetation, including roadside waste areas, recently devegetated areas or disturbed sites. Trail edges are dominated by ruderal species such as bur-clover (*Medicago polymorpha*), cudweed everlasting (*Gnaphalium luteo-album*), bristly ox-tongue (*Picris echioides*), common knotweed (*Polygonum arenastrum*), and others. Open areas were not surveyed in the development of this management plan.

F. Wildlife Surveys

The primary objective of Condor's wildlife surveys conducted on the Reserve was to locate and georeference additional locations for Rare, Threatened, Endangered and locally important sensitive wildlife species known or expected to occur on the Reserve. The occurrence of all wildlife species observed in 2004 and their GPS coordinates were also recorded (Figure 31). This information was used to help develop a list of the wildlife species observed or expected to occur on the Reserve (Appendix 2). Additional wildlife surveys on the edges of the Reserve were conducted by the Department of Fish and Game in order to assess the impacts associated with the proposed fuel break project. The Department's findings are included in Figure 31, described in the EIR, and will be added to the GIS at a later date.

1. Wildlife Survey Methodology

a) Database Review

Information pertaining to the distribution of wildlife at the Reserve was obtained from a variety of sources. Previous studies of the Reserve provided the most detailed site-specific information about the wildlife resources of the Reserve property (Odion et al. 1993, SBCO 1998). Several VAFB studies contained additional information regarding the distribution and habitat characteristics of wildlife found in habitats on the Burton Mesa at VAFB (Coulombe and Cooper 1976, Coulombe and Mahrdt 1976). For bats, sensitive birds and sensitive amphibians, several recent base-wide studies of sensitive wildlife resources at VAFB were reviewed (Christopher 1996, 2002, 2004, Collins 2004, Holmgren and Collins 1999, Pierson et al. 2002).

A database of sensitive wildlife observations on or in the immediate vicinity of the Reserve was compiled using a variety of sources. First, the California Natural Diversity Database (CNDDB) was queried for records from the Lompoc 7.5-minute quad (California Department of Fish and Game 2004) (Appendix 6). Second, museum specimen records and sightings contained in the collections and in

sensitive wildlife databases maintained at the Santa Barbara Museum of Natural History (SBMNH) and the Museum of Systematics and Ecology at the University of California, Santa Barbara (UCSB) were reviewed. Third, local wildlife biologists who have conducted wildlife surveys on or in the vicinity of the Reserve were contacted about their sensitive wildlife observations. Records from avian, amphibian, and bat surveys conducted on Vandenberg Air Force conducted in previous years by Paul Collins and Mark Holmgren were consulted. Finally, recent reports completed for proposed development projects in the vicinity of Vandenberg Village and the Reserve provided additional information on the distribution and habitat affinities of sensitive wildlife (Collins 2002, Condor Environmental 2003, Condor Environmental 2004a & b, Dames and Moore and Garcia and Associates 1999, Department of Fish and Game 2004, Garcia and Associates 1999a & b, 2000; Gevirtz 2004; Gevirtz et al. 2004, HDR 1984, Philbrick and Collins 1997, Tom Olson Biological Consulting 1999, 2001a & b, 2002).

b) Reptile, Amphibian and Mammal Surveys

Focused surveys for sensitive reptiles, amphibians and mammals were conducted by Paul Collins, and Elihu Gevirtz on several occasions, on the Reserve between March 13 and May 31, 2004 (Table 21) by walking through selected habitat areas. The types of surveys are described below and the areal extent of these surveys is shown in Figure 29. During these surveys all animals (including non-sensitive species) or wildlife signs observed were recorded on standardized data sheets. A variety of evidence was used to document a species occurrence including direct observations of individual animals and signs of animals such as burrows, scat, tracks, nest structures, and partial or complete carcasses.

All habitats ("plant communities") found on the Reserve were surveyed as described below during the focused sensitive wildlife surveys. Approximate areas covered during these surveys are depicted in Figure 29. These surveys placed special emphasis on locating rare, threatened, endangered and locally important animals on the Reserve. Rare, Threatened, and Endangered Species that were targeted for this focused survey effort are listed in Table 22. Surveys at the Reserve in 2004 did not include cover boards, scent stations, or small mammal traps. However, scent stations and small mammal traps were used at the adjacent La Purisima State Park, and the data are reported in the Ecosystem Characterization for that property (Gevirtz et al. 2004).

Dip nets were used to sample ephemeral wetlands for California tiger salamander (*Ambystoma californiense*) and western spadefoot (*Spea hammondii*) larvae. Wetlands were also carefully examined during daytime surveys for California red-legged frog (*Rana draytonii*), southwestern pond turtle, (*Actinemys marmorata pallida*), and two-striped gartersnake (*Thamnophis hammondii*). The USFWS protocol for surveying this species requires repeated night surveys to determine presence or absence of this species. Night surveys for California red-legged frog were not conducted by Condor because previous surveys in recent years and museum records had documented their occurrence at the Reserve, and the time could be used instead to survey larger areas for multiple species. The Department conducted repeated nighttime surveys

in 2004 in the unnamed drainage at the southeastern end of the Santa Lucia Management Unit, adjacent to Vandenberg Village.

Sensitive reptiles were recorded by direct observation and for silvery legless lizard (*Anniella pulchra*) by selectively raking soil and accumulated leaf litter found under shrubs and trees. Besides direct observations, scat was also used to identify presence of California horned lizards (*Phrynosoma coronatum frontale*). American badgers (*Taxidea taxus*) were identified by sign such as burrows, tracks and scat while San Diego desert woodrats (*Neotoma lepida intermedia*) were identified by their nest structures. Waypoints were taken at each location where sensitive animals or their sign were observed during the 2004 field surveys. These were georeferenced in the field using a Garmin GPSMAP 76 GPS unit.

Focused surveys for bats were not conducted on the Reserve. Rather, data on the distribution and habitat affinities of bats at Vandenberg Air Force Base gathered during an intensive study of bats at VAFB (Pierson et al. 2002) was used to identify the bat fauna expected to occur within specific habitats at the Reserve.

c) Bird Surveys

Field surveys for birds were conducted by Mark Holmgren, assisted by Elihu Gevirtz on several occasions, on 17 visits from November 7, 2003 to July 25, 2004 (Table 21 and Figure 29). Additional observations of birds were made by Paul Collins in the course of surveys for sensitive amphibians, reptiles, and mammals. Birds were detected by sight, song and call notes, prey remains, nests, whitewash, and occasionally by tracks. Methods of recording bird data included area-specific walking surveys and time standardized point counts. Survey areas were identified based on known habitat or locale affinities of the target species. In very few instances particular habitats or portion of the property were selected for surveys; this was done to achieve fairly even distribution of survey coverage so that our study could characterize wildlife constituents on all habitats on the Reserve. Surveys were conducted mostly in the early morning (pre-sunrise to about 10:30 a.m.), but midday surveys in the bird breeding season were also employed. Some night surveys for owls were also conducted. Binoculars were used on all surveys. Digital recordings of bird songs and calls extracted from commercial tapes and from the internet were used in the field to stimulate behavior from birds. Imitated owl calls and other sounds were used on all surveys except the point counts.

Data recorded included basic weather conditions. The locations of observations and surveys were taken with a Garmin GPS 3+ unit. Standard forms were prepared and filled out in the field (Appendix 7a).

Walking surveys were intended to compile a list of species present by habitat type, significant behaviors, breeding, and site fidelity information (i.e. was the bird on territory or was it a migrant). In these, the surveyor's attention was drawn to any potential or actual activity that could amplify the understanding of the relationship between target species and their habitats. There were 56 surveys of this type completed.

Point counts were intended to quantify the relative abundance of birds within a 50 meter radius of a single spot typically within a uniform habitat type (Ralph no date). These data offer an opportunity to examine changes in animal distribution and habitat use in response to changes (such as from fire) in habitat condition at different stages of the community's succession. Habitat condition was recorded on the field data sheets, and seral stage of the communities surveyed is represented in Figure 17. Twenty point counts were conducted in riparian, chaparral, and coastal sage scrub habitats.

Approximately 5% of the field time for bird surveys was spent adjacent to the Reserve (Figure 29) in areas that either contained habitat critical to understanding activities on the Reserve or to some extent 'bridged' two disjunct portions of the Reserve.

A total of 105 bird species were detected, four of which were previously unreported for the property: Yellow-throated Vireo (*Vireo flavifrons*), Hooded Warbler (*Wilsonia citrina*), Common Raven (*Corvus corax*), and Black-chinned Sparrow (*Spizella atroqularis*).

Table 21

Wildlife Surveys 2003-2004

Habitat	Dates	Observers
Vernal Wetland	03/13/04	P. Collins
	04/08/04	P. Collins, E. Gevirtz
Riparian	03/13/04	P. Collins
	03/27/04	M. Holmgren
	04/08/04	P. Collins
	04/16/04	P. Collins
	04/30/04	M. Holmgren, E. Gevirtz, L. Gallardo
	05/05/04	M. Holmgren
	05/22/04	M. Holmgren
	05/28/04	M. Holmgren
	05/29/04	P. Collins, E. Gevirtz
	05/31/04	P. Collins
	06/20/04	M. Holmgren
	06/27/04	M. Holmgren
	07/25/04	M. Holmgren
Marsh	11/07/03	M. Holmgren, E. Gevirtz
	02/16/04	M. Holmgren
	03/27/04	M. Holmgren
	04/16/04	P. Collins
	04/30/04	M. Holmgren, L. Gallardo, E. Gevirtz
	05/24/04	E. Gevirtz
	05/29/04	P. Collins, E. Gevirtz
	05/31/04	P. Collins, E. Gevirtz
	06/06/04	M. Holmgren, E. Gevirtz
	07/04/04	M. Holmgren, E. Gevirtz

Habitat	Dates	Observers
Coastal Scrub	05/24/04	E. Gevirtz
	05/29/04	P. Collins, E. Gevirtz
	05/31/04	P. Collins
	06/01/04	M. Holmgren
	06/06/04	M. Holmgren, E. Gevirtz
	06/20/04	M. Holmgren
	06/27/04	M. Holmgren
Oak Woodland	11/07/03	M. Holmgren
	02/16/04	M. Holmgren
	03/13/04	P. Collins
	03/27/04	M. Holmgren
	04/08/04	P. Collins
	04/16/04	P. Collins
	05/15/04	P. Collins
	05/16/04	P. Collins
	05/29/04	P. Collins, E. Gevirtz
	06/01/04	M. Holmgren
	06/10/04	M. Holmgren
	06/11/04	M. Holmgren
	06/13/04	M. Holmgren
	06/27/04	M. Holmgren
Grassland	03/13/04	P. Collins
	04/16/04	P. Collins
	05/15/04	P. Collins
	05/16/04	P. Collins
	05/29/04	P. Collins, E. Gevirtz

Maritime Chaparral	03/13/04	P. Collins		06/06/04	M. Holmgren, E. Gevirtz
	03/27/04	M. Holmgren		06/13/04	M. Holmgren, E. Gevirtz
	04/08/04	P. Collins		06/20/04	M. Holmgren
	04/30/04	M. Holmgren			
	05/15/04	P. Collins	**Bishop Pine Forest**	11/07/03	M. Holmgren
	05/16/04	P. Collins		05/16/04	P. Collins
	05/29/04	P. Collins, E. Gevirtz		05/24/04	E. Gevirtz
	05/31/04	P. Collins, E. Gevirtz		07/04/04	M. Holmgren, E. Gevirtz
	06/01/04	M. Holmgren			
	06/06/04	M. Holmgren, E. Gevirtz	**Agricultural field**	11/07/03	M. Holmgren
	06/13/04	M. Holmgren, E. Gevirtz		02/16/04	M. Holmgren
	06/20/04	M. Holmgren		03/16/04	P. Collins
				04/30/04	M. Holmgren
Coastal Scrub	11/07/03	M. Holmgren		05/29/04	P. Collins
	03/13/04	P. Collins		05/31/04	P. Collins
	03/27/04	M. Holmgren		06/06/04	M. Holmgren, E. Gevirtz
	04/16/04	P. Collins		06/20/04	M. Holmgren
	05/15/04	P. Collins			
	05/16/04	P. Collins	**Non-native woodland**	03/27/04	M. Holmgren
	05/21/04	M. Holmgren		05/31/04	P. Collins
	05/22/04	M. Holmgren		06/01/04	M. Holmgren

Table 22
Targeted Habitats to Survey for Targeted Rare, Threatened, and Endangered Species[4]

Common Name	Habitat								
	Vernal Wetland	Marsh	Riparian	Chaparral	Coastal Scrub	Oak Woodland	Bishop Pine Forest	Grassland	Agricultural Fields
AMPHIBIANS									
California Red-legged Frog	X	X	X						
California Tiger Salamander	X								
Western Spadefoot	X								
REPTILES									
California Horned Lizard				X	X				
Silvery Legless Lizard				X	X	X			
Southwestern Pond Turtle		X	X						
Two-striped Gartersnake	X	X	X						
MAMMALS									
American Badger				X	X		?	X	
Agile Kangaroo Rat				X	X			X	
San Diego Desert Woodrat				X	X		X		
BIRDS									
Blue Grosbeak			X		X			X	
Burrowing Owl				X	X			X	
Cooper's Hawk			X			X			
Horned Lark								X	X
Least Bittern		X							
Loggerhead Shrike					X			X	
Long-eared Owl			X			X			
Northern Harrier		X							
Rufuous-crowned Sparrow				X	X				
Sage Sparrow				X	X				
Tri-colored Blackbird		X							X

[4] This table was constructed prior to beginning the surveys in order to create the greatest likelihood of observing these species. It isFuture surveys for these targeted species are recommended that future surveyors for these targeted species to use this table in a similar fashion.

Warbling Vireo			X						
White-tailed Kite			X			X		X	
Yellow Warbler			X						
Sensitive Bird Species To Pursue if Detected in General Surveys									
Ferruginous Hawk	several								
Mountain Plover									X
Sharp-shinned Hawk	several								
Swainson's Thrush			X					X	X
White-tailed Kite (nesting)			X			X		X	
Yellow -breasted Chat			X						

Shaded Cell = Targeted surveys to occur in winter (not conducted in 2004).

INSERT FIGURE 29: SURVEY LOCATIONS: Animals

2. Wildlife Species and Habitats

GIS Feature Class(es):
Wildlife

all_wildlife_field_data
wildlife_survey_areas

A total of 235 species of animals are known or expected to occur on the Reserve. Of these, 153 species were observed during the 2004 surveys (Appendix 2). This includes 109 birds, 25 mammals, 13 reptiles, and 5 amphibians. Of note, are 27 species that were observed for the first time on or near the Reserve. Appendix 2 identifies which animals are expected and which animals were actually observed by Condor in 2004. Of all the communities in the Reserve, the oak woodland and riparian habitats support the highest numbers of animal species (Table 23).

Table 23
Animal Diversity
Burton Mesa Ecological Reserve

Habitat	Number of Animal Species Observed in 2004
Maritime Chaparral	97
Coastal Scrub	96
Oak Woodland	140
Grassland	88
Non-Native Woodland	104
Vernal Wetland	55
Marsh	79
Riparian	130
Total Number of Species Observed in 2004	***153***

See Appendix 2 for complete species list and details.

a) Coastal Scrub

Although amphibians tend to be scarce in Coastal Scrub due to its arid aspect, the mammal and reptile faunas are relatively diverse, including ten species of mammals and nine species of reptiles. Some of the more common species observed in this habitat in the Reserve include western fence lizard (*Sceloporus occidentalis*), side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), southern pacific rattlesnake (*Crotalus oreganos helleri*), striped racer (*Masticophis lateralis*), western skink (*Eumeces skiltonianus*), California ground squirrel (*Spermophilus beecheyi*), desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), California pocket mouse (*Chaetodipus californicus*), deer mouse (*Peromyscus maniculatus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), and mule deer (*Odocoileus hemionus*) (Appendix 2).

b) Coastal Scrub

Photo 33: California horned lizard on Burton Mesa. *Photograph by Elihu Gevirtz.*

Although amphibians tend to be scarce in Coastal Scrub due to its arid aspect, the mammal and reptile faunas are relatively diverse, including ten species of mammals and nine species of reptiles. Some of the more common species expected to frequent this habitat in the Reserve include western fence lizard (*Sceloporus occidentalis*), side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), southern pacific rattlesnake (*Crotalus oreganos helleri*), striped racer (*Masticophis lateralis*), western skink (*Eumeces skiltonianus*), California ground squirrel (*Spermophilus beecheyi*), desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), California pocket mouse (*Chaetodipus californicus*), deer mouse (*Peromyscus maniculatus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), and mule deer (*Odocoileus hemionus*) (Appendix 2).

Long-nosed snake (*Rhinocheilus lecontei*) is an uncommon snake that reaches its westerly distribution limit in Santa Barbara County on the Reserve (Gevirtz 2004). Sensitive wildlife observed or expected to frequent this habitat on the Reserve include silvery legless lizard, California horned lizard, coast patch-nosed snake (rare), and American badger.

As many as 45 species of birds could occur in this habitat, at least on a seasonal basis. The most common species of birds observed in Coastal Scrub are California quail, bushtit, wrentit, spotted towhee, California towhee, and lesser goldfinch. Sensitive bird species in Coastal Scrub include Bell's sage sparrow and rufous-crowned sparrow. Table 27 indicates which species were observed and which are expected.

c) *Maritime Chaparral*

Due in part to the arid characteristics of this habitat, the amphibian fauna is fairly depauperate. Amphibians that can be found in moderate to old growth stages of this habitat include black-bellied slender salamander (*Batrachoseps nigriventris*), ensatina (*Ensatina eschscholtzii*), and Pacific treefrog (*Hyla regilla*).

Reptiles are somewhat more common in this arid habitat. Fifteen reptile species are known to inhabit chaparral. Common species of reptiles that frequent this habitat on the Reserve include California horned lizard, western fence lizard, side-blotched lizard, western skink (*Eumeces skiltonianus*), western whiptail, ring-necked snake (*Diadophis punctatus*), striped racer, common kingsnake (*Lampropeltis getulus*), gopher snake (*Pituophis melanoleucus*), and western rattlesnake (Appendix 2). Long-nosed snake (*Rhinocheilus lecontei*) and coast patch-nosed snake (*Salvadora hexalepis virgultea*) are two uncommon reptiles that reach their western distributional limits in Santa Barbara County on the Reserve. Both species are expected to occur on the Reserve in Burton Mesa Chaparral.

Photo 34: Old, manzanita-dominated maritime chaparral at the Reserve. *Photo by Katrina Burton.*

At least 18 mammals inhabit Burton Mesa Chaparral. A variety of these are small mammals due in part to the dense protective cover this habitat provides. The most common species include brush rabbit (*Sylvilagus bachmani*), Botta's pocket gopher (*Thomomys bottae*), California pocket mouse, agile kangaroo rat (*Dipodomys agilis*), deer mouse, California mouse (*Peromyscus californicus*), pinyon mouse (*Peromyscus truei*), and big-eared woodrat (*Neotoma macrotis*) (Appendix 2).

A variety of mammalian predators are attracted to chaparral due in part to the wide diversity and abundance of available small mammal and reptile prey. Carnivores expected to use this habitat include coyote, common gray fox (*Urocyon cinereoargenteus*), bobcat, long-tailed weasel (*Mustela frenata*), American badger, northern raccoon (*Procyon lotor*), western spotted skunk (*Spilogale gracilis*), and striped skunk *(Mephitis mephitis)* (Appendix 2). Mule deer use this habitat for cover and browse. Sensitive wildlife found in this habitat on the Reserve

Photo 35: Common kingsnake. *Photo by Katrina Burton*

include silvery legless lizard, California horned lizard, coast patch-nosed snake, and American badger.

A variety of mammalian predators are attracted to chaparral due in part to the wide diversity and abundance of available small mammal and reptile prey. Carnivores expected to use this habitat include coyote, common gray fox (*Urocyon cinereoargenteus*), bobcat, long-tailed weasel (*Mustela frenata*), American badger, northern raccoon (*Procyon lotor*), western spotted skunk (*Spilogale gracilis*), and striped skunk (Appendix 2). Mule deer use this habitat for cover and browse. Sensitive wildlife found in this habitat on the Reserve include silvery legless lizard, California horned lizard, coast patch-nosed snake, and American badger.

Photo 36: Spotted towhee. *Photo by Jim Stasz, USGS.*

As many as 52 species of birds are expected in the chaparral. The most commonly observed birds observed in the chaparral are California quail (*Callipepla californica*), western scrub-jay (*Aphelocoma californica*), bushtit (*Psaltriparus minimus*), blue-gray gnatcatcher (*Polioptila caerulea*), Bewick's wren (*Thryomanes bewickii*), spotted towhee (*Pipilo maculatus*), and Anna's hummingbird (*Calypte anna*). Sensitive species in chaparral of low density include Bell's sage sparrow. (See Sensitive Species Section for further discussion.)

d) Coast Live Oak Woodland and Forest

Oak Woodlands on the Reserve support a relatively diverse vertebrate fauna. Because of the more mesic characteristics of this habitat, at least five amphibians use this habitat including black-bellied slender salamander, arboreal salamander (*Aneides lugubris*), ensatina, western toad (*Bufo boreas*), and Pacific treefrog are expected to frequent oak woodlands on the Reserve. Reptiles that can be found in this habitat on the Reserve include silvery legless lizard, western skink, California alligator lizard (*Elgaria multicarinata*), ring-necked snake, and gopher snake.

Photo 37: Coyote.
Photo by Marcia Semenoff-Irving, USGS.

There are 84 species of birds that are either known or expected in Oak Woodland and Forest at the Reserve. The most frequently observed birds include California quail, Anna's hummingbird, oak titmouse, Bewick's wren, wrentit, and spotted towhee. Other common species include northern flicker (*Colaptes auratus*), Nuttall's

woodpecker (*Picoiodes nuttallii*), and Hutton's vireo. Five raptors are also observed in this habitat: American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk, Cooper's hawk (*Accipiter cooperii*), and White-tailed kite (*Elanus leucurus*). Long-eared Owl (*Asio otus*) could occur in oak woodland adjacent to riparian habitat on the Burton Mesa, but none were observed in 2004.

At least 15 species of mammals use this habitat because of its thick cover and well-developed understory vegetation, including the ornate shrew (*Sorex ornatus*), broad-footed mole (*Scapanus latimanus*), brush rabbit, western gray squirrel (*Sciurus griseus*), Botta's pocket gopher (*Thomomys bottae*), California mouse, brush mouse (*Peromyscus boylii*), big-eared woodrat, coyote, striped skunk, bobcat and mule deer. Bats that forage in oak woodlands include California myotis (*Myotis californicus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and pallid bat (*Antrozous pallidus*). Hollow cavities in larger oaks provide bats with protected daytime roosts. Sensitive wildlife expected to occur in this habitat includes silvery legless lizard, Townsend's big-eared bat, and pallid bat.

e) Bishop Pine Forest

Isolated stands of Bishop Pine forest are situated on well-drained rocky soils in the Purisima Hills. This relatively uniform plant community supports a depauperate vertebrate fauna comprised of species found more commonly in other habitats on the Reserve. A few of the more common species associated with this habitat include black-bellied slender salamander, arboreal salamander, western fence lizard, side-blotched lizard, western whiptail, ring-necked snake, striped racer, western rattlesnake, brush rabbit, black-tailed jackrabbit, western gray squirrel, California pocket mouse, agile kangaroo rat, deer mouse, California mouse, big-eared woodrat, coyote, common gray fox, bobcat, and mule deer. Western gray squirrel is the only species of wildlife that occurs more commonly in Bishop pine forests than in oak or riparian woodlands elsewhere on the Reserve. Sensitive wildlife occurring in Bishop pine forests include the silvery legless lizard, and coast patch-nosed snake.

As the Bishop Pines grow and mature in the years following fire, the forest becomes dense, and difficult to penetrate. Common birds in the Bishop Pine Forest include acorn woodpecker, Nuttall's woodpecker, western scrub jay, American crow, cliff swallow, northern rough-winged swallow, oak titmouse, bushtit, Bewick's wren, ruby-crowned kinglet, California towhee, spotted towhee, Brewer's blackbird, lesser goldfinch, and house finch.

f) Grassland (native and non-native)

Grasslands, with their assortment of reptiles and small mammals, provide important foraging areas for a variety of raptors and carnivores. The more common wildlife in this habitat include 5 reptiles: western fence lizard, western skink, gopher snake, common kingsnake, western rattlesnake, and 12 species of mammals: desert cottontail, black-tailed jackrabbit, California ground squirrel, Agile kangaroo rat, Botta's pocket gopher, western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), coyote, striped skunk, long-tailed weasel,

American badger, and mule deer. Sensitive species known or expected to frequent this habitat at the Reserve include California horned lizard, pallid bat, and American badger.

Birds in the grasslands include California quail, mourning dove, California towhee, lesser goldfinch, Anna's hummingbird, lark sparrow (*Chondestes grammacus*), grasshopper sparrow (*Ammodramus savannarum*), western meadowlark (*Sturnella neglecta*), greater roadrunner (*Geococcyx californianus*), and turkey vulture (*Cathartes aura*). Birds of prey that forage in grasslands include red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), white-tailed kite (*Elanus leucurus*), loggerhead shrike (*Lanius ludovicianus*), northern harrier (*Circus cyaneus*), and others.

g) Riparian Woodland

Riparian habitats along seasonal and perennial streams on the Reserve are among the more sensitive and important habitats found on the Reserve because of the high diversity and abundance of wildlife that use this habitat. Riparian and stream habitats are critical to wildlife because they provide: (1) a source of standing freshwater; (2) a broad diversity of microhabitats for nesting, roosting and feeding; (3) an abundance of food and protective cover; and (4) they serve as corridors for movement and dispersal.

The presence of water along with the more mesic conditions found in the understory of these Birds in the grasslands include California quail, mourning dove, California towhee, lesser goldfinch, Anna's hummingbird, lark sparrow (*Chondestes grammacus*), grasshopper sparrow (*Ammodramus savannarum*), western meadowlark (*Sturnella neglecta*), greater roadrunner (*Geococcyx californianus*), and turkey vulture (*Cathartes aura*). Birds of prey that forage over grassland include red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), white-tailed kite (*Elanus leucurus*), loggerhead shrike (*Lanius ludovicianus*), northern harrier (*Circus cyaneus*), and others.

h) Riparian Woodland

Photo 38: Willow Riparian forest at the Reserve Santa Lucia Management Unit. *Photo by Katrina Burton*.

Riparian habitats results in an increase in the diversity of amphibians that use them. At least 23 species of reptiles, amphibians and mammals occur in the riparian habitat on the Reserve (see Appendix 2). The more common amphibians and reptiles that can be found in this habitat on the Reserve include black bellied slender salamander, ensatina, arboreal salamander, Pacific treefrog, western toad, western fence lizard, western skink, southern alligator lizard and perennial streams on the Reserve are one of the more sensitive habitats found on the Reserve because of the high diversity and abundance of wildlife that use this habitat. Riparian habitats are critical to wildlife because they provide: (1) a source of standing freshwater; (2) a broad diversity of microhabitats for nesting, roosting and feeding; (3) an abundance of food and protective cover; and (4) they serve as corridors for movement and dispersal of wildlife. For these reasons, riparian habitats are one of the more important wildlife habitats found on the Reserve.

The presence of water along with the more mesic conditions found in the understory of this habitat results in an increase in the diversity of amphibians that use this habitat. At least 23 species of reptiles, amphibians and mammals occur in the riparian habitat on the Reserve (see Appendix 2). The more common amphibians and reptiles that can be found in this habitat on the Reserve include black bellied slender salamander, ensatina, arboreal salamander, Pacific treefrog, western toad, western fence lizard, western skink, California alligator lizard, ring-necked snake. Common mammals that can be found in riparian woodlands inlcude Virginia opossum (*Didelphis virginiana*), ornate shrew, broad-footed mole, deer mouse, brush mouse, California mouse, big-eared woodrat, coyote, northern raccoon, striped skunk, and mule deer. Sensitive wildlife known or expected to frequent this habitat at the Reserve include California red-legged frog, southwestern pond turtle and two-striped gartersnake. Table 27 identifies which species have been observed and which animals are expected, and the individual species accounts describe where, and in some cases when, these species have been observed.

Birds of prey utilizing the riparian habitats include the red-shouldered hawk, white-tailed kite, Cooper's hawk, and great horned owl (*Bubo virginianus*). Other birds include Anna's hummingbird, Allen's hummingbird, northern flicker, Nuttall's

woodpecker, Downy woodpecker, black phoebe, warbling vireo, Hutton's vireo, cliff swallow, northern rough-winged swallow, oak titmouse, bushtit, ruby-crowned kinglet (*Regulus calendula*), cedar waxwing (*Bombycilla cedrorum*), Phainopepla (*Phainopepla nitens*), yellow–rumped warbler (*Dendroica coronata*), yellow warbler (*Dendroica petechia*), common yellowthroat (*Geothlypis trichas*), orange-crowned warbler (*Vermivora peregrina*), hooded warbler (*Wilsonia citrina*), Wilson's warbler (*Wilsonia pusilla*), black-headed grosbeak (*Pheucticus melanocephalus*), red-winged blackbird (*Agelaius phoeniceus*), brown-headed cowbird (*Molothrus ater*), Lawrence's golfinch (*Carduelis lawrencei*), lesser goldfinch (*Carduelis psaltria*), American goldfinch (*Carduelis tristis*), and house finch (*Carpodacus mexicanus*).

i) Freshwater Marsh and Springs

Freshwater marsh and spring habitats are important to wildlife at the Reserve because they provide wildlife with a source of fresh water during the dry seasons of the year. The large freshwater marsh located adjacent to the east fork of Santa Lucia Creek on the Santa Lucia Management Unit represents one of the more important habitats for wildlife at the Reserve. This wetland supports breeding and larval development for a number of aquatic dependent amphibians and reptiles including Pacific treefrog, western toad, bullfrog (*Rana catesbaiana*), California red-legged frog, southwestern pond turtle, two-striped gartersnake, and coast gartersnake. Sensitive wildlife species that use freshwater marsh as breeding and foraging habitat include California red-legged frog, southwestern pond turtle, and two-striped gartersnake (Hunt 1997). Red-legged frogs and southwestern pond turtles were both observed in the large freshwater marsh on the Reserve in May 2003 (Christopher unpublished data). A southwestern pond turtle was observed at the marsh in 2004 by Condor. The Sensitive Species Section and the Appendices contain information on when and where these species were observed.

Mammals use this habitat as a source of drinking water during the dry season. Mammals that tend to forage along the margins of freshwater marshes include coyote, northern raccoon, striped skunk, and the non-native Virginia opossum. Beaver (*Castor canadensis*) are known to occur in the Santa Ynez River and in San Lucia Creek south of the Reserve. Although beavers are not currently known to occur in wetland habitats on the Reserve, they could reach wetlands on the Reserve by dispersing along Davis or Santa Lucia Creeks.

Birds at the marsh include pied-billed grebe (*Podilymbus podiceps*), great blue heron (*Ardea herodias*), cattle egret (*Bubulcis ibis*), great egret (*Casmerodius albus*), and snowy egret (Egretta *thula*). American Bittern (*Botaurus lentiginosus*), a winter visitor, and Least Bittern (*Ixobrychus exilis*), a summer visitor, are both unlikely. Additional bird species include northern shoveler (*Anas clypeata*), green-winged teal (*Anas cracca*), cinnamon teal (*Anas cyanoptera*), mallard (*Anas platyrhynchos*), Gadwall (*Anas strepera*), ruddy duck (*Oxyura jamaicensis*), and American coot (*Fulica americana*). Sharp-shinned hawk (*Accipiter striatus*), northern harrier, white-tailed kite, and American kestrel all use the marsh. Sora (*Porzana carolina*) and Virginia rail (*Rallus limicola*) could use the marsh, but were not observed. Others include killdeer (*Charadrius vociferous*), great horned owl, belted kingfisher (*Ceryle alcyon*), Hammond's flycatcher (*Empidonax hammondii*), black phoebe (*Sayornis nigricans*),

barn swallow (*Hirundo rustica*), cliff swallow, northern rough-winged swallow, tree swallow, violet-green swallow, marsh wren (*Cistothorus palustris*), yellow warbler, common yellowthroat, song sparrow (*Melospiza melodia*), red-winged blackbird, brown-headed cowbird, and great-tailed grackle (*Quiscalus mexicanus*). Tri-colored blackbird (*Agelaius tricolor)*

Virginia opossum, coyote, northern raccoon, and striped skunk. Beaver (*Castor canadensis*) are known to occur in the Santa Ynez River and in San Lucia Creek south of the Reserve. Although beavers are not currently known to occur in wetland habitats on the Reserve, they could reach wetlands on the Reserve by dispersing along Davis or Santa Lucia Creeks.

Birds at the marsh include pied-billed grebe (*Podilymbus podiceps*), great blue heron (*Ardea herodias*), cattle egret (*Bubulcis ibis*), great egret (*Casmerodius albus*), and snowy egret (Egretta *thula*). American Bittern (*Botaurus lentiginosus*), a winter visitor, and Least Bittern (*Ixobrychus exilis*), a summer visitor, are both unlikely. Additional bird species include northern shoveler (*Anas clypeata*), green-winged teal (*Anas cracca*), cinnamon teal (*Anas cyanoptera*), mallard (*Anas platyrhynchos*), Gadwall (*Anas strepera*), ruddy duck (*Oxyura jamaicensis*), and American coot (*Fulica americana*). Sharp-shinned hawk (*Accipiter striatus*), northern harrier, white-tailed kite, and American kestrel all use the marsh. Sora (*Porzana carolina*) and Virginia rail (*Rallus limicola*) could use the marsh, but were not observed. Others include killdeer (*Charadrius vociferous*), great horned owl, belted kingfisher (*Ceryle alcyon*), Hammond's flycatcher (*Empidonax hammondii*), black phoebe (*Sayornis nigricans*), barn swallow (H*irundo rustica*), cliff swallow, northern rough-winted swallow, tree swallow, violet-green swallow, marsh wren (*Cistothorus palustris*), yellow warbler, common yellowthroat, song sparrow (*Melospiza melodia*), red-winged blackbird, brown-headed cowbird, and great-tailed grackle (*Quiscalus mexicanus*). Tri-colored blackbird (*Agelaius tricolor*) could use the marsh but has not been observed at this location. A variety of bats are known to drink from the surface of open water on freshwater wetlands and a few species forage on emerging aquatic insects such as mayflies, caddisflies, mosquitos and flies. Bats that are expected to forage over open water marsh habitat at the Reserve include Yuma myotis (*Myotis yumanensis*), California myotis (*Myotis californicus*), big brown bat (*Eptesicus fuscus*), and Brazilian free-tailed bat (*Tadarida brasiliensis*).

j) Vernal Pond and other Vernal Wetlands

Vernal wetlands on the Reserve provide important freshwater habitat for a variety of aquatic dependent wildlife. Amphibians and a wide variety of aquatic dependent invertebrates (insects, gastropods, and crustaceans) are known to use vernal wetlands for breeding and larval development.

Photo 39: Large vernal pool at the Reserve in Vandenberg Unit. March 2005.

Photo by Mary Carroll.

Two widely distributed species of amphibians found breeding in vernal wetlands on the reserve included the Pacific treefrog and western toad. Reptiles expected to occasionally forage in vernal wetlands when standing water is present include coast gartersnake (*Thamnophis elegans terrestris*), and two-striped gartersnake. No aquatic dependent species of mammals inhabit vernal wetlands on the Reserve. Vernal wetlands also provide an important source of freshwater for birds and mammals that inhabit surrounding upland habitats.

Sensitive wildlife observed in 2004 breeding in vernal wetlands on the Reserve included the federally-listed threatened vernal pool fairy shrimp (*Brachinecta lynchi*) and the DFG species of special concern western spadefoot (*Spea hammondii*). Both of these sensitive species were observed in several vernal wetlands located south of Highway 1 on the Vandenberg Management Unit (Figure 31). Clam shrimp (*Cyzicus* sp.), an obligate vernal pool breeding invertebrate, were found in several of the larger vernal wetlands located south of Highway 1.

Sensitive wildlife observed in 2004 breeding in vernal wetlands on the Reserve included the federally-listed threatened vernal pool fairy shrimp (*Brachinecta lynchi*) and the CDFG species of special concern western spadefoot (*Spea hammondii*). Both of these sensitive species were observed in several vernal wetlands located south of Highway 1 (Figure 31). Clam shrimp (*Cyzicus* sp.), an obligate vernal pool breeding invertebrate, were found in several of the larger vernal wetlands located south of Highway 1.

Photo 40: Small vernal wetland in Vandenberg Management Unit; February 2005. Fairy shrimp were found in this wetland in early 2004. *Photo by Salomé Dussán-Duque.*

The federally listed threatened California tiger salamander (*Ambystoma californiense*) is another sensitive species of amphibian that is

also known to breed in vernal wetlands in the region. However, based on the results of intensive surveys conducted for this species at Vandenberg Air Force Base (Collins 2004), this species is not expected to occur in vernal wetlands found on the Reserve, nor anywhere in the Lompoc Valley. Two vernal wetlands located on the Lompoc Federal Penitentiary Property due south of the Reserve contain a breeding population of introduced tiger salamanders (*Ambystoma tigrinum*) (Storrer 2000). This non-native amphibian was not observed in any vernal wetlands sampled on the Reserve during this study.

G. Rare, Threatened and Endangered Species: Plants

Photo 41: Seaside Bird's Beak on the Burton Mesa. *Photo by Elihu Gevirtz.*

The Burton Mesa Ecological Reserve has rich and diverse plant communities and associations that are known or likely to provide habitat for 23 Rare, Threatened, or Endangered species of plants (Table 24). These species are listed as rare, threatened, endangered or of special concern, by the Federal government, the State of California or by the California Native Plant Society, and at least 15 of these are endemic. Figure 30 shows their known locations on the Reserve. Among these rare species, is one taxon, *Ancistrocarphus keilii,* (Santa Ynez groundstar), that has only recently been described (Morefield 2004). At present, it does not hold CNDDB or CNPS status, but according to D. Wilken of the Santa Barbara Botanic Garden, this species is probably the rarest flowering plant in Santa Barbara County, and is known from only two occurrences in the world (Wilken, 2005).

Several dominant shrubs at the Reserve are described in detail below. Numerous additional sensitive plants also occur on the Reserve, as listed in Table 23. Table 24. These rare species are part of what makes the Burton Mesa ecologically so significant. Some of these species are probably rarer in total number of occurrences and/or individuals (*Chorizanthe rectispina*, for example) than several of the sensitive dominant species on the Burton Mesa (Wilken 2005). Detailed descriptions of these other taxa are recommended to update this plan. In the interim, Table 24 provides ample information for inventory and management purposes.

Table 24
Rare, Threatened, and Endangered Plants Occurring or Possibly Occurring on the Reserve

Scientific name	Common name	USFWS / DFG / CNPS	Vegetation type in which it normally occurs	Presence at the Reserve
*Ancistrocarphus keilii**	Santa Ynez groundstar	- / - / -* *Endemic*	Maritime chaparral and oak woodland in minute turf-like herb layer beneath shrubs.	Suitable habitat occurs at the Reserve.
Agrostis hooveri	Hoover's bentgrass	- / - / 4	Native grassland in hard sandy soil	Occurs near large vernal pool in Vandenberg Management Unit at the Reserve.
Amsinckia specatablis var. microcarpa	Small-fruited Seaside Fiddleneck	*Endemic*	Openings in coastal scrub and maritime chaparral	Scattered but locally abundant in open areas, especially south facing slopes at the Reserve.
Arctostaphylos purissima	Purisima manzanita	- / - / 1B *Endemic*	Maritime chaparral	Common in maritime chaparral at the Reserve; important dominant.
Arctostaphylos rudis	Shagbark manzanita	SOC / - / 1B *Endemic*	Maritime chaparral; coastal scrub	Scattered in low densities in maritime chaparral in many areas of the Reserve; a dominant of maritime chaparral.
Arctostaphylos tomentosa ssp.. eastwoodiana	Eastwood's manzanita	- / - / 1B	On diatomite on ridge of Purisima Hills	Uncommon, at the Reserve, only occurs on ridge of Purisima Hills
Ceanothus cuneatus var. fascicularis	Lompoc ceanothus	- / - / 4 *Endemic*	Maritime chaparral	Scattered in maritime chaparral at the Reserve, especially in stands that are less than 50 years old; a dominant of maritime chaparral.
Ceanothus impressus var. impressus	Santa Barbara Ceanothus	Locally Important *Endemic*	Maritime chaparral	Common in recently burned maritime chaparral such as northern portion of Vandenberg Management Unit
Ceanothus impressus var. nipomensis	Nipomo Mesa Ceanothus	Locally Important *Endemic*	Maritime chaparral	Historic records from La Purisima Mission State Park at SB Botanical Garden. Not included in Ferren et al 1984. It may occur at the Reserve but it has not been observed.
Chorizanthe rectispina	Straight-awned spineflower	SOC / - / 1B	Maritime chaparral; coastal scrub; cismontane woodland	Found in loose sandy soil in openings of coastal scrub and maritime chaparral at the Reserve.
Cordylanthus rigidus ssp. *littoralis*	Seaside birdsbeak	- / CE / 1B	Coastal scrub; coastal dunes; maritime chaparral; cismontane woodland; closed-cone coniferous forest	Scattered in open sandy areas, including disturbed roadsides at the Reserve.
Delphinium parryi ssp. *blochmaniae*	Dune larkspur	SOC / - / 1B *endemic*	Coastal dunes; coastal scrub; maritime chaparral	Found in low numbers in maritime chaparral, coastal scrub, and openings in oak woodland at the Reserve.

Scientific name	Common name	USFWS / DFG / CNPS	Vegetation type in which it normally occurs	Presence at the Reserve
Erigeron sanctarum	Saint's daisy	- / - / 4	Coastal scrub; chaparral; cismontane woodland	Found in recently burned areas on Burton Mesa. Probably scattered in low numbers throughout maritime chaparral at the Reserve.
Erysimum capitatum ssp.. lompocense	San Luis Obispo wallflower	- / - / 4 *Endemic*	Coastal scrub; maritime chaparral	Scattered in sandy open areas throughout the Reserve.
Erysimum insulare var. suffrutescens	Suffrutescent wallflower	- / - / 4	Coastal scrub; maritime chaparral	Most common in coastal areas, but specimens approaching this variety found at the Reserve in low numbers.
Mimulus aurantiacus ssp. lompocense	Lompoc bush monkey flower	Locally Important *Endemic*	Coastal scrub; maritime chaparral	Common in coastal scrub, chaparral, and woodland habitats on the Reserve.
*Mimulus fremontii**	Fremont's monkey flower	- / - / 4	Coastal scrub, chaparral, woodland	Uncommon at the Reserve in coastal scrub and chaparral, present in recently burned areas.
Monardella undulata	Crisp monardella	SOC / - / 1B	Coastal dunes; coastal scrub	Scattered in open sandy areas at the Reserve.
Pinus muricata	Bishop pine	Locally Important	Diatomite along summits and slopes of Purisima Hills, Solomon Hills, South VAFB, and Burton Mesa	Common on slopes of Purisima Hills on diatomite. Uncommon at lower elevations at the Reserve in Encina and La Purisima Management Units on quartz sands.
Prunus fasciculata var. punctata	Sand Almond	- / - / 4 *Endemic*	Coastal dunes; coastal scrub; maritime chaparral	Only location on the Reserve is in eastern portion of La Purisima Management Unit in low numbers in coastal scrub.
Quercus parvula ssp.. parvula	Santa Cruz Island Oak	- / - / 4	Closed-cone coniferous forest, chaparral, oak woodland	Uncommon in maritime chaparral, coastal scrub, oak woodland at the Reserve. Occurs along Rucker Road in the Reserve, near Cabrillo High School, in Santa Lucia Management Unit, and in Purisima Hills.
Scrophularia atrata	Black-flowered figwort	SOC / - / 1B *Endemic*	Coastal dunes; coastal scrub; chaparral; riparian scrub; closed-cone coniferous forest	Found at the Reserve in coastal scrub and riparian scrub, especially on diatomite.
*Senecio flaccidus var. douglasii**	Bush groundsel	Locally Important *Endemic?*	Coastal scrub, maritime chaparral	Scattered in coastal scrub and chaparral habitats at the Reserve.
Solanum xanti var. hoffmannii	Hoffman's Nightshade	Locally Important	Coastal scrub; maritime chaparral; cismontane woodland	Reported from Burton Mesa, but none of the *Solanum xanti* examined fit this variety perfectly; regional endemic.
Total Number:	***22***			

Status Codes

United States Fish and Wildlife Service (USFWS)

FE Federal Endangered

California Department of Fish and Game (DFG)

CE California Endangered

Scientific name	Common name	USFWS / DFG / CNPS	Vegetation type in which it normally occurs	Presence at the Reserve

FT Federal Threatened

SOC Species of Concern as listed by Sacramento Office (USFWS, 2004)

FSC Federal special concern species

CT California Threatened

CR California Rare

CSC California Species of Concern

California Native Plant Society (CNPS)

1B List 1B: Plants rare, threatened and endangered in California and elsewhere

2 List 2: Plants rare, threatened and endangered in California, not elsewhere

4 list 4: Limited Distribution

* *Ancistrocarphus keilii* has only recently been described by Morefield (2004) and at present, does not hold CNDDB or CNPS status, but according to D. Wilken of the Santa Barbara Botanic Garden, this species is probably the rarest flowering plant in Santa Barbara County, and is known only from two worldwide occurrences: one on Vandenberg Air Force Base, and the other (found in 1929) on sandy soil between Buellton and Lompoc (Wilken, 2005).

**Ceanothus impressus var. nipomensis* is recorded from La Purisima Mission (Wilken, 2005), and appears to be as distinct as other varieties (Fross and Wilken, in press). Ferren et. al (1984) treated all specimens of this species at the Park as *C. impressus* var. *impressus*. Comparative analysis of UCSB Herbarium specimens is recommended by Ferren (*pers. comm*. 2005).

* *Mimulus fremontii*. This species is common in California, but Smith (1998) notes a rare form of this yellow annual found on sandy slopes about Burton Mesa. This has not been published in a scientific journal.

* *Senecio flaccidus* var. *douglasii*. This species is common in California, but Smith (1998) notes that a rare form with 7 to 15 lobed leaves occurs in sandy, chaparral covered hills behind Mission La Purisima, to Burton Mesa and San Antonio Creek, inland to Orcutt and northeast of Buellton. This has not been given formal recognition in the Jepson Manual (Hickman 1993), nor in The Flora of North America (Barkley, in press).

Table 25
Rare, Threatened, and Endangered Plants in the Region Not Known to Occur at the Reserve

Scientific name	Common name	USFWS / DFG / CNPS	Vegetation type in which it normally occurs	Presence at the Reserve
Cirsium loncholepis	La Graciosa thistle	FE/ CT / 1B	Coastal dunes; brackish marshes; riparian scrub	Historic sites for this endemic to coastal wetland habitats includes the Santa Ynez River and San Antonio Terrace as well as near Los Alamos and Orcutt; not found at the Reserve.
Deinandra increscens ssp. villosa	Gaviota tarplant	FE / CE / 1B	Coastal scrub; coastal bluff scrub; coastal dunes; valley and foothill grasslands	Specimens of *Deinandra increscens* from the Reserve keyed to ssp.. *increscens*. *D.i.* ssp.. *villosa* found nearby at VAFB.
Layia carnosqa	Beach layia	FE / CE / 1B	Coastal dunes; coastal scrub	Found in coastal dune habitats on VAFB; unlikely at the Reserve
Rorippa gambelii	Gambel's water cress	FE / CT / 1B	Marshes and swamps	Not found at the Reserve; found nearby at VAFB and Barka Slough.
Eriodictyon capitatum	Lompoc yerba santa	FE / CR / 1B *endemic*	Maritime chaparral; closed-cone coniferous forest	Not found at the Reserve; known from VAFB, hills behind Orcutt, and Hollister Ranch.
Chorizanthe pungens var. *pungens*	Monterey spineflower	FE / - / 1B	Coastal dunes; coastal scrub; maritime chaparral; cismontane woodland; valley and foothill grassland	Highly unlikely, nearest known population in San Luis Obispo County.
Cirsium rhothophilum	Surf thistle	SOC / CT / 1B	Coastal dunes; coastal bluff scrub	Highly unlikely; found on ocean bluffs and ocean-facing dunes near coast from Point Conception to Pismo Beach.
Dithyrea maritima	Beach spectacle pod	SOC / CT / 1B	Coastal dunes; coastal scrub (sea shores and sandy places near the shore)	Unlikely; found on active dunes and foredunes, such as dunes near Surf and sand near Mussel Rock and Point Sal.
Horkelia. cuneata ssp. *sericea*	Kellogg's horkelia	SOC[1] / - / 1B	Coastal scrub; maritime chaparral; closed-cone coniferous forest	Not found at the Reserve; found near Jalama, Jualachichi Summit, VAFB, and Casmalia Hills. May intergrade with ssp.. cuneata on Burton Mesa (Keil and Holland 1998).
Monardella frutescens	San Luis Obispo monardella	SOC / - / 1B	Coastal dunes; coastal scrub	Not found at the Reserve; usually found closer to coast in dunes.
Aphanisma blitoides	Aphanisma	- / - / 1B	Coastal dunes & coastal bluff scrub	Unlikely; found on sea bluffs and coastal sand dunes such as at Lion's Head south of Point Sal and other nearby locations.
Atriplex coulteri	Coulter's saltbush	- / - / 1B	Coastal scrub; coastal bluff scrub; coastal dunes; valley and foothill grasslands	Not found at the Reserve; known from UCSB, Goleta, Jalama, and other locales to south.
Atriplex serenana var. *davidsonii*	Davidson's saltscale	- / - / 1B	Coastal bluff scrub	Not found at the Reserve; known from Santa Barbara.

Scientific name	Common name	USFWS / DFG / CNPS	Vegetation type in which it normally occurs	Presence at the Reserve
				Goleta, Solomon Hills, and Guadalupe; may intergrade with *A. serenana* var. *serenana*..
Deinandra increscens ssp. *foliosa*	Leafy tar plant	- / - / 1B	Valley and foothill grassland	Not found at the Reserve; found near Guadalupe.
Erigeron blochmaniae	Blochman's leafy daisy	- / - / 1B	Coastal dunes	Not found at the Reserve; occurs on sand dunes, including stabilized interior dunes, and sandstone hills from Surf to the Los Osos area in San Luis Obispo County.
Horkelia cuneata ssp. *puberula*	Mesa horkelia	- / - / 1B	Coastal scrub; chaparral; cismontane woodland	Not found at the Reserve; may intergrade with *Horkelia cuneata* ssp.. *cuneata* and ssp.. *sericea*.
Dudleya blochmaniae ssp. b*lochmaniae*	Blochman's dudleya	- / - / 1B	Coastal scrub; coastal bluff scrub; valley and foothill grasslands	Not found at the Reserve; occurs in clay soils in few locations in San Luis Obispo County, and in Casmalia Hills, VAFB, and Point Sal region.
Lasthenia glabrata ssp. *coulteri*	Coulter's goldfields	- / - / 1B	Coastal saltmarshes; vernal pools; valley and foothill grasslands	Highly unlikely at the Reserve; occurs in salt marsh habitats.
Senecio aphanactis	Rayless ragwort	- / - / 2	Coastal scrub; cismontane woodland	Not found at the Reserve; known from Refugio Pass and Jalama, and eastern Santa Ynez Mountains.
Total Number:	***24***			

Status Codes

United States Fish and Wildlife Service (USFWS)

FE Federal Endangered

FT Federal Threatened

SOC Species of Concern as listed by Sacramento Office (USFWS, 2004)

FSC Federal special concern species

California Department of Fish and Game (DFG)

CE California Endangered

CT California Threatened

CR California Rare

CSC California Species of Concern

California Native Plant Society (CNPS)

1B List 1B: Plants rare, threatened and endangered in California and elsewhere

2 List 2: Plants rare, threatened and endangered in California, not elsewhere

4 list 4: Limited Distribution

Insert Figure 30: Rare, Threatened, and Endangered Species Observations: Plants

1. Species Descriptions: Selected Sensitive Dominant Plants

Purisima manzanita (*Arctostaphylos purissima)* is an arborescent shrub up to 4 meters in height. Prostrate, low growing forms are present in hard pan soils, especially close to the ocean. Purisima manzanita bears bristly stems and distinctive overlapping evergreen leaves that have short petioles and clasp the stems. The bright green shiny leaves and the smooth, burgundy red, seasonal peeling bark makes this species easy to recognize from a distance. Flowers appear during the winter months on glabrous inflorescences covered with dense leaf-like bracts; inflorescences form late the previous growing season. Berries also lack hairs and contain separate seeds, a feature that facilitates recognition in the Santa Ynez Mountains from Refugio manzanita (*A. refugioensis*).

Purisima manzanita was first described by Wells in 1968 as a distinctive species. It may be found on shale and diatomaceous earth substrates. Davis et al. (1988) note its tolerance of shallow soils and hard pans and correlate its distribution with such soils.

Photo 42: Purisima manzanita on the adjacent State Park. *Photograph by Mary Carroll.*

At the Reserve Purisima manzanita is common in chaparral habitats that occur on soils of varying depth, and forms especially dense stands at the tops of sandy hillocks in areas that have not burned in more than 55 years. This characteristic species of Burton Mesa chaparral reseeds primarily after fire, with seedlings rarely observed during fire-free intervals. Due to slow seedling growth, dominance by Purisima manzanita gradually increases with stand age for the first 25 years after a fire, then rises more rapidly as the shrubs reach mature size and shade out other shrubs (Odion et al. 1992). At the Reserve, dead Lompoc ceanothus and chamise can be seen under the canopies of large Purisima manzanitas. Seed bank studies show an

almost complete lack of manzanita seed in areas of cleared chaparral that support grassland or coastal scrub vegetation (Odion et al. 1992).

Photo 43: Purisima manzanita. *Photo by Elihu Gevirtz.*

Although Purisima manzanita often occurs with coast live oak at the tops of sandy hillocks, it is also a dominant commonly found with shagbark manzanita (*A. rudis*), Lompoc ceanothus (*Ceanothus cuneatus* var. *fascicularis*), and other shrubs within maritime chaparral. Like many endemic manzanitas and ceanothus species, Purisima manzanita is abundant in the center of its very restricted range on the Burton Mesa, and rare to absent outside this range. It is common throughout Burton Mesa, including the Reserve, La Purisima Mission State Historic Park, Vandenberg Air Force Base, and in neighboring communities such as Vandenberg Village in areas that have not been cleared. Although it extends north into the Purisima and Solomon Hills to Point Sal, it does not cross the Santa Maria River, even on the deep sands of Nipomo Mesa. It may be found on silicaceous and diatomaceous shales, such as those in the Purisima Hills Management Unit of the Reserve, where it was observed in 2004 associated with Bishop pine, and to a lesser extent, Eastwood's manzanita (*A. tomentosa* ssp. *eastwoodiana*). Its distribution also encompasses the westernmost Santa Ynez range to the south, along with its foothills south of Lompoc. It occurs south to the Hollister Ranch and Gaviota Pass (Smith 1998), where its range overlaps with Refugio manzanita. It also extends eastward to Buellton in suitable habitats.

Purisima manzanita is on the CNPS List 1B for species that are rare or endangered in California or elsewhere. It has an R-E-D Code of 2-3-3, and is threatened primarily by development. Development threatens the species through direct removal of plants as well as by fragmentation of natural populations, which alters ecosystem function and fire regimes. Clearing natural populations for fire control is an additional threat.

Shagbark manzanita (*Arctostaphylos rudis*)

Shagbark manzanita, also called sand mesa manzanita, is an evergreen shrub that reaches 2 meters in height and produces a basal burl, from which arise numerous stems. The grayish bark has a reddish tinge under the surface, but does not peel. Leaves are elliptic in shape with a petiole 3 to 8 mm in length. Inflorescences bear scale-like bracts and produce the characteristic urn-shaped manzanita blossoms in fall and winter. Fruits are glabrous, like those of Purisima manzanita.

Shagbark manzanita is a variety of characteristics. Unlike Purisima manzanita, shagbark manzanita has a specific search would usually result in turning up a few specimens in low numbers.

At the Reserve, shagbark manzanita is a co-dominant. In very old stands dominated by Purisima manzanita and coast live oak, shagbark manzanita is uncommon.

Like Purisima manzanita, shagbark manzanita is common on the Aeolian sands of Burton Mesa, although it ranges a bit further north into southern San Luis Obispo County on Nipomo Mesa. It may be found throughout the Reserve, La Purisima Mission State Park, Vandenberg Air Force Base, and in neighboring communities such as Vandenberg Village in areas that have not been cleared. It also is found in the Purisima and Casmalia Hills, Point Sal Ridge, and in Bishop pine forest along Arguello Road (Keil and Holland 1998). It occurs south into Lompoc and La Salle Canyons and west to Buellton.

Photo 44: **Shagbark manzanita on the Burton Mesa.** ***Photograph by Mary Carroll.***

Shagbark manzanita is on the CNPS List 1B for species that are rare or endangered in California or elsewhere. It has an R-E-D Code of 2-2-3. Development threatens the species through direct removal of plants as well as by fragmentation of natural populations, which alters ecosystem function and fire regimes. Clearing natural populations for fire control is an additional threat. Infrequent burn cycles favor the larger Purisima manzanita and coast live oak over time, and frequent burning can deplete nutrient stores in burls and reduce their health and vigor (Keil and Holland 1998).

Lompoc Ceanothus (*Ceanothus cuneatus* var. *fascicularis*)

Lompoc ceanothus, also called Coast Ceanothus, is an endemic variety of the more wide-ranging buckbrush ceanothus (*Ceanothus cuneatus* var. *cuneatus*) that rarely exceeds 1.5 meters in height. Prostrate forms have been observed at Point Sal (Smith 1998). As a member of the subgenus *Cerastes* in the genus *Ceanothus*, it produces dark corky protuberances at the base of leaves, has thick evergreen glossy leaves with sunken stomata on the lower surfaces, fruits with distinctive but tiny 'horns,' and can only reproduce by seed, usually following fires. Flowers are white to lavender or pale blue, appearing in winter and the narrow leaves occur in distinctive bundles.

Cover by Lompoc ceanothus peaks in stands from 10 to 25 years of age, reaching almost 50% cover in places, and then is gradually replaced by manzanitas and coast live oaks in

deep soils (Davis et al. 1988, Odion et al. 1992). One sampled stand of Burton Mesa chaparral over 50 years old had 45% cover of Lompoc ceanothus. It occurred in most sampled chaparral sites on Marina sand but was absent from samples on Arnold sand.

The thick coated seeds of Lompoc ceanothus respond readily to fire and germinate, although mechanical scarification can sometimes stimulate germination as well. Seedlings appear in cleared areas if there are mature Lompoc ceanothus individuals nearby. Seed bank studies show a complete absence of Lompoc ceanothus in previously cleared areas (Odion et al. 1992), indicating recruitment is dependent on a nearby seed source.

Photo 45: Lompoc Ceanothus at La Purisima Mission State Park. *Photograph by Katrina Burton.*

Lompoc ceanothus is scattered to abundant in Burton Mesa chaparral on Burton Mesa and north in the Purisima, Solomon, and Casmalia Hills to Pt. Sal, Nipomo Mesa, and Morro Bay, where it occurs with the Morro manzanita (*A. morroensis*) as well as sand almond (*Prunus fasciculata var. punctata*). It occurs south to the hills behind Lompoc and northeast of Buellton.

Lompoc ceanothus is listed on CNPS List 4, which is a watch list for species with a limited distribution. It has an R-E-D Code of 1-2-3. It is threatened by non-native plants and development activities.

Santa Barbara ceanothus (*Ceanothus impressus* var. *impressus*)

Santa Barbara ceanothus ranges from 3 to 8 feet in height at maturity. It has arching, intricately branched stems that extend horizontally; often the plants are wider than they are tall. The tiny leaves are 10 to 20 mm. in length, and are turned under at the margins and have veins that are sunken (impressed), hence the specific epithet of the scientific name. Flowers are an intense blue. As a member of the subgenus *Ceanothus*, it lacks corky protuberances at the leaf bases, instead producing deciduous stipules, lacks sunken stomata, and produces fruits that lack any horn-like protuberances, although small ridges are present. This species is found on Burton Mesa, especially in stands that are less than 10 years old and that have shallow soils (Davis et al. 1988).

Photo 46: Santa Barbara Ceanothus on the Burton Mesa. *Photo by Salomé Dussán-Duque.*

Odion et al. (1992) report the occasional presence of Santa Barbara ceanothus in stands up to 25 years old. On Burton Mesa and at La Purisima Mission State Park, it is occasionally found along roadcuts, where scarification due to ground disturbance may enable seeds to germinate. It is unusual among members of the genus *Ceanothus* to be so short-lived. *C. impressus* var. *impressus* was abundant in 2004 in recently burned areas of the Reserve, including the Vandenberg and Encina Management Units and roadsides (see Figure 21).

Santa Barbara ceanothus occupies the sandy substrates of Burton Mesa in recently burned areas, from VAFB and Lompoc east towards La Purisima Mission State Park and north to Point Sal and Nipomo Mesa (Philbrick 1992a, b). It is also reported from sandstone hills between San Luis Valley and Arroyo Grande in San Luis Obispo County (Hoover 1970). It was originally collected by Sarah Plummer of Goleta.

Nipomo Mesa Ceanothus (*Ceanothus impressus* var. *nipomensis*)

Nipomo Mesa Ceanothus has larger light green leaves than Santa Barbara Ceanothus and is slightly taller in stature. It was first described in 1942 and recognized in Munz' California Flora in 1959. Although not formally treated by Schmidt in the Jepson Manual (Hickman 1993), it was noted under the name *C. impressus*, but not as a synonym. Recent studies (Fross and Wilken, in press) have confirmed that it appears to be as distinct as other varieties in the genus *Ceanothus*, including *C. cuneatus* var. *fascicularis* and *C. impressus* var. *impressus*. Specimens of *Ceanothus impressus* var. *nipomensis* in the Santa Barbara Botanic Garden herbarium document its occurrence at La Purisima Mission State Park (Wilken 2005). This species is not listed separately in Ferren et al. (1984). Ferren reports that *C. impressus* was quite rare at the State Park when the 1984 study was conducted, and it was all one entity: *Ceanothus impressus* var. *impressus*. Analysis of the material collected by Ferren et al in the UCSB herbarium may yield additional information (Ferren *pers. comm*. 2005).

Sand almond (*Prunus fasciculata* var. *punctata*)

Sand almond is an intricately branched shrub that ranges from 2 to 3 feet in height, although it may sometimes be taller. This winter-deciduous shrub has narrow leaves to 0.5 - 0.75 inches in length with punctate glands on the surface, which are visible primarily with a hand lens while holding the leaf up to light.

Photo 47: Sand almond with lichens in 2004.

The tiny white flowers of sand almond appear in spring and are followed by small, round pubescent fruits. Unlike its desert relative, *Prunus fasciculata* var. *fasciculata*, a desert species native to washes and rocky soils of the western desert regions, sand almond is confined to sandy substrates in coastal Santa Barbara and San Luis Obispo Counties.

Sand almond (*Prunus fasciculata* var. *punctata*) occupies a large swath of Marina sand and a smaller area of Corralitos sand at the southern base of the Purisima Hills on the State Park, but it is not found to the immediate west in the Reserve. The only place that it occurs on the Reserve is in the easterly portion of the La Purisima Management Unit. It is found in coastal scrub and chaparral vegetation that is largely undisturbed, and in open areas that appear to have been heavily grazed in the past; its intricately branched thorny habit may deter herbivory.

Elsewhere, sand almond occurs in Graciosa Canyon on the northern flanks of the Purisima Hills south of Orcutt northwest of Los Alamos, on San Antonio Terrace (Smith 1998), and in the Solomon Hills (Gevirtz, SB Botanic Garden specimen) in Santa Barbara County. Keil and Holland (1998) also report sand almond on San Antonio Terrace in mixed chaparral and in disturbed areas surrounded by grasses, as well as in the Casmalia Hills north of Barka Slough. One outlying population of sand almond lies far to the east of these more coastal populations, on the eastern most extent of the Purisima Hills west of Ballard Canyon (Smith 1998, Philbrick 1992a, 1992b). Sand almond also extends north into San Luis Obispo County on Nipomo Mesa and occurs in maritime chaparral south of Morro Bay.

Photo 48: Dead Santa Barbara ceanothus.
Photograph by Mary Carroll

H. Non-Native Species

1. Non-Native Plants

A total of 124 non-native plant species were noted and mapped while conducting the botanical surveys. Surveys targeting non-natives were not conducted. Therefore, not all locations or all species are known. Table 26 lists the most prominent weed species found on the Reserve. The invasive weeds listed here represent one of the greatest threats to the ecological health of the Reserve. African mustard (*Brassica tournefortii*), for example, is spreading quickly in the La Purisima Management Unit, threatening to replace the native species there and possibly spread to other management units. Veldt grass (*Ehrharta calycina*) is spreading rapidly across Vandenberg Air Force Base, the Burton Mesa, and other areas of the central coast and represents a significant problem, as it displaces native coastal scrub. The populations of these and other high priority weeds should be monitored. Those that pose the most serious threats are highlighted in orange in Table 26. Whenever possible, these high priority weeds should be eradicated. Priority should be given to small populations in order to remove them before they expand. A weed eradication plan should be developed for the 17 highest priority species.

Table 26
Prominent Weeds of
Burton Mesa Ecological Reserve

Number	Scientific Name	Common Name	Growth Form	Cal. Invasive Pest Council Rating
1	*Agave americana*	Century Plant	Herbaceous perennial	No Listing
2	*Agrostis semiverticillata*	Water Bent	Perennial grass	No Listing
3	*Amaranthus albus*	Tumbleweed	Annual	No Listing
4	*Anagallis arvensis*	Scarlet Pimpernel	Annual	No Listing
5	*Anthemis cotula*	Mayweed	Annual	No Listing
6	*Arundo donax*	Giant Reed	Perennial grass	High
7	*Asphodelus fistulosus*	Asphodel	Annual/Perennial	Medium
8	*Atriplex semibaccata*	Australian Saltbush	Prostrate Perennial	Alert
9	*Avena barbata*	Slender Wild Oats	Annual grass	Medium
10	*Avena fatua*	Wild Oats	Annual grass	Medium
11	*Avena sativa*	Cultivated Oats	Annual grass	No Listing
12	*Brassica nigra*	Black Mustard	Annual	No Listing
13	*Brassica rapa*	Field Mustard	Annual	No Listing
14	*Brassica tournefortii*	African Mustard	Annual	Medium
15	*Bromus catharticus*	Rescue Grass	Annual grass	No Listing
16	*Bromus diandrus*	Ripgut Brome	Annual grass	Medium
17	*Bromus hordeaceus*	Soft Chess	Annual grass	No Listing
18	*Bromus madritensis ssp. rubens*	Red Brome	Annual grass	No Listing

19	*Carduus pynocephalus*	Italian Thistle	Annual	No Listing
20	*Carduus tenuiflorus*	Slender Thistle	Annual	No Listing
21	*Carpobrotus edulis*	Iceplant, Hottentotfig	Herbaceous perennial	No Listing
22	*Centaurea melitensis*	Tocalote	Annual	Medium
23	*Cerastium glomeratum*	Mouse-eared Chickweed	Annual	No Listing
24	*Chamomilla suaveolens*	Pineapple Weed	Annual	No Listing
25	*Chenopodium multifidum*	Cut-Leaved Goosefoot	Annual	No Listing
26	*Ciclospermum leptophyllum*	Marsh-parsley	Annual	No Listing
27	*Cirsium vulgare*	Bull Thistle	Annual	No Listing
28	*Cistus salviifolius*	Rock-rose	Shrub	No Listing
29	*Cnicus benedictus*	Blessed Thistle	Annual	No Listing
30	*Conium maculatum*	Poison-hemlock	Annual	Medium
31	*Conringia orientalis*	Hare's Ear	Annual	No Listing
32	*Convolvulus arvensis*	Bindweed	Herbaceous perennial	Low
33	*Conyza bonariensis*	Flax-leaved Fleabane	Annual	No Listing
34	*Cortaderia jubata*	Andean Pampas Grass	Perennial grass	No Listing
35	*Cotula australis*	Australian Brass Buttons	Annual	No Listing
36	*Cotula coronopifolia*	Brass Buttons	Herbaceous perennial	No Listing
37	*Cupressus macrocarpa*	Monterey Cypress	Tree	No Listing
38	*Cynara cardunculus*	Cardoon	Herbaceous perennial	Medium
39	*Cynodon dactylon*	Bermuda Grass	Perennial grass	No Listing
40	*Daucus pusillus*	Rattlesnake Weed	Annual	No Listing
41	*Dipsacus sativus*	Fuller's Teasel	Biennial	Medium
42	*Echinochloa crus-galli*	Barnyard Grass	Annual grass	No Listing
43	*Ehrharta calycina*	Veldt Grass	Perennial grass	High
44	*Ehrharta erecta*	Upright Veldt Grass	Perennial grass	Medium
45	*Erechtites glomerata*	Australasian Fireweed	Annual	Medium
46	*Erodium botrys*	Broad-leaved Filaree	Annual	No Listing
47	*Erodium cicutarium*	Redstem Filaree	Annual	No Listing
48	*Erodium moschatum*	Whitestem Filaree	Annual	No Listing
49	*Eucalyptus globulus*	Blue Gum Eucalyptus	Tree	Medium
50	*Euphorbia lathyris*	Caper Spurge	Biennial	No Listing
51	*Euphorbia peplus*	Petty Spurge	Annual	No Listing
52	*Filago gallica*	Narrow-leaved Filago	Annual	No Listing
53	*Foeniculum vulgare*	Sweet Fennel, Sweet Anise	Herbaceous perennial	No Listing
54	*Gastridium ventricosum*	Nit Grass	Annual	No Listing
55	*Gazania longiscapa*	Gazania	Herbaceous perennial	No Listing

56	*Geranium dissectum*	Cutleaf Geranium	Annual	No Listing
57	*Gnaphalium luteo-album*	Cudweed	Annual	No Listing
58	*Hazardia squarrosa*	Saw-toothed Goldenbush	Shrub	No Listing
60	*Hedypnois cretica*	Cretan Weed	Annual	No Listing
61	*Hirschfeldia incana*	Summer Mustard	Annual	Medium
62	*Holcus lanatus*	Velvet Grass	Herbaceous perennial	No Listing
63	*Hordeum marinum ssp. gussoneanum*	Mediterranean Barley	Annual grass	No Listing
64	*Hordeum murinum ssp. leporinum*	Foxtail	Annual grass	No Listing
65	*Hypochaeris glabra*	Smooth Cat's Ears	Annual	No Listing
66	*Koeleria phleoides*	Annual June Grass	Annual	No Listing
67	*Lactuca serriola*	Prickly Lettuce	Annual	No Listing
68	*Lamarckia aurea*	Goldentop	Annual	No Listing
69	*Lobularia maritima*	Sweet Alyssum	Herbaceous perennial	No Listing
70	*Lolium multiflorum*	Mediterranean Rye	Annual grass	High
71	*Lythrum hyssopifolium*	Hyssop Loosestrife	Annual, herbaceous perennial	Medium
72	*Malva nicaeensis*	Bull Mallow	Annual/Biennial	No Listing
73	*Malva parviflora*	Cheeseweed	Annual	No Listing
74	*Marrubium vulgare*	Horehound	Subshrub, herbaceous perennial	No Listing
75	*Medicago polymorpha*	Bur-clover	Annual	No Listing
76	*Melilotus indicus*	Yellow sweet-clover	Annual	No Listing
77	*Nicotiana glauca*	Tree Tobacco	Shrub	No Listing
78	*Opuntia ficus-indica*	Indian Fig	Succulent Shrub	No Listing
79	*Opuntia megacantha*	Indian Fig	Succulent Shrub	No Listing
80	*Oxalis pes-caprae*	Bermuda-Buttercup	Herbaceous perennial	Medium
81	*Parapholis incurva*	Sicklegrass	Annual	No Listing
82	*Phalaris aquatica*	Harding grass	Perennial grass	No Listing
83	*Phalaris minor*	Littleseed Canary-grass	Annual grass	No Listing
84	*Phalaris paradoxa*	Hood Canary-grass	Annual grass	No Listing
85	*Picris echioides*	Bristly OX-tongue	Annual/biennial	No Listing
86	*Pinus radiata*	Monterey Pine	Tree	No Listing
87	*Pinus torreyana*	Torrey Pine	Tree	No Listing
88	*Piptatherum miliaceum*	Smilo	Perennial grass	Low
89	*Plantago coronopus*	Cut-leaved Plantain	Annual	No Listing
90	*Plantago lanceolata*	English Plantain	Herbaceous perennial	No Listing
91	*Plantago major*	Common Plantain	Herbaceous perennial	No Listing
92	*Poa annua*	Annual Bluegrass		No Listing
93	*Poa bulbosa*	Bulbous Bluegrass	Herbaceous perennial	No Listing
94	*Polycarpon tetraphyllum*	Four-Leaved All Seed	Annual	No Listing
95	*Polypogon monspeliensis*	Rabbit's foot grass	Annual	No Listing
96	*Portulaca oleracea*	Purslane	Herbaceous perennial	No Listing

97	*Raphanus raphanistrum*	Jointed Charlock	Annual	No Listing
98	*Raphanus sativus*	Wild Radish	Annual	No Listing
99	*Rumex conglomeratus*	Green Dock	Herbaceous perennial	No Listing
100	*Rumex crispus*	Curly Dock	Herbaceous perennial	Low
101	*Schinus molle*	Peruvian Pepper Tree	Shrub/Tree	No Listing
102	*Schismus barbatus*	Mediterranean Grass	Annual	Low
103	*Senecio vulgaris*	Common Groundsel	Annual	No Listing
104	*Silene gallica*	Windmill Pink	Annual	No Listing
105	*Silybum marianum*	Milk Thistle	Annual	Low
106	*Sisymbrium irio*	London Rocket	Annual	Medium
107	*Sonchus asper*	Prickly Sow-thistle	Annual	No Listing
108	*Sonchus oleraceus*	Common Sow-thistle	Annual	No Listing
109	*Spergula arvensis*	Corn Spurrey	Annual	No Listing
110	*Spergularia bocconii*	Sand Spurrey	Annual	No Listing
111	*Spergularia villosa*	Sand Spurrey	Herbaceous perennial	No Listing
112	*Stellaria media*	Chickweed	Annual	No Listing
113	*Torilis nodosa*	Knotted Hedge Parsley	Annual	No Listing
114	*Trifolium fragiferum*	Strawberry Clover	Herbaceous perennial	No Listing
115	*Trifolium repens*	White Clover	Perennial	No Listing
116	*Triticum aestivum*	Cultivated Wheat	Annual	No Listing
117	*Urtica urens*	Dwarf Nettle	Annual	No Listing
118	*Vicia sativa ssp.. sativa*	Common Vetch	Annual	No Listing
119	*Vicia villosa*	Winter Vetch	Annual	No Listing
120	*Vinca major*	Periwinkle	Herbaceous perennial	No Listing
121	*Vulpia bromoides*	Gray Brome Fescue	Annual	No Listing
122	*Vulpia myuros var. hirsuta*	Foxtail Fescue	Annual	No Listing
123	*Vulpia myuros var. myuros*	Rattail Fescue	Annual grass	No Listing

California Invasive Plan Council (Cal-IPC) Weed Ratings:

High: These species have severe ecological impacts on ecosystems, plant and animal communities, and vegetational structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. These species are usually widely distributed ecologically, both among and within ecosystems.

Medium: These species have substantial and apparent - but generally not severe - ecological impacts on ecosystems, plant and animal communities, and vegetational structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Low: The ecological impacts of these species are minor. Their reproductive biology and other invasiveness attributes result in low to moderate rates of invasion. Ecological amplitude and distribution are generally limited (these species may be locally persistent and problematic).

Alert: This is an additional designation for some species in either the high or medium category whose current ecological amplitude and distribution are limited. The designation alerts managers to species that are capable of

rapidly invading unexploited ecosystems, based on initial, localized observations, and on observed ecological behavior in similar ecosystems elsewhere.

Considered But Not Listed: In general, this designation is for species for which information is currently inadequate to respond with certainty to the minimum number of criteria questions (i.e., too many "U" responses), or for which the sum effects of ecological impacts, invasiveness, and ecological amplitude and distribution fall below the threshold for ranking (i.e. the overall rank falls below Low). Many such species are widespread but are not known to have substantial ecological impacts (though such evidence may appear in the future). All species receiving a "D" score for ecological impact, regardless of what other section scores they receive, are by default placed into this category.

Highlighted in orange – Immediate removal is recommended.

This page left blank intentionally.

2. Sudden Oak Death (Phytophthora ramorum)

The following is excerpted from the Marin County Cooperative Extension website: Since 1995, large numbers of tan oaks (*Lithocarpus densiflorus*), coast live oaks (*Quercus agrifolia*) and black oaks (*Quercus kelloggii*) have been dying in California's coastal counties. The epidemic, referred to as Sudden Oak Death, was first seen on tanoak in Mill Valley (Marin County) in 1995. By 2002, it had been confirmed in twelve central coastal counties: Marin, Santa Cruz, Sonoma, Napa, San Mateo, Monterey, Santa Clara, Mendocino, Solano, Alameda, Contra Costa, and Humboldt, as well as in Curry County, Oregon. To date it has killed tens of thousands of trees in coastal California.

In June 2000, University of California researchers isolated a previously unknown species of *Phytophthora* ("Phy-TOFF-thoruh"), a fungus-like organism, from dying trees. Relatives of this organism caused the Irish potato famine, Port-Orford cedar root disease in the Pacific Northwest, and are causing oak dieback in many parts of the world. In January, 2001 researchers reported "that a new species of *Phytophthora* isolated as early as 1993 from ornamental rhododendrons in Germany and The Netherlands matches the newly-discovered species found in California. This new species has since been officially named: *Phytophthora ramorum*. The name refers to the pathogen's tendency to cause infection on branches.

Important research discoveries have continued since then. Notable among them are the findings that *Phytophthora ramorum* may be spread through infected wood, soil and rainwater. The leaves of foliar hosts such as bays, madrones and rhododendrons contain large amounts of spores which may be dispersed through the air under moist and windy conditions. However, probably the most important way in which humans spread the pathogen around is by moving infected plants and plant parts.

The species of *Phytophthora* isolated from dying oaks does not match any of the 60 previously known *Phytophthora* species in the world. The pathogen's origins are unknown at this time. Initial results suggest that it is an introduced species to California, but more research is needed. In addition to gathering information about the biology of the organism, researchers have been working on determining the host range (number of species affected) for this pathogen. Susceptible hosts, in addition to those listed above, include the following: Shreve oak (*Quercus parvula* var. *shrevei*), California bay laurel (*Umbellularia californica*), manzanita (*Arctostaphylos manzanita*), California coffeberry (*Rhamnus californica*), toyon (*Heteromeles arbutifolia*), poison oak (*Toxicodendron diversilobum*),and many others. Not all of these hosts are being killed by the *Phytophthora*. There are a number of cultivated species that are also susceptible. Recent discoveries of *Phytophthora ramorum* in Southern California nurseries and other parts of the country highlight the importance of these plants in potentially spreading the disease.

In coast live oak (as well as black oak, canyon live oak, and Shreve oak) the earliest symptom is the appearance of a bleeding canker, burgundy-red to tar-black thick sap oozes on the bark surface. Similar bleeding, though sometimes less viscous, may be seen on tanoak. This bleeding is a response to the *Phytophthora* pathogen, and is typically found from the root crown (the area where the trunk fans out to the roots) to a height of 6 feet. Bleeding has occasionally been observed at greater heights. One of the dangers at the Reserve is the fuel break program will use tools and equipment (and staff shoes) that may

have been used in areas of California where sudden oak death already occurs. Visitors to the reserve may pose the same risk. A plan should be developed to prevent sudden oak death from entering the Burton Mesa. A plan should also be in place to respond to the spread of sudden oak death on to the Burton Mesa Ecological Reserve prior to the organism's arrival in the region. More information can be found at http://www.suddenoakdeath.org.

3. Hybridization

There are several ornamental manzanitas and Ceanothus available in commercial nurseries. These ornamental species may hybridize and genetically intergrade with native species. Homeowners should be discouraged from planting non-native manzanitas and Ceanothus. Notably, one or more commercial nurseries in the Lompoc area are able to collect and grow local seed where authorized and produce commercial grade landscaping materials that could be used in local landscaping.

4. Non-Native Animals

Feral Pig (*Sus scrofa*).
Evidence of feral pigs was observed by Collins during the course of surveys for this study on the ridge of the Purisima Hills in the Purisima Hills Management Unit. Active rooting under coast live oaks by feral pigs in the other Management Units was not observed. This is in contrast with parts of Vandenberg Air Force Base (San Antonio Creek, for example) where habitat damage by pigs is significant (Holmgren, *pers. observation*).

Brown-headed Cowbird (*Molothrus ater*).
Brown-headed cowbirds were not recorded in Santa Barbara County until 1911, but by the 1930s they were widespread throughout the coastal low lands of the county and other populated areas of southern California (Lehman 1994). Cowbirds parasitize riparian breeding birds in the region by laying their eggs in other birds' nests; their young are then typically raised at the expense of some or all of the host species' brood. They are present in the region year-round. However, most of the breeding cowbirds in this region probably leave the region in the winter and are replaced by the great basin race: *M.a. artemisiae* (Holmgren, pers. observation). The species has been studied on Vandenberg Air Force Base (Farmer, 1997), where it has been shown that they are present in low density in most years, though their population numbers fluctuate from year to year. Further, cowbirds are most abundant on the Base along the Santa Ynez River, and many feed at the Floradale cattle feed lot (south of the Vandenberg Management Unit), though there are other feeding sites on the Base as well (Farmer 1997.) No efforts to restrict brown-headed cowbirds from accessing the food at the feedlots have been made to date.

Condor found brown-headed cowbirds in Davis Creek, Meriam Creek, and Los Berros Creek during its 2004 surveys, but no parasitism was detected. They were not observed at the large marsh in the Santa Lucia Management Unit. The numbers of cowbirds in these breeding habitats are low and do not appear to be a substantive threat at this time. However, their status on the Reserve should be monitored in the context of on-going bird surveys. Birds on the Reserve that could be parasitized by cowbirds include Song sparrow (*Melospiza melodia*), Common yellowthroat (*Geothlypis trichas*), Yellow warbler (*Dendroica*

petechia) (if this species breeds on the Reserve), Warbling vireo (*Vireo gilvus*), Hutton's vireo (*Vireo huttoni*), and Blue-gray gnatcatcher (*Polioptila caerulea*), in order of likelihood.

Bullfrog (*Rana catesbeiana*).
Bullfrog is a large non-native frog that preys on larvae of California red-legged frog, and other species. It was observed by Condor in 2004 in the large marsh in the Santa Lucia Management Unit, and in the vernal pond in the Vandenberg Management Unit.

Argentine Ant (*Linepithema humile*).
Argentine ants were first observed in California in the early 1900s. They are smaller than most native ants and pose significant problems for California horned lizard as discussed in the following section on Rare, Threatened and Endangered Animals. They may also have a negative effect on the dispersal of seeds of the plants that would otherwise be dispersed by native harvester ants.

Tiger Salamander (*Ambystoma tigrinum).*
The non-native tiger salamander (*Ambystoma tigrinum)* has not been observed on the Reserve. However, they do occur in the ponds on the Federal Prison property, 1.6 miles south of the vernal pond in the Vandenberg Management Unit (Collins, Santa Barbara Museum of Natural History data). Because of their close proximity they represent a threat to native tiger salamanders (*Ambystoma californiense*) in the region.

I. Rare, Threatened and Endangered Species: Animals

There are 39 species of animals on the Burton Mesa Ecological Reserve that are rare, threatened, endangered, or locally important, as shown in Table 27. Of this total, there are two invertebrates, two amphibians, six reptiles, nine mammals, and twenty birds that have either been observed or are expected to occur on the Reserve. All known sensitive wildlife sightings from the Reserve from the 2003-2004 surveys are shown on Figure 31 and listed in Appendix 2. In addition, Appendices 4 and 5 contain databases of Museum records of previous observations in the immediate vicinity of the Reserve.

Two of the sensitive wildlife species known to occur at the Reserve are federally listed as threatened (e. g. vernal pool fairy shrimp, and California red-legged frog) and the remaining ten species of reptiles, amphibians and mammals are Department of Fish and Game "Species of Special Concern" (i. e. western spadefoot, silvery legless lizard, California horned lizard, southwestern pond turtle, coast patch-nosed snake, two-striped gartersnake, Townsend's big-eared bat, pallid bat, and American badger). One bird, the white-tailed kite, is a fully protected species. Fourteen of the bird species are listed as Department of Fish and Game Species of Special Concern; and the remaining five are considered locally important. The following species accounts provide additional information about the legal status, habitat requirements, regional distribution and site specific distribution of each sensitive species on the Reserve.

This page left blank intentionally.

Insert Figure 31: Rare, Threatened, and Endangered Species Observations: Animals

This page left blank intentionally.

Table 27
Rare, Threatened, Endangered, and Locally Important Species: Animals

Species						Habitat									
Common Name	Scientific Name	Status	Seasonal Status (Birds only)	Site Specific Status	Observed in 2004	Vernal Wetland	Marsh	Riparian	Maritime Chaparral	Coastal Sage Scrub	Oak Woodland	Grassland	Bishop Pine Forest	Non-Native Woodland	Ag Fields
INVERTEBRATES															
Vernal Pool Fairy Shrimp	*Branchinecta lynchi*	Federal Threatened	-	O*	PC	X									
Small Lycaenid Butterfly	*Philotiella speciosa purisima*	Locally Important	-	O					X						
AMPHIBIANS															
California Tiger Salamander	*Ambystoma californiense*	Federal Threatened;	-	U		X									
California Red-legged Frog	*Rana draytonii*	Federal Threatened; State Species of Special Concern	-	O		X	X	X							
Western Spadefoot	*Spea hammondii*	Federal Species of Concern; State Species of Special Concern	-	O*	PC	X		X	X		X	X			
REPTILES															
Silvery Legless Lizard	*Anniela pulchra pulchra*	Federal Species of Concern (former Cat. 2 candidate species); State Species of Special Concern	-	O	VS (Near the Reserve)			X	X	X	X		X		
Southwestern Pond Turtle	*Actinemys marmorata pallida*	Federal Species of Concern (former Cat. 2 candidate species); State Species of Special Concern	-	O*	LG		X	X							
California Horned Lizard	*Phrynosoma coronatum frontale*	Federal Species of Concern (former Cat. 2 candidate species); State Species of Special Concern	-	O	MH; PC;EG				X	X					

Species						Habitat									
Common Name	Scientific Name	Status	Seasonal Status (Birds only)	Site Specific Status	Observed in 2004	Vernal Wetland	Marsh	Riparian	Maritime Chaparral	Coastal Sage Scrub	Oak Woodland	Grassland	Bishop Pine Forest	Non-Native Woodland	Ag Fields
Coast Patch-nosed Snake	*Salvadora hexalepis virgultea*	State Species of Special Concern	-	E	PC (Near the Reserve)				X	X		X			
Two-striped Gartersnake	*Thamnophis hammondii*	State Species of Special Concern	-	U		X	X	X							
Western Whiptail	*Cnemidophorus tigris*	Locally Important	-	O	MH; PC				X	X		X			
Long-nosed Snake	*Rhinocheilus lecontei*	Locally Important	-	E	EG (Near the Reserve)				X	X					
MAMMALS															
San Diego Desert Woodrat	*Neotoma lepida intermedia*	Federal Sensitive Species (former Cat. 2 candidate species); State Species of Special Concern (in review)	-	O*	MH; PC				X	X	X	X			
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Federal Species of Concern (former Cat. 2 candidate species); State Species of Special Concern	-	SUN				X			X		X		
Pallid Bat	*Antrozous pallidus*	State Species of Special Concern; USFS Region 5 Sensitive Species	-	SUN				X			X		X		
Ringtail	*Bassariscus astutus*	State Fully Protected Species; State Species of Special Concern	-	U				X			X				
American Badger	*Taxidea taxus*	State Species of Special Concern (in review); Locally Important	-	O*	MH;EG; PC				X	X	X	X	X	X	
Western Gray Squirrel	*Sciurus griseus*	Locally Important	-	O*	MH; PC			X			X		X	X	

Species						Habitat									
Common Name	Scientific Name	Status	Seasonal Status (Birds only)	Site Specific Status	Observed in 2004	Vernal Wetland	Marsh	Riparian	Maritime Chaparral	Coastal Sage Scrub	Oak Woodland	Grassland	Bishop Pine Forest	Non-Native Woodland	Ag Fields
BIRDS															
White-tailed Kite	*Elanus leucurus*	State Fully Protected Species	RB	U	MH;EG		X	X			X	X			
Long-eared Owl	*Asio otus*	State Species of Special Concern	SUN	R			X	X			X			X	
Burrowing Owl	*Athene cunicularia*	State Species of Special Concern	WV	R	MH?				X	X		X			X
Northern Harrier	*Circus cyaneus*	State Species of Special Concern	RB	U	MH	X	X			X		X			X
Yellow Warbler	*Dendroica petechia*	State Species of Special Concern	M/SV	C	MH		X	X						X	
Yellow-breasted Chat	*Icteria virens*	State Species of Special Concern	T	R				X							
Cooper's Hawk	*Accipiter cooperii*	State Species of Special Concern	WV	U	MH; PC			X			X		X	X	
Sharp-shinned Hawk	*Accipiter striatus*	State Species of Special Concern	WV	U			X	X			X		X	X	
Least Bittern	*Ixobrychus exilis*	State Species of Special Concern	SV	R		X	X								
Tri-colored Blackbird	*Agelaius tricolor*	State Species of Special Concern	T	R		X	X								X
Bell's Sage Sparrow	*Amphispiza belli*	State Species of Special Concern	M	U	MH; PC;EG				X	X					
Ferruginous Hawk	*Buteo regalis*	State Species of Special Concern	WV	U					X	X		X			X
Mountain Plover	*Charadrius montanus*	State Species of Special Concern	WV	R								X			X

Species						Habitat									
Common Name	Scientific Name	Status	Seasonal Status (Birds only)	Site Specific Status	Observed in 2004	Vernal Wetland	Marsh	Riparian	Maritime Chaparral	Coastal Sage Scrub	Oak Woodland	Grassland	Bishop Pine Forest	Non-Native Woodland	Ag Fields
Horned Lark	*Eremophila alpestris actia*	State Species of Special Concern	WV	C	MH; PC							X			X
Loggerhead Shrike	*Lanius ludovicianus*	State Species of Special Concern	WV	U	MH; PC;EG				X	X		X		X	X
California Rufous-crowned Sparrow	*Aimophila ruficeps canescens*	State Species of Special Concern; Locally Important	SUN	U	MH; PC				X	X					
Grasshopper Sparrow	*Ammodramus savannarum*	State Species of Special Concern; Locally Important	SV	R	MH; PC							X			
Swainson's Thrush	*Catharus ustulatus*	Locally Important	SV	U	MH			X			X				
Blue Grosbeak	*Passerina caerulea*	Locally Important	SV	R	MH			X		X		X			X
Warbling Vireo	*Vireo gilvus*	Locally Important	SV	C	MH; PC			X			X				
Total Number of Species	***39***	***-***	***-***	***-***	***24***	***8***	***11***	***18***	***15***	***15***	***15***	***14***	***9***	***7***	***8***

Site Specific Status Designations

O	Observed	The species has been recorded in the project area.
O*	Observed first time in 2004	The species has been recorded in the project area.
E	Expected	The species is expected to occur in the project area within the indicated habitats.
U	Unlikely	Though the project area lies within the species' know distributional range, suitable habitat is limited or of marginal quality so, its occurrence is possible but unlikely.
SUN	Status Uncertain	The species may occur in the project area though its regional distribution is poorly understood. Suitable habitat is present.

Seasonal Status Designations

RB	Resident Breeder	The species is a year-round resident and nests in the project site area.
SV	Summer Visitor	The species is migratory, occurring regionally within the indicated habitats during the breeding season but is not present year-round. Nesting activity was observed or is expected in the project site area.
WV	Winter Visitor	The species is migratory, occurring in the project site area during the non-breeding season. No nesting records are known from the vicinity of the project area.
M	Migrant	The species occurs in the project site area only as a spring and/or fall migrant. Its presence should be considered as strictly transitory.
T	Transient	The species may occur with regular or irregular frequency during all seasons as a visitor to the project area.
SUN	Status Uncertain	The species may occur in the project area though its regional distribution and/or seasonal status are poorly understood.
(I)	Introduced	The species is not native to the project region.

Abundance Designations

A	Abundant	The species is regularly encountered in the indicated habitats in moderate to large numbers.
C	Common	The species is often encountered in the indicated habitats but not in large numbers.
U	Uncommon	The species may be encountered in the project area but occurrence can be irregular in small numbers.
R	Rare	The species may occur in the project area but likelihood of encountering it, though possible, is very unlikely. Records suggest irregular and/or seasonally transitory occupation.

Observers

PC	Paul Collins
MH	Mark Holmgren
EG	Elihu Gevirtz
LG	Leticia Gallardo
VS	Vince Semonsen

1. Rare, Threatened, and Endangered Wildlife Species Descriptions

Ambhibians

Western Spadefoot (*Spea hammondii*)

Western spadefoot[5] is listed as a Federal and State Species of Special Concern. It is threatened throughout its range in California by widespread habitat loss due to urban development and agricultural intensification (Jennings and Hayes 1994). While this species of toad is known to co-occur at many localities in Santa Barbara County with the federally listed threatened California tiger salamander, it tends to be more widespread and occurs at many freshwater breeding sites in western Santa Barbara County that lack California tiger salamanders. Typical breeding habitat for this species in the region includes ephemeral wetlands (ponds and pools) that hold water for at least 22 days and agricultural impoundments that are free of introduced predators such as fish and bullfrogs. Spadefoots are not known to breed in streams or rivers in the region (S. Sweet, P. Collins, L. Hunt, J. Storrer, *unpublished data*).

Western spadefoots emerge from subterranean retreats (burrows of their own construction) following relatively warm late fall to late winter/early spring rains. They move to nearby ephemeral ponds to breed and lay eggs. Larval development occurs in these ephemeral wetlands and ranges in length from 21 to 77 days after hatching. Following breeding, adult western spadefoots occupy shallow, temporary burrows in the vicinity of their breeding pools during the daytime. In the late spring when their breeding ponds begin to dry up, juvenile western spadefoots metamorphose into small toads and disperse away from their drying pond. Adult western spadefoots will dig an underground burrow in which they will spend the dry season aestivating. Juvenile western spadefoots will also retreat underground for the dry season using soil cracks, mammal burrows, and burrows that they construct to escape the desiccating affects of the dry season (Svihla 1953, S. Sweet, L. Hunt, P. Collins, *unpublished data*).

In the project region, western spadefoots have been found in several ephemeral wetlands located on the Burton Mesa, in a number of agricultural impoundments in the Purisima Hills east of the Reserve, and in several ponds at the east end of the Santa Rita Valley. They have been found in two ponds on the Federal Penitentiary property south of the Reserve (Collins *unpublished data*, Storrer 2000) and are known from several wetlands situated on Burton Mesa near the Base cantonment on north Vandenberg AFB (Christopher 1996).

During the spring 2004 field surveys western spadefoot tadpoles were found in four ephemeral wetlands located on the Reserve south of Highway 1 and east of Santa Lucia Canyon in the Vandenberg Management Unit (Figures 4 and 31). Aside from the vernal wetlands located south of the Highway 1 in the Vandenberg Management Unit, no other freshwater wetlands (the marshes, the springs, and the riparian areas) on the Reserve appear to be suitable for western spadefoot breeding.

[5] According to Jennings (2004) the correct common name is Western Spadefoot, not Western Spadefoot Toad.

California Red-legged Frog (*Rana draytonii*)

California red-legged frog is federally listed as threatened and is a California Species of Special Concern. Degradation and loss of critical freshwater and riparian habitat for flood control purposes throughout the range of this species, coupled with increased predation and competition from introduced predators like the bullfrog and a variety of nonnative fish (e.g. bass, sunfish, carp, and mosquitofish) are believed to be the primary factors responsible for the decline of this species in central and southern California (Jennings and Hayes 1994).

Red-legged frogs inhabit a variety of freshwater wetland habitats depending upon their life stage and the season. All life history stages can be found in and around breeding sites such as coastal lagoons, marshes, springs, permanent and semi-permanent natural ponds, ponded backwater portions of streams, as well as artificial impoundments (e. g. stock ponds, irrigation ponds and siltation ponds) (USFWS 1997). Tadpoles remain in the above listed aquatic habitats until metamorphosis during the summer months.

Photo 49: California Red-legged frog.

Young red-legged frogs frequent slow moving, shallow riffle zones in creeks and the margins of ponds. During the summer, adult red-legged frogs are typically found close to a pond or a deep pool in a creek which has emergent vegetation, undercut banks, or semi-submerged rootballs which afford shelter from predators (USFWS 1997). The absence of *Typha, Scirpus,* and *Salix* at an aquatic site does not preclude the possibility that a site is inhabited by red-legged frogs. However, the presence of one or all of these plants is an important indicator that a site may provide foraging and/or breeding habitat for this species.

Red-legged frogs breed between late November and late April in pond habitats (Jennings and Hayes 1994) and occasionally in stream habitats (Hunt unpublished data). Eggs are laid in ponds and generally hatch 6-14 days after fertilization. Larvae remain in ponds for 4-5 months and generally metamorphose between July and September.

California red-legged frogs are fairly widespread in the project region. They are found in many freshwater wetlands and along most of the perennial streams on VAFB (Christopher 1996, 2004). They are also known to occur along the Santa Ynez River from the Wastewater Treatment Plant west to at least the 13th Street bridge, along the lower reach of Santa Lucia Canyon, in the northwest corner of North Vandenberg Village, and along the east and west forks of Davis Creek (Christopher 1996, 2002, 2004, Collins 2002, Philbrick and Collins 1997, Vince Semonsen *pers. comm.*, Edward Mullen *pers. comm.*). Juvenile and/or subadult California red-legged frogs can disperse into and through upland habitats in winter. For example, this species has been collected from road kills found on Titan and North Oaks Avenues in North Vandenberg Village during the winter of 1999-2000 (Collins 2002, See also Appendix 4a of this report). These frogs are thought to have come from a wetland along Santa Lucia Creek, just west of the Reserve's Santa Lucia Management Unit (Collins 2002).

Night surveys for this species were not conducted by Condor in 2004. Although no red-legged frogs were observed on the Reserve during the spring 2004 field surveys, this species has been observed in previous years in three wetlands on the Reserve. Red-legged frogs were found in two wetlands along the east fork of Santa Lucia Creek in the spring of 2003 (Collins *unpublished data*, Christopher *unpublished data*). They were observed in an old spring box in a small wetland situated next to the northwest corner of the agricultural field in Santa Lucia Canyon and in the large freshwater marsh in the Santa Lucia Management Unit. They have also been reported in the east and west forks of Davis Creek (Collins 2002, Philbrick and Collins 1997) and are also expected to occur in isolated pockets along the main stem of Davis Creek between Burton Mesa Boulevard and Highway 1. This species was observed by the Department of Fish and Game in 2004 in isolated wetlands off Davis Creek, west of Clubhouse Road, outside of the Reserve (M. Meyer *pers. comm.* 2005). Night surveys conducted in the winter, spring and fall of 2004, and the winter of 2005 at the unnamed drainage just north of Highway 1 on the Santa Lucia Management Unit detected no California red-legged frogs (Hovey *pers. comm*. 2005).

Reptiles

California Horned Lizard (*Phrynosoma coronatum frontale*)

California horned lizard is a California Species of Special Concern and a Federal Sensitive Species (former Category 2 species). Two subspecies of California horned lizards (*Phrynosoma coronatum*) occur within the Central Coast region: *frontale*, a northern race that ranges from Ventura and western Los Angeles counties northward to the Sacramento Valley, and; *blainvillii,* a southern race found along the coastal slopes from approximately the Santa Barbara/Ventura County line southward into northwestern Baja California (Jennings and Hayes 1994, Stebbins 1985). The northern race of California horned lizard (i. e. *frontale*) occurs in the project area and on the Reserve.

Photo 50: California Horned Lizard.

California horned lizards are generally associated with loose, sandy loams and sandy-gravely soils that support scattered shrubs and an open canopy (Stebbins, 1985; Zeiner et al., 1988; Jennings and Hayes 1994). In Santa Barbara County they have been found in riparian scrub, dune scrub, coastal scrub, and open chaparral. Critical characteristics of habitats frequented by this species include open bare soil areas for basking, loose (sandy) soils for burrowing, and presence of native harvester ants for foraging (Stebbins 1985). They forage on the ground on native ant nests. Besides ants, horned lizards are known to eat wasps, grasshoppers, flies, and caterpillars (Stebbins, 1954).

Horned lizards are active above-ground between April and October, with most activity concentrated between April and June. During the remainder of the year they aestivate underground in mammal burrows or beneath cover objects such as boulders and logs, or in rock crevices. Horned lizard activity patterns appear to be closely associated with specific air and soil temperatures (Hunt, unpublished data).

In the project area there are recent records of California horned lizards from the Purisima and Solomon Hills, from Burton Mesa, and from the Lompoc and San Antonio terraces on VAFB (Christopher 1996, UCSB and SBMNH specimen and sighting records). On Vandenberg Air Force Base, horned lizards have been reported from Burton Mesa near 13th Street and in the vicinity of the Pine Canyon Lakes, and from the San Antonio Valley north of San Antonio Creek (Christopher 1996, Collins unpublished data). Horned lizards have also been observed in the Purisima Hills (Collins unpublished data), on the Clubhouse Estates property north of the junction of Clubhouse Road and Burton Mesa Boulevard (Philbrick and Collins 1997), and in several areas along the CCWA pipeline right-of-way north and west of North Vandenberg Village (unpublished CCWA monitoring reports). Horned lizards were observed in a number of locations on the Reserve during the spring 2004 field surveys on the Santa Lucia and La Purisima Management Units (Figure 31 and Appendix 2). On the Reserve, California horned lizards are most common on sandy soils vegetated with open Burton Mesa chaparral, and open coastal scrub.

This species is threatened throughout much of its range in California due to widespread habitat loss (Jennings and Hayes 1994). Historically California horned lizards were probably more widely distributed on sandy soils in the project area. However, widespread urban and industrial development and agricultural intensification in the Lompoc Valley, especially on the Burton Mesa, have destroyed large areas of sandy soil that would have been suitable for this species. Although widely distributed throughout Santa Barbara County, this species is often locally uncommon.

In addition to habitat loss, California horned lizards are also threatened by the indirect effects of Argentine ant (*Linepithema humile*), an exotic species in California. Argentine ants penetrate into natural areas from adjacent urban edges where they are more abundant (Suarez et al. 1998). In areas that are not invaded by Argentine ants, the diet of horned lizards consists primarily of native ants, particularly harvester ants in the genera *Pogonomyrmex* and *Messor* (Suarez et. al 2000). In areas invaded by Argentine ants, these researchers found that most native ants were displaced, and remaining horned lizards incorporated more non-ant arthropods and smaller ants into their diet. Further, Argentine ants were never detected in horned lizard fecal pellets, suggesting that they are not a suitable replacement for the native species they are displacing (Suarez et. al 2000). In several fecal pellets examined by Collins and Gevirtz at the Reserve in spring 2004, small beetles were the predominant prey item. Suarez et al (2000) conclude that reserves need to be managed to prevent the penetration of Argentine ants in order to minimize their direct and indirect effects on natural communities.

Silvery Legless Lizard (*Anniella pulchra pulchra*)

The silvery legless lizard is a California Species of Special Concern and a Federal Sensitive Species (former Category 2 species). A variety of factors have contributed to the decline of this species in California including loss of habitat from urbanization and intensive agriculture, development of coastal dunes, and introduction of non-native plants such as veldt grass (*Ehrharta calycina*), ice plant (*Carpobrotus edulis* and related species), eucalyptus (*Eucalyptus* sp.), and other invasive plants which displace native vegetation and create unsuitable microhabitat conditions for silvery legless lizards (Jennings and Hayes 1994, Hunt unpublished data).

Photo 51: Silvery legless lizard next to the Reserve in 2004. *Photo by Katrina Burton.*

This species ranges from San Francisco Bay and the northern San Joaquin Valley southward along the margins of the Central Valley and inner Coast Ranges to the Transverse and Peninsular Ranges of central and southern California into northwestern Baja California Norte, Mexico (Stebbins 1985, Jennings and Hayes 1994). This is the only limbless lizard found in western North America. It is a highly specialized, sedentary, fossorial lizard which is a habitat generalist but a microhabitat specialist. It occurs in a broad range of habitats including coastal sand dunes, dune scrub, coastal scrub, chaparral, riparian scrub, oak woodland, and pine woodland (Stebbins 1985, Zeiner et al. 1988, L. Hunt *pers. comm.*).

The wide habitat affinities of this lizard belie its narrow microhabitat requirements, which include a loose, sandy substrate in which to burrow, and abundant leaf litter beneath trees and shrubs in which to forage. Because this species uses head and body movements to burrow in the soil, they tend to occur on soils with a high sand content (L. Hunt unpublished data). This lizard may be active near the ground surface beneath cover objects or at the interface between the leaf litter layer and underlying soil throughout the year in some coastal areas. At inland locations this species is typically active near the surface between early November and late May, avoiding the high surface temperatures and low soil moisture regimes of the late spring, summer and early fall months (Hunt, unpublished data).

Silvery Legless Lizards are an abundant resident of the Burton Mesa (Odion et al. 1993). Although not observed during the present field surveys, legless lizards have been recorded previously from a number of locations on or adjacent to the Reserve property (Appendix 4a). They are expected to occur throughout the Reserve where ever suitable sandy soil is associated with open Burton Mesa chaparral, coastal scrub, and oak woodland. They are probably absent from areas of the Reserve that have extensive rocky soils like those found in the Purisima Hills.

Western Whiptail (*Cnemidophorus tigris*)

The western whiptail is widely distributed, but uncommon, over much of its range in California, except in desert regions where it is abundant in suitable habitats. The species is found throughout the state except in the humid northwest, along the humid outer Coast Ranges, and in mountainous regions above 7500 feet (Morey n.d.). The western whiptail occurs in a variety of arid and semi-arid habitats where vegetation is relatively sparse including some oak woodlands, conifer forests, riparian habitats in the valleys and foothills, pine-juniper woodlands, chamise-redshank chaparral, chaparral, desert scrub, desert wash, alkali scrub, and annual grasslands. Two subspecies occur in the region: (the coastal subspecies: *C. tigris multiscutatus* that occurs closer to the coast of Southern California and western Baja California; and the California subspecies *C. tigris mundus*) that occurs from northern California south to the central California coast.

In Santa Barbara County, most reports of this species are from the interior, no further west than the Santa Ynez and San Rafael Mountains (Santa Barbara Museum of Natural History records). Historically they may have occurred along drainages in secondary floodplains, including the Santa Ynez River (P. Collins *pers. comm.*). Most of these secondary floodplains in southern and central California have been channelized, and/or converted to agriculture. Southern California, in particular, has seen many of these habitats developed with urban or suburban uses. In Santa Barbara County, it is typically not found in the fog belt close to the coast. However, chaparral and coastal scrub in the Purisima Hills and on the Burton Mesa provides habitat for this species, although it is less abundant here than in more xeric, interior localities. It is described here as Locally Important because it is usually not found this close to the coast, it has low abundance here, and because, it is near the limits of the geographic distribution of both subspecies.

Photo 52: Western Whiptail. *Photograph by William Flaxington (2003).*

Whiptails forage actively on the ground near the base of vegetation taking a wide variety of ground-dwelling invertebrates including grasshoppers, beetles, ants, termites, insect larvae, and spiders (Stebbins, 1954). Individuals often probe cracks and crevices and dig in loose soil as they forage. Whiptails occasionally appear to stalk larger prey items such as grasshoppers. Individuals have been observed breaking up termite galleries in dead vegetation (Morey n.d.). Vitt and Ohmart (1977) reported that the diet of whiptails may change seasonally to reflect the abundance of seasonally available prey items. Insects, scorpions, and spiders are eaten (Behler and King 1979). Whiptails are always most common in and around dense vegetation (Morey n.d.). They spend little time in open areas but will cross barren spaces in order to reach the cover of dense shrubs in sparsely vegetated areas. Initially they rely on speed or the cover provided by dense vegetation to avoid predators, but if pursued they will eventually seek refuge in burrows.

Whiptails are primarily diurnal. Adult whiptails usually become inactive by early fall, but juveniles extend the period of activity until late fall or even early winter depending on local conditions (Morey n.d.). Vitt and Ohmart (1977) suggest that the active, constantly moving behavioral pattern of whiptail lizards makes them subject to a high frequency of predation attempts by diurnal predators, such as snakes, larger lizards, and predaceous birds. Ohmart (1973) found that whiptails make up a large percentage of the food items consumed by roadrunners. Western whiptails were observed in 2004 at the Park in coastal scrub and chaparral.

Southwestern Pond Turtle (*Actinemys*[6] *marmorata pallida*)

The Southwestern pond turtle is a California Species of Special Concern and a Federal Sensitive Species (former Category 2 species). Alteration of wetland habitats from flood control projects, groundwater extraction and water diversions for agricultural, residential, and commercial use, along with alteration of upland habitats adjacent to wetlands used for nesting and over-wintering have led to the decline and elimination of many populations of pond turtles throughout its range in California (Holland 1991, Jennings and Hayes 1994, Rathbun et al. 1991). Additional reasons for the species' decline include introduction of exotic species of turtles and other aquatic organisms (T. Hovey *pers. comm.* 2005).

Historically, southwestern pond turtles occurred along most streams and rivers in central and southern California. Today, they can be found along the upper reaches of larger streams and rivers, in small-to-medium sized streams in foothill areas, and in man-made agricultural ponds, canals and reservoirs (Holland 1991, Jennings and Hayes 1994). Within these types of habitats, this species generally selects slow-moving or stagnant aquatic habitat that forms deep pools (at least three feet deep) that also have some sort overhanging bank cover such as vegetation, tree roots, or boulders (Rathbun et al. 1991). The combination of deep pools with overhanging/undercut banks provides adult and subadult pond turtles with protected areas for escape when threatened. Suitable aquatic basking sites such as mats of emergent vegetation, submerged mats of aquatic vegetation, exposed logs, rocks, or mud banks are also a critical element of aquatic habitat for adult and subadult pond turtles. Because hatchling and juvenile pond turtles are very susceptible to predation from birds and mammals, they tend to forage in shallow water habitat that has a dense submerged or short emergent cover of vegetation (P. Collins *pers. observations*).

Pond turtles also require suitable upland habitat adjacent to watercourses for overwintering and nesting (Rathbun et al. 1991). Typical overwintering sites include south facing stream terraces vegetated with riparian scrub vegetation and thick leaf litter, and that are elevated above the stream channel.

In the vicinity of the Reserve, pond turtles are known to occur along the length of the Santa Ynez River and in a number of ponds and lakes on Vandenberg Air Force Base (Christopher 1996). The only record of this species from the Reserve was from the large freshwater marsh along the east fork of Santa Lucia Creek. Several individuals were observed in this marsh during field surveys conducted in spring of 2003 (Christopher *unpublished data*). An adult pond turtle was observed during Condor's 2004 field surveys basking on the east side of the large marsh in the Santa Lucia Management Unit. They are also expected to occur along Davis Creek and along perennial flow segments of Santa Lucia Creek southwest of the Reserve boundary. Aside from the freshwater marsh and perennial flow segments of Davis Creek, there does not appear to be any other freshwater

[6] The taxonomic treatment of this species is in flux. Jennings (2004) has included the Western Pond Turtle in the genus *Actinemys* while others have suggested that it be included in the genus *Emys.* This generic allocation to Emys has not yet been published in the Society for the Study of Amphibians and Reptiles "Scientific and Standard Names of amphibians and reptiles of North America north of Mexico, with Comments Regarding Confidence in Our Understanding" publication. The most recent version of this publication (Crother, B.I., ed. 2000) lists this species as *Clemmys marmorata pallida*.

habitat (springs, and ephemeral wetlands) on the Reserve property likely to support a resident population of pond turtles.

Two-striped Gartersnake (*Thamnophis hammondii*)
The two-striped gartersnake is a California Species of Special Concern. Throughout its range this species has been adversely affected by alteration of its aquatic habitat from urban and agricultural developments, flood control activities, creation of reservoirs, and livestock grazing (Jennings and Hayes 1994). It is generally confined to coastal slope drainages in the Coast, Peninsular and Transverse Ranges from Monterey Bay southward through Baja California Sur, Mexico (Jennings and Hayes 1994, Stebbins 1985). The two-striped gartersnake is a highly aquatic snake that is rarely found far from water, which it freely enters to forage or escape from predators.

This species is known to occur in suitable perennial and ephemeral drainages throughout Santa Barbara County. It commonly inhabits perennial and intermittent streams that have rocky bottoms and that are bordered by willow thickets or dense vegetation (Stebbins 1985). This species is also known to occasionally utilize stock ponds and other artificially-created aquatic habitats as long as there is a dense border of emergent vegetation and suitable amphibian and fish prey present. Two-striped gartersnakes are active from late February through September with peak activity occurring in June. By late September, this species retreats into nearby upland habitat where it hibernates in rock crevices and animal burrows that are out of reach of high water stream flows.

Two-striped gartersnakes are relatively widely distributed throughout Santa Barbara County with local populations reported along San Antonio Creek, the upper Santa Ynez River, Honda Creek, Jalama Creek, and from a number of streams along the south-facing slopes of the Santa Ynez Mountains (UCSB and SBMNH specimen and sighting records, S. Sweet unpublished data). The distribution of this snake in the project area is poorly known. Although Odion et al. (1993) list this species as a probable resident of the Burton Mesa area, there are no records from the project area, nor are there any records of this species in wetlands on or in the immediate vicinity of the Reserve. According to Christopher (1996) two-striped gartersnakes inhabit several streams that cross Vandenberg AFB (e. g. San Antonio Creek, Honda Creek, Jalama Creek). They are also expected to occur in several tributary streams along the lower Santa Ynez River such as Salsipuedes/El Jaro, Nojoqui and Zaca Creeks. This species was not observed on the Reserve during the spring 2004 surveys. However, suitable wetland habitat for this species occurs along Davis Creek in the Encina Management Unit and in the large freshwater marsh in the Santa Lucia Management Unit.

Coast Patch-nosed Snake (*Salvadora hexalepis virgultea*)
The coast patch-nosed snake is a California Species of Special Concern. This subspecies ranges west of the deserts from near Creston in central San Luis Obispo County southward into Baja California Norte, Mexico (Jennings and Hayes 1994, Stebbins 1985). Very little is known about the life history of this snake and even less about this subspecies. Patch-nosed snakes are associated with rocky or gravely soil vegetated with a low scrub growth of minimum density such as coastal chaparral and coastal scrub (Jennings and Hayes 1994, Stebbins, 1985, Zeiner et al. 1988).

Coast patch-nosed snakes are presumed to overwinter in small mammal burrows and/or woodrat nests (Jennings and Hayes 1994). They emerge from overwintering sites in March and retreat to these sites in October (Klauber 1939). They are most active in mid-to-late spring and early summer when they tend to restrict their above ground activity to late mornings and late afternoons (Jennings and Hayes 1994, Zeiner et al. 1988). Coast patch-nosed snakes appear to feed extensively on western whiptail lizards (*Cnemidophorus tigris*) which are captured as these lizards emerge from or retreat to their underground haunts (Jennings and Hayes 1994).

In Santa Barbara County the distribution of this species is not very well known. It has been recorded in the Santa Ynez and San Rafael Mountains. The closest locale to the Reserve where this species has been documented is from Figueroa Mountain (UCSB specimen record). One patch-nosed snake was observed during the spring 2004 field surveys along the lower slopes of the Purisima Hills adjacent to the northeast corner of the Reserve (Figures 7 and 31). This locale represents a significant range extension for this species in Santa Barbara County and is the first confirmed record for this species near the Reserve. On the Reserve coast patch-nosed snakes are expected to inhabit rocky areas along the crest and south-facing slopes of the Purisima Hills that are vegetated with an open, low cover of shrubs and trees such as chaparral and open Bishop pine forest.

Long-nosed Snake (*Rhinocheilus lecontei*)

The Long-nosed Snake is not a Species of Special Concern, nor is it listed by the State or Federal Government. However, it is reported here because its recent documentation adjacent to the Reserve (Gevirtz 2004), represents a significant extension of its range (S. Sweet *pers. comm.* 2004), and is the first confirmed record for this species near the Reserve. In Santa Barbara County, the closest records are from Figueroa Mountain and the Cuyama Valley, more than 20 miles from the Burton Mesa. This species occurs in habitats ranging from the hot and dry Chihuahuan, Sonoran and Mohave desserts and the colder Great Basin desert to the tropical habitats of Mexico (Medica 1975). It occurs from northern California, southwest to northern Baja California, to southeastern Arizona, Nevada, Utah, and Texas (Wright and Wright 1957). It is largely nocturnal, and burrows in the burrows of small mammals beneath the ground surface and in rock crevices if available. It lives under brush of chaparral and coastal scrub on sandy soils, among other habitats, and feeds on gophers, rodents, lizards, small snakes and insects. Most appear in late spring through mid summer. (Wright and Wright 1975).

Photo 53: Long-nosed snake in Burton Mesa Reserve. *Photo by Elihu Gevirtz*

Mammals

Townsend's Big-eared Bat (*Corynorhinus townsendii*)

Townsend's big-eared bats are considered Federal Species of Concern (former Category 2 candidate species) and California Species of Special Concern (Pierson et al. 1999, Williams 1986). The principal threat to this species comes from disturbance to and destruction of roost sites (Pierson et al. 1999). Townsend's big-eared bats are widely distributed in California with most populations concentrated in areas offering caves or mines as roosting habitat (Pierson et al. 2002). This species is locally common in coastal and lower montane habitats throughout California. However, site specific aspects of its distribution in the project area are not entirely known. In the vicinity of the Reserve, this species has been observed in small numbers at Vandenberg AFB (Pierson et al. 2002).

Townsend's big-eared bats inhabit a variety of habitats in California including coastal conifer and broad-leaf forests to semi-arid scrubland and grasslands of the desert and eastern Sierra Nevada foothills (Williams, 1986). They feed primarily on small moths and other soft-bodied insects which they capture in flight or glean from vegetation (Zeiner et al., 1990). This species is primarily a cave dweller, and has been found roosting in limestone caves, lava tubes, mine tunnels, buildings, and a variety of other artificial structures (Pierson et al. 2002, Williams, 1986). They have very restrictive roost requirements, such as suitable hibernacula sites free from human disturbance and a close proximity to a source of water. Townsend's big-eared bats are extremely sensitive to disturbance due to their habit of roosting on cave walls and other exposed surfaces, rather than in protected crevices (Williams, 1986). They hibernate between October and April. Females form large maternity roosts, which may be abandoned following a single visit by humans. Males are solitary during the maternity period (spring-summer) when females form maternity colonies. In winter this species generally roosts singly (Barbour and Davis 1969, Pearson et al. 1952). This species exhibits a high degree of roost site fidelity, with more than half of the young females returning to the same roost where they were born (Williams, 1986).

Surveys for bats were not conducted in 2004. No Townsend's big-eared bats were observed onsite during the spring 2004 field surveys. Due to a lack of caves and mines, the only location where this species might roost at the Reserve is in the barns in the La Purisima Management Unit. Some buildings in Vandenberg Village may also provide some suitable roosting habitat for this species. Coast live oak woodland/forest, willow riparian woodland, and Bishop pine forests provide some foraging habitat on site for this species. Currently, the nearest known maternity roost for this species occurs along the Santa Ynez River east of the town of Santa Ynez.

Pallid Bat (*Antrozous pallidus*)

Pallid bats are considered DFG Species of Special Concern and USFS Region 5 Sensitive Species. In California this species occurs throughout the state in a variety of habitats including deserts, moist oak woodlands, redwood forests of the coastal region, and open, dry habitats such as grasslands, oak savannah, and open scrublands (Pierson et al. 2002, Williams 1986). Pierson et al. (2002) found pallid bats to be widely distributed on Vandenberg Air Force Base in a variety of woodland habitats including oak and riparian woodlands and eucalyptus stands. Pallid bats that roost in Upper Honda Canyon on Vandenberg Air Force Base were recorded foraging in tanbark oak habitat situated on

surrounding ridges and in coast live oak and riparian woodland habitats found along Honda and Miguelito creeks (Pierson et al. 2002).

This species is highly social and forms single-species or mixed-species roosts in rock crevices, caves, mines, tunnels, tree hollows, bridges and buildings (Brown 1980; Pierson et al. 2002). Pallid bats forage primarily on large arthropods caught on the ground or gleaned from vegetation. Discarded large arthropod remains commonly found under pallid bat roosts include scorpions (Order: Scorpionidae), long-horned beetles (Family: Cerambycidae), cicadas (Family: Cicadidae) and Jerusalem crickets (*Stenopalmatus fuscus*) (Brown, 1980; Brylski et al. in review).

Pallid bats were not observed on the Burton Mesa Ecological Reserve but are expected to forage in oak and riparian woodlands, the marsh, and in pine forests found on the property. Although rock cave and crevice habitat is lacking on the Reserve, large hollows in coast live oaks may provide suitable roosts. The rocky outcrops on the north side of the road that forms the northern boundary of the Reserve's La Purisima Management Unit may provide suitable roost habitat for this species. The nearest known roosts for this species to the Burton Mesa Reserve occur under the Highway 1 bridge over the Santa Ynez River (night roost), and in a eucalyptus tree on North VAFB along Terra Road (Pierson et al. 2002). This species was also recorded foraging over lower Pine Canyon Lake on VAFB just west of the Reserve (Pierson et al. 2002).

San Diego Desert Woodrat (*Neotoma lepida intermedia*)

The San Diego desert woodrat is a California Species of Special Concern and a Federal Sensitive Species (former Category 2 species). The San Diego desert woodrat is not expected to be included on the Updated Mammal Species of Special Concern in California (Brylski, *et. al, in review*).

The San Diego desert woodrat is one of seven subspecies of desert woodrats found in California (Hall 1981). It ranges along the coastal slope of the coast ranges from San Luis Obispo County south through northern Baja California (Hall, 1981). Historically, this subspecies occurred throughout lower elevations of southern California in coastal scrub and chaparral habitats. However, during the past century, urbanization and agricultural developments have destroyed much of the habitat occupied by this subspecies. It has been extirpated from coastal areas of Los Angeles, Orange and San Diego Counties. In contrast, this subspecies can still be found in much of its historic range in San Luis Obispo and Santa Barbara Counties.

Photo 54: Desert Woodrat. *Photograph by Dr. Lloyd Glenn Ingles*

Desert woodrats are folivorous and granivorous and feed on a variety of fruits, seeds, bark, leaves, and young shoots of a variety of plants (Meserve 1974). The distribution of this species is known to be limited by the availability of suitable nest sites provided by rock outcrops and patches of cactus (Zeiner et al. 1990). The presence of sandy soils over most of the

Reserve coupled with the absence of cactus (*Opuntia* sp.) patches and developed rock outcrops makes much of the Reserve unsuitable for this species. The only areas of the Reserve that offer suitable habitat for this species occur in the northern portion of the La Purisima Management Unit. Nest structures of this species were found during spring 2004 field surveys in rock crevices and hollows along the northeastern boundary of the Reserve.

American Badger (*Taxidea taxus*)

American badgers are listed as a California Species of Special Concern (Williams 1986); and are expected to be included on the watch-list on the update that has been prepared for the Mammal Species of Special Concern in California (Brylski, *in review*). Badgers are considered of local concern by regional wildlife biologists. This species' decline noted by Williams (1986) has been attributed to conversion of grasslands and pasturelands to agricultural and urban uses, and to trapping and poisoning. Badgers are still widely distributed in grassland and open scrub habitats throughout the undeveloped parts of Santa Barbara County. They are more common along the north coastal and interior areas of the county (particularly on Vandenberg AFB and in the Cuyama Valley) than along the south coast (P. Collins, *unpublished data*). They have declined in areas of the county that have been developed or planted in agricultural crops (i. e. much of the South Coast, the Santa Maria Valley, Lompoc and Santa Ynez Valleys) (P. Collins, *unpublished data*). Although badgers have declined in some areas of northern Santa Barbara County, they still occur throughout much of the undeveloped areas of the Burton Mesa and across much of Vandenberg AFB where they tend to be widespread and locally common (Coulombe and Mahrdt 1976). Their preferred habitats include grassland, oak savannah, and sparse coastal scrub.

Badgers have been observed along the CCWA pipeline right-of-way north and west of the Reserve (V. Semonsen *pers. comm.*), on the Clubhouse Estates property north of Burton Mesa Boulevard (Philbrick and Collins 1997), off Highway 1 approximately 1.8 miles NNE of the Reserve (SBMNH sighting records), and in other locations elsewhere on Burton Mesa (Odion et al. 1993, Appendix 4).

An adult badger was observed by Condor on the grassy mesa close to the chaparral and wetland south of Highway 1 in spring 2004. Other evidence (tracks, burrows, and digging) was detected in many areas of the Reserve. Condor observed that the preferred habitat for badgers on the Reserve includes Burton Mesa chaparral, grassland, and coastal scrub. Badgers were most commonly detected in areas of the Reserve with sandy soil and evident populations of burrowing mammals such as California ground squirrel (*Spermophillus beecheyi*), agile kangaroo rat (*Dipodomys agilis*) and Botta's pocket gopher (*Thomomys bottae*). These three species of burrowing mammals comprise the principal prey for badgers (Williams 1986).

Invertebrates

Vernal Pool Fairy Shrimp (*Brachinecta lynchi)*

The vernal pool fairy shrimp occupies a variety of different vernal pool habitats, from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools. Although the species has been collected from large vernal pools, including one exceeding 25 acres, it tends to occur more commonly in smaller pools. It is most frequently found in pools measuring less than 0.05 acre. These are most commonly in grass or mud bottomed swales, or basalt flow depression pools in unplowed grasslands. Vernal pool fairy shrimp have been collected from early December to early May.

Photo 55: Vernal pool fairy shrimp.

Female fairy shrimp carry their eggs in a ventral brood sac. The eggs are either dropped to the pool bottom or remain in the brood sac until the mother dies and sinks. When the pool dries out, so do the eggs. They remain in the dry pool bed until rains and other environmental stimuli hatch them. Resting fairy shrimp eggs are known as *cysts*. They are capable of withstanding heat, cold and prolonged desiccation. Though the resting period usually varies between 6 to 10 months, eggs have been hatched in a laboratory after 15 years (Peckersky 1990, Pennak 1989). Winter eggs usually hatch 30 hours after being exposed to water. When the pools refill, some, but not all, of the cysts may hatch. The cyst bank in the soil may contain cysts from several years of breeding. Average time to maturity is only forty-one days. In warmer pools, it can be as little as eighteen. (Eriksen and Belk 1999).

Winter eggs can be carried from pool to pool by traveling animals, or, in the case of pools that dry out completely, picked up in the wind and be blown to other pools. For reasons currently unknown, there is an uneven level of population in a pool from year to year. In a single pool, fairy shrimp may be abundant for several consecutive years and absent the next. The limiting factor in the size of fairy shrimp populations is typically not predation, but the need of one part per million dissolved oxygen (Peckersky 1990, Pennak 1989).

The vernal pool fairy shrimp is widespread but not abundant in California. Known populations extend from Stillwater Plain in Shasta County through most of the length of the Central Valley to Pixley in Tulare County. Along the central coast, they range from northern Solano County to Pinnacles National Monument in San Benito County. Four additional, disjunct populations exist: one near Soda Lake in San Luis Obispo County, one in the mountain grasslands of Figueroa Mountain in northern Santa Barbara County, one on the Santa Rosa Plateau in Riverside County, and one near Rancho California in Riverside County.

The vernal pool fairy shrimp was identified relatively recently, in 1990. There is little information on its historical range. However, since it is currently known to occur in a wide range of vernal pool habitats, the historic distribution may have coincided with the historic distribution of Central Valley and Southern California vernal pools. The species was designated as Threatened by the U.S. Fish and Wildlife Service in 1994, being known to occur in California and Oregon.

Paul Collins and Elihu Gevirtz observed a population of fairy shrimp in the ephemeral wetlands (tire ruts) on the Reserve south of Highway 1 in March, 2004. Paul Collins collected some samples, identified the species in the lab, and sent the material to Christopher Rogers who confirmed the species identification. This represents a significant range extension for this species in Santa Barbara County. It was previously known only as close as Figueroa Mountain, roughly 20 miles to the east. Subsequent fairy shrimp surveys conducted in vernal wetlands on Vandenberg Air Force Base in early 2005 found this species to be widely distributed in ephemeral wetlands on the Base (M. Ball *pers. comm.*).

Birds

Twenty sensitive species of birds were targets for Condor's surveys in 2004 because of their known occurrence on or near the Reserve or their likelihood of occurring there. Thirteen of these were detected during this study.

White-tailed Kite (Elanus leucurus)
This species is considered a Fully Protected species by the State of California (California Fish and Game Code, Section 3511). White-tailed kites are found in open country, preferring grasslands and the upper sections of marshes for hunting. These areas may be maintained as year-round territories or they may be unused for several years before being used again. Communal nocturnal roosts often occur in oak woodland on the edge of grassland, but communal roosts can also occur in willows, and orchards. In Santa Barbara County, the species occurs mostly in lowland coastal areas, but also in the Santa Ynez Valley. It is has been observed flying over habitat in the Cuyama Valley, and in the interior higher elevations of the county, but breeding in these locations has not been observed (Holmgren *unpublished data*).

Population monitoring of white-tailed kite breeding populations and roosting aggregations has occurred frequently in the past 40 years along the south coast of Santa Barbara County, but only occasionally in northern Santa Barbara County (Lehman 1994, Holmgren *unpublished data*). On Vandenberg Air Force Base, the species is most persistent in the 3 to 4 miles of the Santa Ynez River valley. Kites also breed in several parts of north Vandenberg Air Force Base (along San Antonio and Shuman creeks, Grant Road, and near Titan Pasture), but apparently not on Sudden Ranch which is immediately adjacent to the coast. No significant roosting aggregations are known anywhere on VAFB other than in the immediate vicinity of the Santa Ynez River. Other sightings of large numbers of kites (90+) have been recorded in Orcutt (Holmgren *unpublished data*).

Suitable nesting habitat occurs throughout the Reserve. Close to the Reserve on VAFB, kites occur occasionally in the Pine Canyon and Santa Lucia Canyon areas, and formerly nested regularly in Barka Slough (prior to the fire in 2001). On the Reserve, individuals were noted in the Vandenberg Management Unit on May 5 (an adult) and June 13, 2004 (age unknown), flying over the large marsh in the Santa Lucia Management Unit and on May 24, 2004 (age unknown). All of the management units, with the exception of the Purisima Hills Management Unit have habitat that appears suitable for nesting. However, evidence of nesting was not found.

Long-eared Owl (Asio otus)
This species is considered a Species of Special Concern by the Department of Fish and Game. Long-eared owl nests in mature riparian or oak woodlands adjacent to riparian zones near open areas. Wintering birds may form communal roosts in dense riparian thickets.

The decline of long-eared owl in California has been attributed to the loss of bottomlands to cultivation (Grinnell and Miller 1944). The decline of long-eared owl in this region may also be due to increasingly favorable conditions for great horned owls. It appears the presence of great horned owls corresponds with the absence of long-eared owls (Holmgren *personal observation*).

Although surveys were conducted on February 16, June 10, June 27, and July 25, 2004, no long-eared owls were detected. Recent records of this species include a roost of up to ten individuals in upper Miguelito Canyon south of Lompoc in December 1992, January 1993, and December 2003 (Lehman 1994). A handful of road killed salvages, almost all in winter from Santa Barbara County are documented at UCSB Museum of Systematics and Ecology. On the Reserve, in the Encina Management Unit, suitable habitat exists along Davis Creek south of Highway 1, south and west of the large marsh on the Santa Lucia Management Unit and south of the northern access road on the northern Encina Management Unit.

Burrowing Owl (Speotyto [=Athene] cunicularia)
Burrowing owls occur in dry, sparse grassland and agricultural areas, and use ground squirrel burrows for roosting and nesting. Burrowing owl is considered a Species of Concern. This species is nearly completely extirpated from Santa Barbara County. One or two pairs nested in the western Santa Maria Valley in the mid 1990s and another pair may have nested in the Cuyama Valley (Lehman 1994). Breeding still occurs in the Carrizo Plain in San Luis Obispo County. From 1995 to 1997, 31 locations inhabited by owls were found on VAFB in winter (Collins 1999). Suitable habitat exists at the Reserve.

Sufficient nighttime surveys to detect owls were not conducted; and most of this study was conducted between early April and mid-September, when burrowing owl would not be expected to reside on the Reserve. An early morning survey on March 27 along the northern edge of the Santa Lucia Management Unit turned up two animals along the side of the road that might have been burrowing owls, but they were gone before the spotlight could illuminate them.

Northern Harrier (Circus cyaneus)
The northern harrier is considered a Species of Special Concern by the Department of Fish and Game. Declines in population numbers of this species throughout California were noted as early as the 1940s (Grinnell and Miller 1944). Loss of marshlands and other wetland habitats has been the principal reason for population declines. This species forages and breeds in wetlands, meadows, grasslands, and along the edges of sloughs (C. Harrison 1978). Nests are constructed on the ground, usually in marshy areas and grasslands.

Northern harriers are uncommon visitors in the fall, winter, and early spring in the area of the Reserve, and an uncommon summer resident along the north coast of the county (Lehman 1994). There is evidence of nesting at Point Sal, the mouth of San Antonio Creek, the mouth of the Santa Ynez River, and on Vandenberg Air Force Base (Lehman 1994). It was observed at the Reserve in 2004.

Cooper's Hawk (*Accipiter cooperii*)
The Cooper's hawk is listed by the Department of Fish and Game as a Species of Special Concern, but is unlikely to appear on the updated list (L. Comrack *pers. comm.*). This species occurs in wooded and forested habitats throughout California. Regionally, they are found in oak woodland, oak savanna, and open riparian woodlands. Foraging occurs in similar habitats, as well as over cultivated fields and grasslands.

In Santa Barbara County, Cooper's hawks occur mostly as transients and winter visitors, with scattered nesting locations. This species is experiencing population growth state wide (L. Comrack *pers. comm.*). Cooper's hawks are known from La Purisima Mission State Park and the Lompoc area, where they can be found throughout the year (Human, no date; Lynch 1997, Gevirtz et al. 2005). Based on Condor's 2004 surveys, the Reserve appears to be an important local area for Cooper's hawks. There were eight sightings of Cooper's hawks between March and June 2004, including a nest on June 11, and a nest with chicks on June 27.

Sharp-shinned Hawk (*Accipiter striatus*)

The sharp-shinned hawk is considered a Species of Special Concern by the Department of Fish and Game, but will not be included on the updated list (L. Comrack, *pers. comm.*). This species is likely to occur on a rare to uncommon basis during late fall, winter, and early spring at the Reserve in oak woodland and riparian habitats. There is only one possible nesting record in Santa Barbara County (Lehman 1994). Sharp-shinned hawks are reported to be uncommon, but regular visitors to the Lompoc Valley in general, and specifically to La Purisima Mission State Park (Lynch 1997; Human, no date). No sharp-shinned hawks were found during the 2004 surveys at the Reserve or the adjacent State Park.

Ferruginous Hawk (*Buteo regalis*)

The ferruginous hawk is considered a Species of Special Concern by the Department of Fish and Game but will not be included on the updated list (L. Comrack *pers. comm.*). Ferruginous hawks forage over open habitats, including grassland, cultivated fields, shrublands, and the edges of woodlands. Nesting occurs in trees where available, as well as on the ground and in rocky ledges. Nest structures are often re-used, with materials, such as sticks, grass, bones, and cattle scat, added each year. As such, nest structures often become quite large over the years.

In Santa Barbara County, this species is a fall transient and winter visitor. It does not nest locally. Lehman (1994) considers the ferruginous hawk to be very uncommon in the Lompoc area, an assessment consistent with that of Lynch (1997) for the Lompoc Valley and Human (no date) for La Purisima Mission State Park. This species is more frequently observed during the winter in the Santa Maria Valley. No ferruginous hawks were observed at the Reserve or the nearby La Purisima Mission State Park during the spring 2004 field surveys.

Loggerhead Shrike (*Lanius ludovicianus*)

The loggerhead shrike is considered a Species of Special Concern by the Department of Fish and Game. It is found in a variety of open habitats, including grassland, coastal scrub, and oak savanna, the edges of woodlands, cultivated fields, and non-native plantings. This species preys on insects and small vertebrates including reptiles and birds. Prey items are often stored by attaching the item to a pointed object nearby (such as barbed wire, thorn, or sharp sturdy twig) and consumed at a later time. Active nests have been observed in a small, isolated willow (*Salix* sp.) tree in an oil refinery in Carson (Olson, personal observation), and in a bottlebrush shrub next to an administration building at a Santa Maria oil facility (Storrer, personal communication, 2003).

This species is an uncommon resident in northern Santa Barbara County and there are few nesting records for the entire county (N. Francine *pers. comm.*). One breeding record is from near Barka Slough in May 1985 (Lehman 1994). In the Lompoc area, it is a relatively common winter visitor and rare to uncommon summer resident (Lynch 1997). Shrikes were observed on a regular basis at La Purisima State Park in November 2004 by Tom Olson, foraging for large insects, such as Jerusalem crickets by following directly behind equipment tilling the agricultural fields (Gevirtz et al. 2005).

On the Reserve, there were four sightings of loggerhead shrike by Condor in 2004, including March 13, May 21, June 27, and July 25. These include three individuals that were observed together on May 21.

Yellow Warbler (*Dendroica petechia*)

Yellow warbler is considered a Species of Special Concern by the DFG. This species breeds in riparian woodlands characterized by a canopy of tall willows, Black or Fremont Cottonwoods (*Populus balsamifera var. trichocarpa,* or *P. fremontii*), Big-leaf Maple *(Acer macrophyllum*), Western Sycamore (*Platanus racemosa*), or White Alder (*Alnus rhombifolia*). Oak woodland, especially near riparian, is also used occasionally. A long distance migrant, Yellow Warblers are on breeding territory by mid-April and begin to leave breeding habitats by mid-July. They migrate northwards through Santa Barbara County from April through the third week of June and southwards from July to October or later (Lehman 1994, Gallo et al 2000, Holmgren *pers. observation*).

The decline in breeding populations of yellow warblers throughout much of southern California has been linked to the loss and degradation of riparian habitats and to intense brood-parasitism (Lehman 1994). It is indeed one of the favored hosts of brown-headed cowbirds (*Molothrus ater*) (Holmgren *pers. observation*).

While yellow warblers sing mainly from the canopy, they may forage and nest in the understory. Therefore, the condition of the understory may influence their occupancy and success while breeding. Cattle grazing, for example, is shown to have a negative influence on occupancy. When cattle are removed and shrub density recovers, the yellow warbler population responds positively (Taylor and Littlefield 1986).

In California, yellow warblers breed in lowland and foothill riparian habitats west of the Sierra Nevada and, at least formerly, in some desert oases to the east. On the south coast of Santa Barbara County, yellow warblers seem to have been reduced in numbers (Lehman 1994), although many of the foothill canyons between Hollister Ranch and Goleta have not been adequately surveyed. In the north county, they are broadly distributed from the upper Santa Ynez River and near tributaries, and parts of the Sisquoc, Manzana, and Santa Cruz creeks. On Vandenberg Air Force Base, yellow warblers are present in riparian habitat where canopy vegetation exists and are most abundant on San Antonio Creek and the Santa Ynez River. In 1998, more than 30 pairs of Yellow Warblers per 40 hectares were found (Gallo 1999).

On the Reserve, a suspected breeding pair was detected along Davis Creek in mid-June. Additional surveys detected at least two breeding pairs in each of two wetland areas. It was surprising that Davis Creek did not support any other yellow warblers, as the habitat seems suitable, especially just north of Highway 1.

Warbling Vireo (*Vireo gilvus*)
The warbling vireo is recognized by local biologists as a regionally rare bird (Holmgren and Collins 1998), but it is not considered a Species of Special Concern by the Department of Fish and Game. It is more common in northern Santa Barbara County than in the southern portion of the county (Lehman 1994). Generally in the Lompoc Valley, and more specifically at La Purisima Mission State Park, the warbling vireo is considered to be relatively common in spring and summer (Lynch 1997; Human, no date). This species is very rare in the county during winter.

Warbling vireos nest in wooded habitats, including riparian and oak woodlands. Declines in population numbers are thought to be caused by loss and fragmentation of habitat, especially oak woodland. Nest parasitism by brown-headed cowbirds may also contribute to a reduction in numbers (Lehman 1994). Nests are established in trees and shrubs. Although warbling vireos in the eastern United States often nest at heights of 20 feet or greater (C. Harrison 1978), those in the western states usually build nests at heights less than 12 feet (H. Harrison 1979). Warbling vireos were found in June and July 2004 at the Reserve on Los Berros Creek, Meriam Creek, and a spring on the western boundary of the Santa Lucia Management Unit. An adult with a dependent juvenile was observed on July 25, 2004.

Yellow-breasted Chat (*Icteria virens*)
Yellow-breasted Chat is considered a Species of Special Concern by the Department of Fish and Game. Chats use dense, willow-dominated, usually wet tangles of riparian habitat; overgrown swampy areas; and, occasionally, pond edges with willow thickets.

The distribution of this species has been summarized as uncommon and local in southern California (Garrett and Dunn 1981). In Santa Barbara County, Lehman (1994) noted that it had declined markedly, though little information was known about its occurrence in the northern portion of the county. Since that publication, the species has been found to be common along San Antonio Creek on Vandenberg Air Force Base (Gallo et al. 2000). Density estimates of approximately 3 pairs per 40 hectares were found on the four drainages studied by Gallo et. al (2000) on the Base. On the Reserve, Davis Creek and its eastern tributary appear to have suitable habitat. However, yellow-breasted chats were not detected; nor were they observed at La Purisima State Park by Condor in 2004.

Least Bittern (*Ixobrychus exilis*)
Least Bittern is considered a Species of Special Concern by the Department of Fish and Game. Least bitterns are very secretive and frequent dense stands of bulrushes (*Scirpus californicus*) and cattails (*Typha latifolia*) surrounding freshwater lakes and marshes (Lehman 1994). Destruction of freshwater marshes, especially extensive beds of dense, tall cattails is considered a principal threat (Remsen 1978). Additionally, poor water quality in marshes can contribute to unfavorable conditions for prey of least bitterns.

Least bittern is poorly studied in Santa Barbara County (*Holmgren pers. observation*). No more than ten localities of overwintering or oversummering are known. A few other sites have hosted migrants for very short periods. Fewer than four breeding events are known, none from the north county. Locally, least bitterns have been found a short distance west of the Reserve on Vandenberg Air Force Base at Lake Canyon, at Punchbowl Pond, and at

Waterfowl Management Ponds near the Santa Ynez River. Its breeding status at these sites has not been confirmed (Holmgren and Collins 1999).

The large marsh in the Santa Lucia Management Unit is the only suitable habitat for this species on the Reserve. It is large enough to support at least one pair. The least bittern was not found during this study despite several visits to the large marsh. Taped playbacks were used, and on one occasion investigators waded into the marsh in search of this and other species.

Tricolored Blackbird (*Agelaius tricolor*)

This species is considered a Species of Special Concern by the Department of Fish and Game and a "Nongame Bird of Management Concern" (USFWS 1995). Tricolored blackbirds prefer to nest in tules, cattails, and willows in or adjacent to freshwater or brackish wetlands that are within 5 kilometers of grassland suitable for foraging. If marsh habitat is not available, tricolored blackbirds may nest in sedges, nettle, thistle, mustard, blackberry tangles, tamarisk, mulefat, grasses, and in various crops (Neff 1937, Grinnell and Miller 1944, Unitt 1984, Small 1994). They generally do not occupy the same breeding sites in successive years. Management for this species requires grasslands or other foraging grounds as well as marshes for breeding.

In winter, tricolored blackbirds often roost at night in large flocks in wetlands large or small, but during the day they commute to feeding areas along lake shores, in city parks, lawns, cemeteries, golf courses, airports, bare fields, feedlots, horse and cattle ranches, and garbage dumps (Garrett and Dunn 1981, Unitt 1984, Small 1994, Lehman 1994, Hamilton and Willick 1996). They forage for grains, which are their major food during the colder, winter months when insects are less common (Ehrlich et al. 1988).

In Santa Barbara County, tricolored blackbirds are largely restricted to the north county where they generally choose large marshes surrounded by extensive fields or shrub land for breeding. Probably fewer than ten occurrences of breeding are documented in Santa Barbara County in the last 25 years (Holmgren *pers. observation*). Breeding sites near the Reserve have been documented at Punchbowl Pond on Vandenberg Air Force Base (1997) and breeding is suspected along San Antonio Creek, Santa Ynez River, and near Los Alamos. On the Reserve, breeding may have occurred in summer of 1997 (Holmgren and Collins 1999). Suitable habitat exists at the large marsh in the Santa Lucia Management Unit. Although not observed during 2004 at the Reserve, a group of ten tri-colored blackbirds were observed flying overhead near oak woodland at La Purisima Mission State Park (Gevirtz, et al. 2005) This species has been observed nesting in the cattails at the pond at the State Park during most years (Shuler-Jones *pers. comm.*, 2004).

Bell's Sage Sparrow (*Amphispiza belli belli*)

Bell's sage sparrow is on the Federal "Nongame Bird of Management Concern" list and is also considered a Species of Special Concern by the Department of Fish and Game, but will not appear on the updated list (L. Comrack, *pers. comm.*). Sage sparrow is a ground dwelling sparrow that forages in leaf litter and lower portions of shrubs (Grinnell and Miller 1944, Bent 1968). In northern Santa Barbara County, Bell's sage sparrow requires chaparral or coastal scrub (Gallo et al. 2000). Within this vegetation type, sage sparrows generally select more sparsely vegetated settings. Sparsely vegetated Burton Mesa Chaparral is created either by fire or a paucity of surface soils on bedrock.

Photo 56: Bell's Sage Sparrow. *Photo Courtesy of John Gallo*

The link between sage sparrows and habitats influenced by fires is especially important because in the extreme coastal portions of the central coast region they occur in almost no other habitat. Studies on Vandenberg Air Force Base clarified the relationship of fires to habitat occupancy by this species. Areas burned within seven to ten years are preferred to older stands of chaparral and scrub that are more closed in (Gallo 1999). The rule of thumb is that if one can walk through the chaparral easily, then it may be suitable for sage sparrows. Unlike Rufous-crowned sparrow, this species prefers flat or gently sloping terrain (less than 20% slope). Consequently, sage sparrows are often found along ridge crests and mesa tops.

Bell's sage sparrows can occur at low or high elevations, but more than 10 to 15 kilometers inland, it shows greater habitat flexibility. The Santa Ynez, San Rafael, and Sierra Madre mountains all support widely scattered populations (Lehman 1994). The occurrence of Bell's sage sparrow on the Reserve in 2004 was documented on numerous occasions by Condor. Males were on territories, indicating nesting in the chaparral within the scar of the Azalaea Fire (Figures 17 and 21). This species is absent from survey results for old growth chaparral and oak-dominated chaparral probably because these forms of chaparral are too tall and too dense to be used by Bell's sage sparrow.

Southern Rufous-crowned Sparrow (*Aimophila ruficeps canescens*)

Southern rufous-crowned sparrow is listed as a Species of Special Concern by the Department of Fish and Game, but will not be on the updated list (L. Comrack, *pers. comm.*).

Rufous-crowned sparrows use various forms of moderately sloped Coastal Sage Scrub habitats, at high or low elevations, whose aspects are predominately oriented SW, S, or SE. In less xeric forms of Coastal Scrub, they prefer early stages in the development of the habitat (i.e., in the first 15 years following fires (Collins 1999) and where a diverse mix of scrub vegetation and grasslands co-occur. Xeric forms tend to be more open in most cases and this provides excellent habitat for them as well. Rufous-crowned sparrow can also occupy areas where oaks, grasslands, and bluff scrub intermingle with Coastal Scrub.

Photo 57: Rufous Crowned Sparrow

Because the majority of individuals in north coastal Santa Barbara County inhabit slopes between 15° and 60° (Collins 1999), those on steeper slopes may not suffer from local losses to development. However, where these settings are converted to vineyards or orchards or are grazed heavily, rufous-crowned sparrow is excluded. On the more gentle slopes of the coastal plain much loss of habitat has occurred because of large-scale conversion to other land uses. Rufous-crowned sparrows may have been much more abundant on the coastal plain in the past, but they are largely absent now.

Several observations of rufous-crowned sparrow were made on the Reserve during this study. They were mostly found in the Purisima Hills Management Unit, the northern portion of the Santa Lucia Management Unit, and the northern La Purisima Management Unit, where the steeper slopes are found. At the Reserve, the habitats utilized by rufous-crowned sparrow are plentiful. However, if veldt grass replaces coastal scrub, or if coastal scrub, in the absence of fire, is replaced by another form of vegetation, this species is likely to experience a decline in its population here.

Grasshopper Sparrow (*Ammodramus savannarum*)

Grasshopper Sparrow is considered a Species of Special Concern by the Department of Fish and Game. It is also considered a locally rare species. This species occurs in extensive grassland areas, either flat or sloped, where there are scattered shrubs or other taller plants that are utilized as perches. The grasshopper sparrow was previously more widespread across the county as a breeding species, particularly along the south coast, including Santa Barbara and Goleta (Lehman 1994). Urban development, cultivation, and habitat fragmentation have removed much of the grassland habitat that this species uses for breeding. Grasshopper Sparrow is less common away from breeding areas, but does occur in the area as a fall transient near the coast. Grasslands on the Reserve and La Purisima Mission State Park are uncommon and therefore the opportunities for breeding at the Reserve and the park are limited. Lynch (1997) considered the grasshopper sparrow to be a regular, but uncommon, visitor to the Lompoc area during spring and summer. Localities in the region that support or are likely to support breeding populations of Grasshopper Sparrow include the Point Sal/Corralitos Canyon area, north Vandenberg Air Force Base, the north side of the mouth of the Santa Ynez River, areas near the south gate of Vandenberg Air Force Base, Ytias Creek and the Santa Rosa Hills.

Swainson's Thrush (*Catharus ustulatus*)

Swainson's thrush is not considered a Species of Special Concern by the Department of Fish and Game, but is considered locally important due to its disjunct breeding distribution and it's proximity to the far southwestern corner of its breeding range. Its habitat requirements are fairly narrow. For breeding it uses lush, moist shrubby or vine-thick terraces in or near canopied broad floodplain riparian or oak riparian forest. Nests are placed low in thickets of blackberry or Clematis, for example. Leaves and mud are essential for nest formation. Most of these settings are in perennial wetlands.

In Santa Barbara County, Swainson's thrush is largely absent from the south coastal areas. North of Point Conception, late spring and summer densities of Swainson's thrush are high on Vandenberg Air Force Base at Honda Creek, Santa Ynez River, Shuman Creek and especially San Antonio Creek. Swainson's thrush occurs in the Santa Ynez River just east of Lompoc, at Buellton, and at the confluence with Mono Creek miles upstream of Lake Cachuma. Some of the larger riparian and spring-fed tributaries to the Santa Ynez River also support small numbers of birds. More than 14 pairs per 40 hectares were observed on the Base by Gallo (2000).

On the Reserve, Swainson's thrushes were found in oak riparian habitat in Meriam Creek and in the more deciduous Davis Creek within the Encina Management Unit. One other individual was found in suitable breeding habitat during the migration period (May 22, 2004) off the Reserve in a canyon south of the easterly portion of the Purisima Hills Management Unit. Follow-up surveys were not conducted to check on this individual. One individual showing defensive behavior in Meriam Creek on June 27, was in suitable habitat and was probably breeding. A total of eight individuals in eight separate territories were detected in suitable habitat after the majority of migrants had passed through the Reserve.

Mountain Plover (*Charadrius montanus*)

The mountain plover is considered a Species of Special Concern by the California Department of Fish and Game. This species breeds in Rocky Mountains and Great Plains states, particularly Wyoming, Montana, and Colorado. Many wintering areas for mountain plovers are located in the Central and Imperial valleys of California (Wunder and Knopf 2003). Most habitats utilized by mountain plovers, either during breeding or winter, are characterized by limited vegetative cover. Nesting sites are often found in croplands, as well as short-grass and mixed-grass prairie modified by intensive grazing and burrowing mammals. Wintering locations are often in irrigated alfalfa or Bermuda grass.

In Santa Barbara County, mountain plovers are uncommon winter visitors to localized areas in the Santa Maria Valley and Vandenberg Air Force Base (Lehman 1994). One persistent location through the years has been the vicinity of Black and Betteravia roads in Santa Maria, where this species is seen along with wintering common snipe (*Gallinago gallinago*) and long-billed curlews (*Numenius americanus*) (Lehman 1994; T. Olson *personal observations*). Winter counts of mountain plovers have been conducted in recent years at the airport on the Air Force Base.

Neither Lynch (1997) nor Human (no date) list the mountain plover among birds regularly observed in the Lompoc Valley and at La Purisima Mission State Park. No mountain plovers were observed during 2004 surveys at the Reserve or at nearby La Purisima Mission State Park. This species is not expected to nest at the Reserve, but could occur on rare occasions during the winter. The most likely habitat to be utilized by wintering mountain plovers would be the cultivated fields. Bare dirt or nearly bare dirt is required by this species in winter (Comrack *pers. comm.* 2005).

California Horned Lark (*Eremophila alpestris actia*)

The subspecies of horned lark known as the California horned lark is considered by the Department of Fish and Game as a Species of Special Concern, but will not be included on

the updated list (L. Comrack *pers. comm.*). The California horned lark subspecies occurs in coastal areas from Sonoma County south to Mexico. It also occurs in the San Joaquin Valley and eastward to the foothills of the Sierra Nevada. Winter migrants from other states add to the numbers in the state seasonally, particularly in desert areas. Types of habitats used are primarily treeless, with very low vegetation. Examples include grasslands, playas, alkali flats, cultivated fields, and tundra. Horned larks feed on insects and spiders during the breeding season, and mostly seeds during the remainder of the year (Bent 1942). This taxon has suffered declines primarily due to loss and fragmentation of habitats, particularly in southern California where relatively level and gently sloping grassland and cultivated areas have been converted to residential developments (Lehman 1994).

Nests consist of round cup-like depressions in the ground that are lined with grass and down. Clutch size can vary from two to seven eggs, with four being the average (Harrison 1978). The eggs are incubated by the female only for 10 to 14 days. Nestlings are fed by both parents and usually leave the nest at 9 to 12 days of age.

In Santa Barbara County, this species is a common transient and winter visitor, and a common local breeding species along the coast (Lehman 1994). It is more widespread as a summer resident in more inland locations in the county. Open habitats with sparse vegetation are utilized, such as active and fallowed cultivated fields, short grasses, and sand dunes. It is still a quite common local breeder in the Santa Maria and Lompoc valleys (Lynch 1997, Lehman 1994). There are substantially greater numbers of horned larks in the county during migration and winter.

In 2004 surveys there were observations in grassland and cultivated fields at the Reserve. This species is expected to occur at the Reserve as an uncommon migrant and winter visitor. In addition, it may nest on rare occasions at the Reserve; and they are rare breeders on Vandenberg Air Force Base, where a small number of nests have been found in short grass grasslands. The most likely habitat to be frequented during all seasons of use is the cultivated fields, except for nesting. Depending on the timing of crop planting, cutting, and windrowing, nesting in the field could have variable results. The grassland areas and mixed coastal scrub/grassland areas are expected to be used to a lesser degree, primarily in the winter; as the height of the vegetation in those habitats is greater than that usually preferred by this species.

This page left blank intentionally.

Management Goals and Tasks

IV. MANAGEMENT GOALS AND TASKS

Introduction 227
Definition of Terms Used in This Plan 227
A. Administration Element 229
1. Information Management 229
2. Site Security 229
3. Easement Management 230
4. Access 231
5. Existing Structures 233
6. Unauthorized Uses 233
7. Hazards 234
B. Biological Element 234
1. Biodiversity 234
2. Upland Resources 236
3. Wetland Resources 237
4. Water Quality 240
5. Non-Native Species and Nuisance Species 241
6. Wildlife 243
7. Habitat Restoration 244
8. Monitoring 245
9. Future Surveys and Research 246
C. Public Use Element 249
1. Compatible Public Uses 249
2. Public Education 253
3. Hunting 251
4. Public Safety 252
5. Coordination with Adjacent Neighborhoods 253
D. Cultural Resources Element 253
1. Protection 253
2. Compatible Uses 254
E. Commercial Lease Element 255
F. Fire Management Element 255
1. Tasks – Before Fire 258
2. Tasks – Wildfire Response During a Fire 260
3. Tasks – After Fire 260

Introduction

The Burton Mesa Ecological Reserve is a jewel among the many lands held in trust by the State of California. Its geographic position at the transition between southern and central California, its expansive area of protected inland dunes, and the numerous sensitive and rare plants and significant animals that it supports emphasize the importance for cherishing, protecting, and engaging with the Burton Mesa Ecological Reserve.

This section of the Management Plan (modeled after the Department's standard format in: "*A Guide and Annotated Outline for Writing Management Plans*" and adapted for the specific needs of Burton Mesa Ecological Reserve [2004]) articulates goals and sets forth specific action items that are intended to: 1) engage the local community in the Reserve; 2) protect the resources on the Reserve; 3) restore native ecological communities in those portions of the Reserve that have been altered by humans; 4) continue to learn more about this unique ecosystem through an effective system of monitoring and research; and 5) use and continuously update the Geographic Information System that has been developed for the Reserve.

Definition of Terms Used in This Plan

Elements relate to broad topical categories and refer to any biological unit, public use activity or facility maintenance program as defined below for which goals have been prepared and presented in this plan;

Administration Elements consist of maintenance and administrative programs for orderly and beneficial management of the Reserve;

Biological Elements consist of species, habitats or communities for which specific goals have been developed in this plan;

Public Use Elements refer to any recreational, scientific or other use activity engaged in by the general public appropriate to and compatible with the purposes for which Burton Mesa Ecological Reserve was acquired;

Cultural Resources Elements consist of programs and activities for the protection and recognition of important cultural resources on the Reserve.

Commercial Use Elements specifically describe commercial operations on the Reserve for which goals have been developed in this plan;

Fire Management Elements consist of fire related programs conducted for public safety, resource protection and resource management.

Goals are statements within each element of intended long-range results of management based on feasibility and compatibility with the purposes of the Reserve;

Tasks are individual projects or activities that implement goals and are useful in planning operations and maintenance budgets.

Wildlife is generally defined by the Department as including vertebrate animals, invertebrate animals and plants.

A. Administration Element

1. Information Management

Goal: Maintain current data on the resources of the Reserve.

Tasks:

1. Regularly update the GIS as information becomes available. Encourage and facilitate use of the GIS by staff, researchers, and students.

2. Site Security

Goal: Delineate the Reserve boundary and prevent unauthorized entry and use of the Reserve.

Tasks:

1. Conduct boundary surveys and install survey benchmarks at property corners. Fence the Reserve boundary. Post signs that clearly identify ownership, allowed uses such as nature observation, and prohibited uses such as motorized vehicles and creation of new trails. Make sure the fences allow movement of wildlife. At a minimum, the signs should be installed at all gates and at the main entry points, especially from Vandenberg Village, Mission Hills and Mesa Oaks.
2. Develop and implement a coordinated signage program for the Reserve, which includes a map that identifies access points, and articulates the regulations. The signs should include an invitation to people to use the Reserve in ways that are compatible with the ecosystem and Reserve regulations. The phone number of a local office of a person or persons responsible for day-to-day operations of the Reserve should be incorporated. The phone number for CALTIP and the County Sheriff (911) should also be included on the boundary signs.
3. Consider installation of signs on the interior of the Reserve that communicate that it is illegal to cross on to adjoining U.S. military property and the oil field. Request funding assistance from these entities for this task.
4. Conduct periodic monitoring and maintenance of the signs and fencing. Install additional signs in problem areas, such as disturbed or restored areas.
5. Install gates, fences, signs and other controls where necessary at all access points, informal roads and trails where unauthorized vehicle access occurs regularly.
6. Regularly monitor access controls/barriers and modify as necessary.
7. Enforce and request assistance of the County Sheriff to enforce laws prohibiting vehicular access, consistent with the equestrian facility lease.
8. Identify locations where illegal encroachment of private uses onto state lands has occurred. Provide written notification to violators and establish a process

and timeline for the removal of fencing, landscaping, outbuildings and/or other forms unauthorized appropriation of state property. Seek remediation from unauthorized users and restore damaged habitats as necessary.

Goal: ***Coordinate access with neighboring landowners, the oil company to the north, the military to the south and west, and La Purisima Mission State Park to the east.***

Tasks:

1. Retain the State's rights of access via easements over roads within the adjacent oil field.
2. Preserve access easements within the Reserve for use by the adjoining oil company.
3. Provide fencing and clear boundary signs that direct people away from oil company land to the north and military land to the south and west.
4. Install additional signage near the oil plant area of the La Purisima Unit to direct the public away from the oil plant.
5. Identify the locations of all 18 easements outlined in the agreement that transferred property to the State, mark their boundaries in the field, and record them in the GIS.
6. Work with Vandenberg Air Force Base to maintain access for Reserve management and security vehicles on VAFB roads adjacent to Reserve boundaries.
7. Restrict access where appropriate. Encourage vehicle access controls be installed on adjacent lands contiguous with the Reserve boundary.

3. Easement Management

Goal: ***Minimize damage to sensitive biological and cultural resources by governmental agencies and public utilities.***

Opportunities and Constraints:
Several public utilities and governmental agencies provide services to the local community and use the Reserve to accomplish their roles. Their cooperation in protecting the unique resources of the Reserve is needed.

Tasks:

1. Require all agencies with stated claims of access on the Reserve for utility maintenance (The Gas Company, the Community Services Districts, PG&E, Caltrans, etc) to submit documents that provide proof of legal access. If no such documentation exists, require a formal application for interim access and establish an agreement that provides for public health and safety, with conditions that are protective of the Reserve's resources. Evaluate and amend

easements and agreements as necessary to ensure inclusion of adequate notification and coordination procedures.

2. Conduct annual meetings with the Gas Company, the Vandenberg Village and Mission Hills Community Services Districts, PG&E, Caltrans, the Central Coast Water Authority (CCWA) and any other public utility (at least once per year), so that management and maintenance staffs are aware of the boundaries of the Ecological Reserve, and the boundaries of where work is permitted and where it is not permitted. Develop and provide outreach materials targeted to these parties.
3. Require from the Gas Company, the Vandenberg Village and Mission Hills Community Services Districts, PG&E, Caltrans, and any other public entity, submittal of an annual maintenance plan for all activities scheduled, and reasonably foreseeable emergency actions within the Reserve in the following year. Conduct annual joint meetings with agencies if necessary to review plans and make modifications necessary to protect the resources of the Reserve while providing for the maintenance of public utility lines and other public services.
4. Prior to granting permission for access and work on the Reserve, the Department will require the utility proposing work to establish GPS points or prepare an acceptable map of the permitted access area (per language in the appropriate easement document) and to provide this information to Fish and Game so adherence to the boundaries can be monitored and enforced. Utilities will be required to install temporary construction fencing and signage that clearly delineate the boundary of the area where permission to enter the Reserve and conduct utility maintenance is granted. A written permit from the Department of Fish and Game is required prior to commencement of any work, including any and all preparations such as equipment staging, dropping off construction materials, etc. All permits for utility work, including routine maintenance, on the Reserve will require biological and archaeological monitoring, and if necessary, a habitat restoration plan drafted and implemented by a qualified biologist approved by the Department of Fish and Game and paid for by the utility.

4. Access

Goal: ***Maintain public access to the Reserve through pedestrian hiking trails. Provide a network of trails, including loop trails, linking interesting areas while protecting resources and preventing unauthorized uses.***

Opportunities and Constraints:
The relatively flat mesa and mostly gentle slopes with numerous existing roads and trails provide opportunities for easy public access. Controlling access to specific trails will be especially important where resources are more sensitive. Construction of new pedestrian trails will be restricted to avoid intact habitat areas and prevent further fragmentation and disturbance.

Tasks:

1. Implement the Trails Plan illustrated in Figure 19 so that everyone knows where it is appropriate to walk and where designated access points are located.
2. Work with State Parks to evaluate the necessity and feasibility of establishing trail connections to La Purisima Mission State Historic Park.
3. Develop interpretive trails within the Reserve, for use by the general public and schools, working with local schools, teachers, students and volunteers.
4. Design and install interpretive signs and other displays within the Reserve. This could be accomplished by using the signs specifically about the Burton Mesa designed by Condor Environmental for the adjacent Providence Landing project by Capital Pacific Homes.
5. Consider construction of orientation kiosks for visitors to learn more about the Reserve from visual interpretive displays.
6. Close existing trails as shown in Figure 19 using natural barriers such as boulders and logs, and restore native habitat, accompanied by signage.
7. Conduct periodic reviews of public uses in the Reserve and assess the need for modifications to the public use program, the need for additional trails, and/or closure of some trails.
8. Develop public use guidelines for the Reserve and post them on the Reserve's web site. Amend regulations as needed.
9. Maintain trails as necessary for passage, public safety and resource protection by trimming vegetation, controlling erosion and removing weeds.
10. Conduct feasibility study, environmental review and engineering design for proposed new trails.
11. Replace the bottom and top wires of barbed wire fencing with smooth wire at appropriate heights, and generally limit the use of barbed wire fencing to allow safe wildlife passage.

Goal: Enhance public access and use of the Reserve for persons with disabilities.

Tasks:

1. Evaluate the potential for establishing access for disabled persons to the Reserve and programs. Further study is needed to address this issue and to identify possible locations. In the short term, allow access for disabled persons on some existing paved roads in the Reserve, with safe access points and gates to be determined. Three locations to be explored should include:
    - The existing paved road that extends easterly from Rucker Road in the La Purisima Management Unit;

- The access road along Davis Creek from Burton Mesa Boulevard to Highway 1 in the Encina Management Unit;
- The paved road between Harris Grade Road and Meriam Creek in the Encina Management Unit.

2. Design interpretive displays and signs to meet the needs of disabled persons.

Goal: Provide administrative vehicular and pedestrian access for the Department and Department contractors in order to conduct essential habitat restoration, resource assessment and patrol activities.

Tasks:

1. Periodically inspect gates and locks at administrative access points to ensure they are operable.

2. Train Department staff and contractors on appropriate use and security of administrative access points.

3. Provide access letters or permits to contractors specifying dates and times of authorized access, and information on regulations and area restrictions.

5. Existing Structures

Goal: Effectively manage existing structures for resource protection, safety and prevention of unauthorized uses.

Tasks:

1. Regularly monitor the condition and use of existing structures listed in Table 8.
2. Take actions as needed to keep desired structures in good repair.
3. Take actions to demolish and remove those structures which are or have become unsafe or undesirable.
4. Document facilities needs in Department maintenance and capital outlay database.

6. Unauthorized Uses

Goal: Prevent unauthorized uses of the Reserve

Task:

1. Patrol the Reserve and enforce regulations that prohibit unauthorized uses.

2. Use signage and written notifications to foster cooperation. Issue citations and/or pursue legal action when voluntary cooperation cannot be obtained.

Goal: ***Discourage dumping of trash and yard waste within the Reserve.***

Task:

1. Remove existing rubbish and other unwanted materials. Before removing these materials, consider whether they provide habitat and if significant (such as an old rust truck cab that provides shelter for amphibians or an old rusty piece of sheet metal that blocks a trail from unauthorized use) replace these elements with natural materials that serve the same function.
2. Establish a regular monitoring and removal program. Ensure removed materials are taken to an appropriate and approved disposal site.
3. Notify violators and work closely with enforcement agencies, including Fish and Game wardens, County Sheriff, County Fire Department and Solid Waste Management to prevent disposal of, and to remove unauthorized material.

7. Hazards

Goal: ***Minimize potential hazards within the Reserve.***

Tasks:

1. Collaborate with the company that owns the oil field to the north, as well as the County Planning & Development Department and the Department of Fish and Game Office of Spill Prevention and Response to develop an emergency response plan in the event of a leak from an oil pipeline or drilling pad. The plan, at a minimum, should include plans for containment to minimize contamination on the Reserve, and 24-hour emergency contact persons and phone numbers. It should be updated annually.
2. Conduct site assessments for oil contamination or other hazards prior to construction of new facilities within the Reserve.
3. Implement the Fuel Management Plan and Wildfire Response Plan, as described herein.

B. Biological Element

1. Biodiversity

Goal: ***Maintain and enhance the biological diversity of the Reserve.***

Opportunities and Constraints:
The biological diversity of this 5,125 acre ecological reserve includes at least 326 native plants and more than 230 native animals. The Reserve supports eleven endemic plant species found nowhere else in the world, 22 plant and 39 animal species that are rare, threatened or endangered, and many species of flowering annuals. The arthropod diversity at the Burton Mesa is poorly documented and it is likely that many hundreds of additional species of insects and other arthropods occur here. The array of habitat types found at the Reserve, including conifer and hardwood forests, shrub-dominated scrubs and chaparral, native and annual grasslands, stream corridors and isolated wetlands such as springs, marshes and vernal pools, contribute to the rich diversity of plants and animals found here. This diversity is due in part to the presence of large areas of sparsely developed land that surround the Reserve allowing top predators with large home ranges to move freely. These predators, such as mountain lion, bobcat, coyote, common gray fox and badger keep populations of mid-level predators such as northern raccoons and skunks in balance. This contributes to a remarkable diversity of lizards, snakes, amphibians, and small mammals. Thus, an extraordinary opportunity exists on the Burton Mesa to preserve a unique and diverse ecosystem. There are challenges, however, as the edge of the Reserve abuts three residential communities that collectively contain more than 3,500 homes and roughly 10,000 people. New developments and continued population growth in the local region will place increasing pressure on public open spaces, including the Reserve. Past disturbances and fragmentation have left some areas in need of restoration and others with a continuing problem of weed invasion and expansion.

Tasks: The Department will work to implement the following broadly defined tasks which reflect basic principles of biodiversity conservation.

1. Identify and remove or circumvent any barriers to movement of large mammals.
2. Restore native habitats, reduce fragmentation, increase habitat availability for wildlife and minimize adverse edge effects.
3. Encourage proliferation of native pollinators such as native bees, moths, and butterflies by prohibiting the introduction of non-native pollinators and prohibiting chemical and biological treatments that could adversely affect the native pollinator species.
4. Control and limit the spread of exotic species that threaten to dominate the landscape and outcompete native species.

Goal: ***Maintain wildlife corridors, including those allowing passage of large predators, on the Reserve.***

Tasks:

1. Choose and implement fencing suitable to allow free movement of wildlife, including large predators.

2. Maintain wildlife movement corridors for large animals on the Reserve and surrounding lands.

Goal: Maintain habitat continuity around the Reserve.

Tasks:

1. Work with County Planning & Development, private land owners, and other conservation partners to develop a long range conservation plan for the Purisima Hills.
2. Work with the U.S. Air Force and State Parks to promote maintenance of continuous open lands to the south in order to provide long term connections to the Santa Ynez River.
3. Pursue acquisition of lands adjacent to and in the vicinity of the Reserve for conservation of habitat values.
4. Consider accepting land donations or mitigation set asides which expand protected natural habitats and increase habitat values in areas contiguous to the existing Reserve.

2. Upland Resources

Goal: Maintain and enhance upland habitats for native plants and animals in a manner that conserves biodiversity.

Opportunities and Constraints: More than 4,500 acres of upland habitats occur on the Reserve. The challenges here are to improve their continuity, to close gaps that are vulnerable to invasion by weeds, to protect a community of rare plants and animals that have habitat requirements sometimes at odds with each other, and to protect physical connections between upland and wetland sites for species that rely on both habitats for different parts of their life cycle or their daily foraging habits.

Tasks:

1. **Connectivity.** Maintain and restore habitat continuity between upland and wetland habitats (such as oak forest adjacent to the riparian forest along Davis Creek and compacted roadways surrounding vernal wetlands) and connections between adjacent upland sites such as oak woodlands and grasslands for the benefit of such animals as small mammals and lizards that use both habitats. Remove physical barriers that interrupt these connections.
2. **Utility Easements.** Reduce impacts from maintenance of utility easements where they disrupt ecological functions by minimizing size and/or frequency of impact, and/or other methods.

3. **Rare Plants.** Protect rare plant populations from unplanned disturbance. Because some rare plants, particularly herbaceous annuals and short lived perennials, appear to prefer low competition growing sites and mild disturbance, allowing continued disturbance (such as keeping a trail open for use by pedestrians) may be preferable because it would maintain the openings between the shrubs that are suitable for several species. For example, two annuals, *Cordylanthus rigidus ssp.littoralis* and *Monardella undulata* often occur along roadsides, margins of fields, fuel breaks and pipeline corridors. Therefore, maintain, but do not intentionally create, some openings (such as dirt roads and trails) in the chaparral to allow for rare plant populations. Develop species-specific management plans to ensure persistence of these rare plants and monitor their known populations to ensure that weed invasion does not degrade habitat values.
4. **Grasslands.** Maintain some annual grassland habitat that is conducive to burrowing by ground squirrels, badgers, and other fossorial mammals, and important foraging habitat for raptors.
5. **Groundwater.** Encourage local residents, the Vandenberg Village and Mission Hills Community Services Districts, and the County to use and/or require low-flow plumbing fixtures and drought-tolerant landscaping in order to conserve groundwater for the benefit of the ecosystem.
6. **Restore Degraded Uplands.** Identify and restore suitable degraded uplands.

3. Wetland Resources

Goal: Protect vernal wetlands.

Opportunities and Constraints:
In the sandy environment of the Burton Mesa, wetlands are rare. These seasonal water bodies are particularly attractive to people when water is present, but they are also susceptible to changes in hydrology and damage from vehicle traffic that compacts the soil and damages sensitive plants and animals. Important animals occur in some of these wetlands, including western spadefoot, vernal pool fairy shrimp, red-legged frog, and southwestern pond turtle. Other more common species such as western toad and tree frog and possibly California red-sided gartersnake also depend on these wetlands for survival. Rare plants such as Hoover's bent grass also occur in and around some of these wetlands. These wetlands provide excellent opportunities for wildlife observation and study, yet protecting them from adverse human activities such as unauthorized vehicle use and introduction of non-native fish is a challenge.

Tasks:

1. Install and maintain fencing that prevents unauthorized vehicles from entering the property. Complete the installation of fencing along Highway 1. Additional smooth-wire or other suitable interior fencing is recommended to control access around the vernal wetlands north and south of Highway 1.

2. Protect vernal pools on the Reserve, including the large vernal pool south of Highway 1 in the Vandenberg Management Unit and the population of Hoover's bent grass (*Agrostis hooveri*) it supports.
3. Evaluate habitat for vernal pool species and the feasibility of expanding vernal pool habitat on the Reserve with the possible creation of additional depressions within the open annual grasslands south of Highway 1. Protect existing wetland-dependent vegetation and animals in conducting any vernal pool restoration or creation activities.
4. Retire and restore existing trails and roads unless they provide critical and unduplicated management or public access.
5. Coordinate with the United States Fish and Wildlife Service regarding any activities that could adversely affect federally listed species including the vernal pool fairy shrimp.

Goal: Maintain and enhance the marshes in the Santa Lucia Management Unit.

Opportunities and Constraints:
The large marsh is one of the most significant resources on the Reserve, and many questions remain about this system. Information is needed about the water source and use of the marsh by sensitive species. Constraints on animals that use or have potential to use the marsh likely include introductions of non-native fishes, non-native crayfish and the presence of bullfrogs which adversely affect the marsh and reduce the likelihood of survival of most native amphibians. Unauthorized activities such as waterfowl hunting also adversely affect the marsh and the species it supports. Such unauthorized activities need to be prevented.

Tasks:

1. Work with lessees on the Reserve to minimize agricultural transport of sediment affecting the marshes of the Santa Lucia Management Unit using silt fencing and/or sediment traps.
2. Develop and implement plans for exotic species removal described in more detail in Item 5. Non Native Species and Nuisance Species.
3. Conduct surveys for springs that may contribute water to the freshwater marsh for a better understanding of the hydrology and variations in water level.
4. After fire has burned the vegetation on the slopes surrounding the marsh, conduct a survey for springs that may contribute water to it. This would contribute to understanding of the hydrology of the marsh and perhaps to be able to answer why the water level of the marsh changes over time.
5. Develop a restoration plan for the agricultural field adjacent to the marsh.
6. Monitor public use of the marsh and enforce Reserve regulations.

7. Develop and install appropriate signage for the marsh area, which specifies authorized and unauthorized uses of the area.
8. Monitor changes in the large marsh including the amount of open water, vegetation composition and extent, water depth, chemistry, pollutants, changes in aerial extent, and wildlife populations, including non-natives. If necessary, consider alternate management practices to better achieve desired results.
9. Monitor any implemented management measures to protect and enhance the marsh ecosystem.

Goal: Maintain and enhance stream corridors and associated riparian vegetation.

Opportunities and Constraints:
The most extensive perennial streams on the Reserve, Meriam and Davis Creeks, flow through the Encina Management Unit. Smaller streams include the two forks of Los Berros Creek in the La Purisima Management Unit, the easterly drainages of Santa Lucia Canyon in the Santa Lucia Management Unit, and several unnamed drainages in the Vandenberg and Santa Lucia Management Units. All of these flow, ultimately, into the Santa Ynez River. With the exception of Davis Creek, these streams flow only intermittently. Because they contain water during (at least part of the year) segments of these streams support tall, dense vegetation that provides critical habitat for a large variety of songbirds and other species that use the shelter of the riparian vegetation for cover, foraging and movement through the Reserve. These movement corridors provide opportunities for enhancing the biological diversity of the entire Reserve.

Tasks:

1. Restore riparian habitat along both forks of Los Berros Creek and the easterly drainages of Santa Lucia Canyon as they flow through the agricultural fields by providing a 25 to 50 foot separation between the existing stream bank and cultivated crops, and removing invasive non-natives. Recontouring the drainages may be necessary to ultimately restore the historic hydrology, as most streams passing through historically farmed areas have been straightened and are incised. As the Revegetation effort progresses, expand outward, increasing the width of riparian vegetation to as much as 100 feet, or more to its sustainable extent.
2. Expand existing riparian corridors to minimize the risk of nest parasitism by brown headed cowbirds.
3. Restore degraded riparian areas by planting native trees and shrubs along drainages to a width of 25 to 50 feet on each side.
4. Monitor bank erosion and sedimentation regularly, and address hydrological restoration needs. This might include modification of upstream land uses to minimize sedimentation, decreasing slopes of drainages, or restoration with deep-rooted native grasses to help retain soil moisture.

5. In the riparian forest on the Santa Lucia Management Unit, remove young Eucalyptus seedlings, gradually eliminate mature Eucalyptus trees, and replace them by encouraging recruitment of native riparian trees already present in this location: cottonwoods, willows, and wax myrtle. Plant additional individuals of these native species using cuttings from onsite.
6. Maintain habitat for red-legged frog by protecting suitable wetland habitat such as the old spring box in the riparian forest and marshes in the Santa Lucia Management Unit, and the creeks in the Encina Management Unit.
7. Encourage and work with homeowners in Vandenberg Village, Mission Hills, and Mesa Oaks to utilize landscaping techniques that retain soil on their properties and minimize sedimentation of the unnamed drainage on the west side of Vandenberg Village, and Davis and Meriam Creeks. Ask the County Public Works Department or Caltrans to help with installation and maintenance of sediment traps and pre-existing storm drains.
8. The existing oil extraction and maintenance operations of the oil company lands north of the Reserve appear to confine impacts to the drilling pads and roads themselves thereby minimizing adverse impacts to downstream drainages. Encourage installation of spill containment measures at the pads themselves that, in the event of an accident, would prevent oil and other substances from spilling into drainages on the Reserve.

4. Water Quality

Goal: ***Monitor the quality of water entering and leaving the Reserve. Improve water quality where necessary.***

Opportunities and Constraints:
As in so many areas of southern and central California, "water is life" and many organisms depend on it. On Burton Mesa Ecological Reserve, water has not been tested to determine its physical (sediment type, grain size) or chemical (organic or inorganic, or hazardous) qualities.

Tasks:

1. Conduct annual water quality sampling in the large marsh to understand the role water quality in sustaining wetland-dependent species.
2. Work with the County Public Works Department to install sediment traps in Vandenberg Village in order to minimize sedimentation of the unnamed drainage in the Vandenberg Unit and other drainages.
3. Monitor water quality in the streams as they enter and leave the Reserve.
4. Work with local Regional Water Quality Control Board staff to determine beneficial uses, watershed goals, and effective monitoring and testing techniques that could be implemented at the Reserve.

5. Non-Native Species and Nuisance Species

Goal: ***Minimize the presence and impact of non-native species.***

Opportunities and Constraints:
Non-native plants and animals threaten the native biological diversity on the Reserve. The challenges are to prioritize eradication efforts, to respond quickly to stop further invasions, and to reverse the trends of invasion.

Tasks:

1. Monitor for new non-native species that could present significant problems on the Reserve. Immediately remove highly invasive species that currently have few populations at the Reserve. For example *Brassica tournefortii* is transported by vehicle tires and is spreading rapidly in the Reserve, notably in the La Purisima Management Unit.
2. Monitor expansion of known invasions, such as veldt grass and pampas grass and map with a GPS.
3. Prohibit authorized vehicles from traveling off of internal Reserve roads. When authorized vehicles need to travel "off-road", tires must be washed in a safe area and the ground must be hard enough to avoid undue compaction. Prohibit authorized vehicles from driving on dirt roads for 48 hours after rainfall or when they are saturated.
4. Develop and implement a weed eradication plan, including detailed removal techniques for each unit of the Reserve. Conduct periodic surveys for noxious weeds using a GPS unit and the GIS. Identify locations of the highest priority species such as iceplant, African mustard, Australasian fireweed, veldt grass, pampas grass, Italian thistle and star thistle. Prioritize actions to stop new infestations of these and other highly invasive weeds. Coordinate with Santa Barbara County Weed Management Area in controlling non-natives.
5. Monitor roadsides and recreational trails for weeds, and take corrective action when found. Prevent creation of new or informal trails. Require equestrian patrols to use only designated trails.
6. Eliminate iceplant by covering with black plastic for intervals of three to eight weeks (depending on air temperature). Then remove the plastic and leave the dead iceplant in place. The dead iceplant can serve as mulch around native plants that are part of a habitat restoration effort.
7. Plant native species in and around the Eucalyptus forests and groves shown on the vegetation map so that the non-natives can be phased out. Remove all seedlings and saplings of these non-native trees. Consider the structural diversity that these tall non-natives provide for wildlife and balance their removal in consideration of existing trees and with the planting of tall native trees that can serve the same function. Remove non-native Monterey pine and Eucalyptus trees and seedlings. Retain the native Bishop pines scattered on the

Reserve. Conduct surveys of large groves of non-native trees prior to their removal to determine whether these trees provide important nesting, foraging and/or roosting habitat for wildlife, including bats.

8. Maintain and monitor restoration of the cultivated fields in order to prevent outbreaks of invasive exotics.
9. Restore disturbed and degraded areas with plants propagated from native species on the Reserve.
10. Work with the oil company that owns the land north of the Reserve to minimize establishment and expansion of non-native plants such as veldt grass, pampas grass, iceplant, and Eucalyptus on its land.
11. Work with Vandenberg Air Force Base to stop the spread of veldt grass and pampas grass.
12. Seek methods to minimize the spread of Argentine ants. For restoration projects, ensure that containerized plant materials are free of Argentine ants before allowing them to be planted in interior areas of the Reserve. Limit the use of year-round irrigation in revegetation efforts.
13. Enforce regulations that prohibit commercial and hobby bee keeping on the Reserve. Honey bees outcompete native bees and other native insects that pollinate native flowering plants on the Burton Mesa.
14. Monitor freshwater wetlands on the Reserve for introductions of non-native tiger salamanders and bullfrogs. Work with the U.S. Bureau of Prisons and the U.S. Air Force to eradicate breeding non-native tiger salamanders from the ponds due south of the vernal pond in the Vandenberg Management Unit. If native tiger salamanders are found on the Reserve, they could be outcompeted by the non-native salamanders. Meanwhile, these non-native salamanders pose a threat to existing native tiger salamander populations elsewhere in the region. This effort could entail 7 to 10 years of ongoing monitoring and trapping to ensure the successful eradication of non-native tiger salamanders from these wetlands.
15. Eradicate bullfrogs from the marshes on the Santa Lucia Unit where they are known to occur, and elsewhere on the Reserve if they are found.
16. Develop a routine inspection route to determine if feral pigs have colonized portions of the Reserve, and if so, develop a feral pig management plan. The plan should include monitoring, trapping, and removal of pigs if any are found and potentially a harvesting program, if found to be compatible with the population and location. It should also include fencing of sensitive resource areas with pig-proof fencing to help reduce the adverse affects that feral pigs could have on the Reserve.
17. Conduct surveys of the large freshwater marsh on the Santa Lucia Unit for non-native fishes and crustaceans. Design a program to control or eradicate these non-natives from this wetland if found. Develop a monitoring and maintenance program after the non-natives have been eliminated to prevent reintroductions.

6. Wildlife

Goal: Continue to study and learn about wildlife-habitat interactions on the Reserve.

Opportunities and Constraints:
Tremendous and unlimited opportunities exist for scientific learning on the Reserve. For example, little comprehensive study of wildlife resources has occurred on the Burton Mesa. In 2004, Condor surveyed the biological communities on the Reserve and on La Purisima State Historic Park. In total, 24 new animal species were recorded for the first time on the Burton Mesa or in the Purisima Hills. These findings add significant knowledge about the distribution of these species and the importance of Burton Mesa and the Ecological Reserve to the region. It is reasonable to expect that with time additional species information will be gained through study of the Reserve.

Tasks:

1. Monitor migrations of birds that use the Reserve through the use of Global Positioning Systems and the GIS.
2. Encourage local schools to participate in monitoring using visits to the Reserve, computers in the classroom and the Reserve's website.
3. Conduct surveys for bat roosts on the Reserve in suitable habitat, including structures. Conduct bat surveys prior to modification or demolition of any structures.
4. It is possible some native animals expected to breed on the Reserve may not be breeding due to deficiencies or threats in or near otherwise suitable habitats. Identify restoration needs and implement management measures as needed to restore these habitats if feasible.
5. Monitor for the intrusion of Argentine ants and if they are observed and implement ecologically sound management measures to eradicate them.
6. If feasible, study deer and mountain lion populations in order to understand how they are using the Reserve and surrounding lands, and to identify management measures for maintenance of balanced and healthy populations.
7. Monitor breeding of sensitive bird species in order to understand distribution and population trends. The results should be considered in a regional context that includes populations on nearby lands, such as Vandenberg Air Force Base and La Purisima Mission State Park. Implement management measures as needed to restore habitat and eliminate threats to these populations.
8. Monitor changes in wildlife populations and distributions in the habitats of the Reserve over time, and enter spatial data using the list.

7. Habitat Restoration

Goal: ***Restore degraded and disturbed areas to natural habitats that provide ecosystem functions for native plants and animals.***

Opportunities and Constraints:
Over 150 years of cultivated agriculture has occurred on roughly 500 acres at scattered locations throughout the Reserve. Successful habitat restoration of these areas will benefit the ecosystem and will require funding, careful planning, experimentation, monitoring and adaptive management.

The presence of a number of springs in the northwestern portion of the Santa Lucia Management Unit (in the vicinity of the large agricultural field), coupled with dense stands of riparian trees, freshwater marsh vegetation, and a tributary to Santa Lucia Creek bisecting the field suggest existence of a larger wetland ecosystem in the past. A more complete understanding of springs, seeps, and wetland vegetation of the area will guide restoration of the agricultural field as farming is phased out. Additionally, anecdotal information suggests that a saturated water table occurs in this area several feet below ground which would potentially influence habitat restoration efforts.

Tasks:

1. Prioritize sites within the Reserve for habitat restoration and consider the feasibility of restoration techniques and likelihood of success given current technology. Highest priority should be given to those sites that would improve ecological functions as follows:
2. Restore ecological function to disturbed areas adjacent to continuous habitat;
3. Minimize edge effects wherever possible;
4. Restore the integrity of intact communities by removing non-natives;
5. Minimize the risk of invasion by non-natives by restoring degraded areas to native vegetation.
6. When planning a restoration effort, identify the desired "ultimate" community (for example oak woodland or Burton Mesa chaparral), but "restore from the ground up", by starting with colonizers, and allowing the restoration to occur gradually, over decades. Emphasize restoring the health of the native soil community and begin by restoring the first phases, rather than the later or "final" phases of seral succession.
7. Create restoration plans that encourage regeneration of native plants. Plan for experimentation successes and failures, and intensive weed management.
8. Restoration plans should include goals for vegetation and wildlife, plans regarding soil, water, seed and/or plant source, propagation technique, cultural resources, cost, funding, monitoring, adjustments, and a schedule.

Ensure that restoration plans address the potential for damage to new vegetation from native herbivore.

9. Study the soil community characteristics (including mysorrhizae and invertebrate populations) in adjacent undisturbed habitat prior to beginning the restoration efforts. This will provide understanding of the soil community characteristics that may be required for a successful restoration effort.
10. Consider the availability of water and soil types in restoration areas. For restoration of the cultivated agricultural fields, there is probably water only a short distance beneath the surface that will facilitate restoration and influence habitat types appropriate for restoration. However, additional water may be necessary for intial establishment. If intial tests show that water is limiting, explore short-term options such as trapping surface runoff from springs, or drilling a shallow well. Use caution in bringing in unseasonal water sources to restoration sites which could allow establishment of Argentine ants.
11. Revegetate only with native plants from seeds and cuttings collected on the Burton Mesa in order to protect the genetic integrity of plant populations.
12. Develop a working relationship with one or two of the commercial nurseries near the Reserve that specialize in propagation of native plants.
13. Develop and implement long-term restoration plans for agricultural fields on the Reserve. These may require modifications to existing hydrology, and structural changes, such as recontouring the banks of the drainages or recreating natural stream meanders and shallow benches to restore sustainable habitat. There are two agricultural fields in the La Purisima Management Unit, one in the Encina Management Unit at the intersection of Rucker Road and Harris Grade, and three in the Santa Lucia Unit. Restore the agricultural fields to a variety of sustainable habitats per field (such as riparian scrub, oak woodland, and grasslands) as conditions dictate to benefit of a diversity of sensitive wildlife species.
14. Retain at least some of the grasslands on the Reserve for the benefit of sensitive animals such as American badger, western spadefoot, burrowing owl, white-tailed kite, loggerhead shrike, and northern harrier. Strategically timed prescribed fire may be an appropriate management tool to reduce cover of non-native annual grasses and expand cover of native grassland species.
15. Consider modification of the banks of the stream channels in order to increase the amount of wetland and riparian habitat, benefiting yellow warbler, Swainson's thrush, and others.
16. Restore fire breaks, control lines and staging areas immediately following wildfire suppression events.

8. Monitoring

Goal: *Improve understanding of ecosystem processes and trends, and evaluate the implementation, effectiveness and validity of management actions on the Reserve through*

an effective monitoring program. Use the information obtained to adjust management strategies as appropriate.

Opportunities and Constraints:
Future research is likely to result in new understanding of ecosystem processes on the Burton Mesa and improved management of the landscape.

Tasks:

1. Inventory and monitor plant and animal populations using the GIS, including both rare and common species, in order to understand changes in the ecosystem. Monitoring will enable response to changes by evaluating the effectiveness of management techniques and considering various management strategies.
2. Conduct further vegetation assessments using the CNPS methodology to understand the vegetation of the Burton Mesa and classify it to the association level. Identify thresholds for detecting change and conduct periodic vegetation surveys (i.e. every 5 to 10 years) with particular attention to succession following disturbance events, such as fire. Permanent vegetation plots could be established to allow quantitative analysis of vegetation changes and species composition over time. Existing data should also be used as a basis for further investigation. Permanent plots in certain areas to track populations can provide valuable information on recruitment, survival, and mortality of common as well as rare, threatened and endangered species.
3. Encourage long-term studies of the biology of rare plant species on the Burton Mesa, as they may result in greater understanding of rare plant distribution, life history and management needs.
4. Monitor for hybridization of native and non-native plants. Refer to La Purisima Mission Ecosystem Characterization (Gevirtz et. al 2005) for further information.

9. Future Surveys and Research

Goal: ***Fill gaps in the existing body of knowledge about the Reserve and the species it supports. Encourage and support scientific research by universities and other institutions, and educational research programs by and for local elementary, middle, and high schools.***

Opportunities and Constraints:
Scientific research will contribute to the knowledge necessary to evaluate and adopt new land management techniques over time.

Task 1. Support Scientific Research and Environmental Education Programs:

a) Support scientific research and environmental education. Local elementary schools, Cabrillo High School, Hancock College, UCSB, Cal State San Luis Obispo, Santa Barbara Botanic Garden, Santa Barbara Museum of Natural History, and the Maritime Chaparral Association are possible cooperators.

b) Periodically solicit assistance from appropriate educational institutions and key contacts in conducting needed research to encourage studies that will help the Department achieve its protection and management goals.

Task 2. Conduct High Priority Surveys

a) **Invertebrate surveys** within upland and wetland habitats should be conducted, as the invertebrate fauna is largely unknown. Of note are ant species (such as Argentine ants) as these have a significant negative impact on native ant populations and the population of California horned lizards, western whiptails, and many species of arthropods. Surveys for additional populations of the Small Blue Lycanid Butterfly (*Philotiella speciosa* ssp. *purisima*) are urgently needed. Surveys of pollinating insects should be conducted to identify pollination relationships in the flora of the Burton Mesa and Purisima Hills.

b) **Non-Native Plant Species Surveys.** A thorough survey for non-native plants within the Reserve should be conducted. This would provide the basis for developing a weed management and removal plan, which would prioritize weeds for removal, outline weed removal techniques, and monitor spread and progress in eradication.

c) **Fall and winter bird surveys** should be conducted to assess the importance of the Reserve to migratory and wintering birds and to supplement spring and summer surveys done in 2004 for this Land Management Plan.

d) **Bat Roost Surveys.** Structures, including the two barns, caves and other suitable habitats for bat roosts on the Reserve should be surveyed. Any areas found to support roosting bats should be protected and periodically monitored.

e) **Rare Plant Monitoring.** Populations of rare plants, including *Chorizanthe rectispina, Cordylanthus rigidus* ssp. *littoralis, Delphinium parryi ssp. Blochmaniae, Scrophularia atrata,* and *Ancistrocarphus keilii* should be inventoried and monitored (See Table 23). These are USFWS Species of Concern and CNPS list 1B species, except for *A. keilii*. Only recently described by Morefield (2004), this species is probably the rarest flowering plant in Santa Barbara County (D. Wilken *pers. comm*. 2005), and is known only from two occurrences in the world. It has not yet been found on the Reserve, but ecological data suggest it has potential for occurring there (D. Wilken *pers. comm.* 2005). The distribution of *Chorizanthe rectispina* is limited to only two known occurrences in the County, and the distribution of *Scrophularia atrata* is limited as well and should be monitored. *Delphinium parryi* ssp. *blochmaniae* is present in low numbers within the Reserve and should be monitored semi-annually for distribution and population changes. Ongoing botanical surveys may add other rare plants to

the flora of the Reserve; and any additional rare plants should be added to the monitoring list. Any decline of the more widespread sensitive taxa should be monitored and potential causes investigated and solutions proposed, such as habitat restoration.

f) **Rare Annual Plant Surveys.** Additional rare plant surveys should be conducted in the spring of good annual wildflower years and tracked using the GIS.

g) **Long-eared Owl and Burrowing Owl Surveys.** Focused surveys for long-eared owls and burrowing owls should be conducted. These species may occur on the Reserve where there is suitable habitat, but they have not been detected. If they are found on the Reserve, consider land management strategies to support their continued presence.

h) **Desert Woodrat Live-Trapping.** Focus trapping for desert woodrats in habitats that appear suitable for this species: chaparral and coastal scrub with cover elements such as cactus patches[7], rocky areas, and even dumped concrete and debris. Data collected on important habitat elements for desert woodrats would assist protection and management of this species.

i) **Vernal pool fairy shrimp.** Conduct focused surveys of ephemeral wetlands to determine if vernal pool fairy shrimp occur in other locations on the Reserve.

Task 3. Conduct Medium Priority Surveys as time and budget permit.

a) **Focused surveys for Bell's sage sparrow and rufous-crowned sparrow.** Conduct taped playback surveys focused on chaparral and coastal scrub to determine distribution, density and habitat use of these species for their protection and management. These data would inform managers of the consequences of habitat management that may favor one type of shrub-dominated vegetation over another.

b) **Water Quality testing of the Creeks and Drainages.** Water quality testing of water entering the Reserve and leaving the Reserve may yield useful information.

Task 4. Conduct Low Priority Surveys

a) **Bat Surveys (presence/absence).** Conduct a literature search and contact VAFB biologists regarding bat data collected on base. Conduct general bat surveys near the marsh and at points along the creeks and unnamed drainages. These surveys are of less importance than surveys for bat roosts because they are unlikely to yield information that is different from the data collected on VAFB, although they would provide useful information about use of non-roost habitats on the Reserve.

[7] There are several cactus patches on the Reserve. Two examples include on the trail just west of Cabrillo High School, and along Davis Creek near Clubhouse Drive.

b) **Deer herd surveys.** Surveys of the Santa Barbara County deer herd could be conducted to update population estimates and gain information about deer habitat use on the Reserve. It would be interesting to see how the herd size changes over time, particularly if there are changes in mountain lion populations, and/or changes in land use nearby. Such an effort should be coordinated with Vandenberg Air Force Base and the DFG Deer program.

c) **Large Carnivores.** A focused study using trail master photographic stations could yield some understanding of movements of large animals in the region.

C. Public Use Element

1. Compatible Public Uses

Goal: ***Support compatible wildlife dependent public uses.***

Opportunities and Constraints:

The public plays an integral role in the stewardship of Burton Mesa Ecological Reserve. As users, and in some cases neighbors of the reserve, the public can contribute and derive a great deal from the Reserve, with involvement in its protection and by learning about its ecology and enjoying its scenic beauty. The key to maintaining Burton Mesa Ecological Reserve for all to enjoy is balancing the many demands for use of the area with the primary importance of protecting the sensitive habitats, plants and animals of the Reserve.

Recreational demands of the local and regional population are continuously increasing, some of which are inappropriate on the Ecological Reserve. The Department is mandated to first protect wildlife and the habitat upon which it depends, and secondly, to provide compatible, wildlife-dependent use for enjoyment by the public. The Department practices an adaptive management strategy that allows for continual monitoring, and if warranted, provides the flexibility to change uses and management techniques. The Department strives to obtain the best scientific information as the basis to make sound decisions. In instances where specific scientific knowledge is lacking, all decisions will be made to maximize protection of resources. Compatible uses are determined through an iterative process whereby the Department evaluates not only scientific literature and site-specific data, but also by assessing site security, enforcement, safety, and management implications of uses. The Department also tries to incorporate the desires of the public by conducting public meetings, soliciting public involvement in the regulatory and management planning processes and determining how they mesh with mandates and other specific issues.

Tasks:

1. Encourage compatible wildlife-dependent uses by the public that are consistent with the Department's regulations regarding Ecological Reserves.
2. Encourage, facilitate, and invest in a public stewardship program that involves docents and volunteers.
3. Prohibit motorized vehicles, bicycles, and horses, implemented through fencing, signage, education and enforcement of regulations.
4. Prohibit camping, unauthorized commercial activities, and bee keeping, implemented through signage, education and enforcement of regulations.
5. Consider needs for visitor facilities such as parking lots, restrooms, or a visitor center at the Reserve. Determine the feasibility, funding, environmental analysis and review, and construction needs as well as operations and maintenance for any amenity determined appropriate.
6. Consider public involvement in reserve management activities that protect sensitive species, maintain healthy and sustainable populations of plants and animals and restore habitats in the Reserve.
7. Provide opportunities for public involvement in Fish and Game land management activities such as weed removal, planting native plants, biological monitoring, trail maintenance, and creating and maintaining a web site specifically for the Reserve to develop a community of local land stewards.
8. Develop a website or webpage with information on Reserve location, access points and compatible uses, ecological resources, interpretive elements and trails. Include a contact person's name, phone number and email at the Department for comments and suggestions on compatible uses of the Reserve.
9. Conduct periodic review of public uses on the Reserve. Evaluate rules, regulations, guidelines and materials to ensure compatibility of public uses and protect the Reserve.

2. Public Education

Goal: ***Educate the public and provide opportunities for learning about the ecosystem on the Burton Mesa.***

Opportunities and Constraints:
Being so close to the urban boundary, the Reserve is readily accessible, providing an outdoor classroom just waiting to be explored. Educational activities may be expensive in the short run, but in the long run they will provide long term advocates for protection and land stewardship.

Tasks:

1. Support environmental education within the Reserve by development and distribution of interpretive materials.

2. Reach out to schools and groups in the community to foster education and stewardship. Consider adopting some of the methods used to promote public awareness and participation by the U.S. Bureau of Land Management (BLM) Ford Ord school planting days, weed pulling volunteer corps, community planting and trail restoration days accompanied by live music and food, etc.
3. Establish a volunteer program to conduct educational tours and perform "workday"events.
4. Encourage local elementary schools, middle schools, and high schools to monitor bird migration on the Reserve's website, in partnership with a scientific organization that is monitoring migratory birds.
5. Provide local school groups access to the riparian habitat of Davis Creek during appropriate times of the year to avoid impacts to sensitive species. The presence of the road along Davis Creek between Highway 1 and Burton Mesa Boulevard, provides the Reserve's best access for school groups to visit and learn about riparian systems in a safe and quiet environment.

3. Hunting

Goal: Identify and evaluate potential opportunities to allow hunting on the reserve.

Opportunities and Constraints:
The State has proposed removal of an existing special regulation that allows for upland game hunting on the Reserve in designated areas. Through the Land Management Planning effort, including biological inventory and public access components, the Department has determined that there are insufficient areas to allow a quality hunting experience on the Reserve. Baseline species surveys and habitat assessment show lack of suitable habitat and insufficient upland game populations to adequately support a hunting program. Additionally, it was learned through this process that access to support a safe hunting program is limited. The restrictions placed on the property by oil company easements and above-ground pipelines, the adjacency of the Air Force Base and Prison, and the close proximity to residential and school properties caused the Department to reassess the special regulation that allowed for upland game hunting in designated areas. No hunting areas have ever been designated under that regulation, so no change in actual use will occur with this amendment. The property will be monitored and managed adaptively and will allow for future regulatory changes as conditions change or improve.

Tasks:

1. Identify and evaluate areas, species and seasons for which hunting may be appropriate on the Reserve.
2. Amend regulations as necessary to allow hunting as deemed appropriate.
3. Identify and post hunting zones, identify species legal to take.
4. Monitor populations of targeted species.

5. Identify potential conflicts with other recreational uses and resolve such conflicts prior to allowing hunting.
6. Inform the public of times and locations where hunting is allowed and all other restrictions and regulations.
7. Monitor or supervise hunting opportunities as needed.
8. Coordinate with VAFB on their hunting programs and potentially allow for a consolidated, jointly operated program.
9. Evaluate hunting program and regulations, recommend warranted changes through Title 14 process (i.e. potentially add a feral pig harvest if pig populations increase on the Reserve.)

4. Public Safety

Goal: ***Make the public aware of potential risks in order to encourage safe use of the Reserve.***

Opportunities and Constraints:
Risks are inherent in any physical activity. They should not preclude public enjoyment of the Reserve, but people should be aware of the environment around them.

Tasks:

1. Identify areas where warning signs are needed.
2. Post warning signs to identify potential hazards, such as along stream channels, erosive slopes, and the Point Pedernales Oil Pipeline.
3. If feasible, limit public access near oil field equipment.
4. Restrict access to unsafe areas. Suggested locations include:
    a) The unnamed drainage in the Vandenberg Management Unit.
    b) The deeply incised unnamed drainage in the Encina Management Unit between Providence Landing and Highway 1.
    c) The steep slopes in the Purisima Hills Management Unit where a road or trail is evident in older air photographs.
    d) Along the Point Pedernales oil pipeline corridor in the Vandenberg, Santa Lucia, and Encina Management Units.

5. Coordination with Adjacent Land Owners and Neighbors

Goal: ***Maintain relationships with neighbors to address management issues.***

Opportunities and Constraints:
Maintaining constructive working relationships with the Reserve's neighbors is important and will require good communication.

Tasks:

1. Meet or correspond with adjacent landowners and interests as needed to maintain communication about the management needs of the Reserve, access needs of adjacent landowners, and to convey useful information regarding activities, potential disturbances and impacts within the Reserve. Key entities that should be included are: Caltrans, La Purisima Mission State Park, Vandenberg Air Force Base, Plains Exploration and Production Company, VVCSD, MHCSD, County Fire and Sheriff Departments, Cabrillo High School, Vandenberg Village Little League Association and residential neighbors. Notices could also be posted in the Santa Barbara News Press and the Lompoc Record.
2. Identify opportunities to coordinate with private residential neighbors. Develop a mechanism whereby adjacent home owners can offer management suggestions and ideas for improvement to appropriate DFG staff.
3. Develop and update as needed a map of designated access points (see Section 4 "Access" and Figure 19) to reduce unauthorized access from adjacent back yards. This is necessary to avoid undue habitat destruction and unplanned trails.
4. Consult with Plains Exploration and Production Company or its successors prior to changing land uses near their facilities. (See Easements and Restrictions Section for further detail.)

D. Cultural Resources Element

1. Protection

Goal: Establish a clear understanding of and protect the cultural resources within the Reserve.

Tasks:

1. Conduct archaeological surveys of any areas proposed for new development (structures, roads, fences) or management activities that have not previously been surveyed as shown in Figure 15. Surveys may be phased, such as:
2. *Higher priority zones* include those proposed for fuel breaks that have not already been surveyed, more intensive recreational use, and other areas

proposed for construction of structures, fencing, and habitat restoration that will involve ground disturbance.

3. *Medium priority zones* would include those somewhat elevated areas along the periphery of floodplains of major drainages where a higher concentration of cultural resources is expected to occur. Areas around springs and other sources of fresh water are also assigned this priority.
4. *Lower priority zones* would be all other areas not included within medium or high priority zones.
5. Conduct archaeological surveys immediately after wildfires and protect any sites that may be discovered.
6. Conduct research to more precisely determine the alignment of the historical El Camino Real within the Reserve and develop a mechanism to adequately protect and interpret this historical road.
7. Test and evaluate archaeological and historical sites as required.
8. Evaluate the historical significance of existing barns and other structures within the Reserve prior to their removal or alteration.

2. Compatible Uses

Goal: ***Evaluate requests by Native Americans for use of the reserve for activities such as gathering native plant materials for cultural purposes.***

Opportunities and Constraints:
Humans have been present in the central coast area for at least 9,000 years. It is important to consider possibilities for cultural uses of the Reserve while ensuring protection of the sensitive resources.

Tasks:

1. Work with native peoples requesting access to determine the purpose and need for access and/or collections within the Reserve based on applicable laws and treaties related to tribal use of State Properties.
2. Develop access plans and issue use permits for native peoples that are compatible with the goals of the Land Management Plan. Any authorization for access would identify species, limits, locations, seasons, and include standard liability clauses.

E. Commercial Lease Element

Opportunities and Constraints: *While farming has probably been part of the Burton Mesa for more than 100 years, the land is now owned by the State of California, and managed as an ecological reserve for its natural resource values. Restoration of cultivated fields to native habitats is consistent with this objective.*

Goal: Phase out all commercial leases by 2015. Remove cattle by 2007.

Tasks:

1. Develop a detailed plan for phasing out the commercial leases and restoring habitat to the agricultural fields. Initiate the habitat restoration transition by 2007.

2. Remove cattle from the Reserve, except as needed for management purposes, by 2007.

3. Modify lease terms to assist the transition from agriculture to habitat. Begin the transition to restored habitat by 2007, with a goal of initiating restoration of all agricultural fields by 2015.

4. Monitor restoration areas for invasion of non-native species and implement control measures.

F. Fire Management Element

The chaparral and other habitats on the Reserve are resilient to wildfire and the plants within them have a variety of ways to respond successfully to these events where they occur at a frequency and intensity consistent with natural fire cycles. Although three large fires occurred between 1990 and 2000 and burned portions of the Reserve, more than 3,400 acres of the Reserve have not burned in more than 70 years. The age of vegetation alone does not make it more susceptible to a wildfire event - many factors come into play. Wind, moisture conditions, lightning strikes, or increased urban influences all have an affect on the potential for fire. Hundreds of homes line the edges of the Reserve and hundreds more are nearby. It is challenging to design a Fire Management Element that provides for public safety and at the same time protects the numerous special status plants and animals that occur in the Reserve. Some of these rare plants are chaparral dominants and are important biological resources but also sometimes viewed as a fire hazard by fire managers. It is the preparation of an adequate strategy and continued coordination that will make a difference in the event of a wildfire.

Goal: ***Contribute to the safety of residents living near the Reserve by coordinating with the Santa Barbara County Fire Department, enforcement agencies, local jurisdictions and adjacent large landowners.***

Opportunities and Constraints:

Tasks:

1. Meet at least annually with the Fire Department to discuss fire-related issues relevant to the Reserve, including vegetation management, resources, current contact information and procedures.

2. Implement procedures to notify enforcement agencies of chronic dumping of flammable yard wastes and debris into the Reserve and cite individuals responsible.

Goal: ***Ensure that new development projects adjacent to the Reserve are reviewed during CEQA by Department staff and that project documents address fuel reduction needs and requirements entirely outside Reserve lands. Work with local jurisdictions and fire departments to ensure that project proponents are knowledgeable of the Reserve and that State property cannot be impacted by future developments for any purpose.***

Opportunities and Constraints:

Santa Barbara County Land Use Element policies require new developments adjacent to and near the Reserve to incorporate fuel breaks or fuel management zones on private land rather than on the Reserve (Santa Barbara County, 1999). The County also requires some development projects adjacent to the Reserve and other wildland areas to prepare a Fire and Vegetation Management Plan. (See Burton and Gevirtz, 2003 for an example).

Tasks:

1. Assign appropriate Department staff to review and comment on projects proposed in the vicinity of and adjacent to the Reserve.

2. Proactively patrol the Reserve boundaries looking for encroachments, adjacent grading and other potential impacts that may or may not be permitted appropriately.

Goal: ***Encourage the implementation of policies and efforts at the local, state and federal levels that reduce fire risks at individual home sites.***

Opportunities and Constraints:

Protection from fire requires vigilant maintenance by homeowners of their yards, removal of flammable landscaping within their property lines and, as is feasible, installation of structural improvements, such as double-paned glass and fire-safe roofs. Any new structures constructed should have adequate space between Reserve vegetation and the structure.

Keeping homes from being ignited during a wildfire is dependent not only upon the distance from flames, but also the amount of time that flames are burning next to homes (Cohen 1999). The length of burn time is dependent on fuel. If a fire produces heat sufficient to ignite an outside wall of a house, but the flame duration is less than that required for ignition, then ignition will not occur (Cohen 1999). Studies of home losses in the 1961 Belair-Brentwood Fire in Los Angeles by Stanford Research Institute and in the 1990 Painted Cave Fire in Santa Barbara by the University of California, Berkeley found a 95% survival of homes with nonflammable roofs that had a clearance of 10 to 18 meters (33 to 59 feet) in the Belair-Brentwood Fire, and 86% home survival with nonflammable roofs and a clearance of 10 meters (33 feet) or more in the Painted Cave Fire (Howard et. al 1973, Foote and Gilless 1996). These studies show that keeping the first 35 to 60 feet surrounding the home free of flammable vegetation is the most important strategy in protecting life and property (Cohen 1999).

The second most important strategy to protect homes from wildfire in adjacent wildlands is the type of roofing used on the home. The proper type of roof (Class A) can add significantly to the safety from flames that are adjacent to the structure and "firebrands". Firebrands (flaming debris that are lofted in to the air and transported by wind during wildfires) are also a principal ignition factor for homes next to wildlands. Highly ignitable homes can ignite during wildland fires without fire next to or near the structure due to firebrands coming from a distance of 1 kilometer (0.62 mile) or more. Eucalyptus is often a source of firebrands. During severe fires, houses with flammable roofs often ignite and burn without the surrounding vegetation burning, suggesting that homes can be more flammable than the surrounding vegetation. For example, during the 1991 fires in Spokane, Washington, unpublished video documented houses with flammable roofs igniting without the adjacent vegetation already burning (Cohen 1999, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, Montana). Cohen concludes "although firebrands may be lofted over considerable distances to ignite homes, a home's materials and design and its adjacent flammables largely determine the firebrand ignition potential."

Measures that can be taken by private homeowners to increase their personal safety include replacing wood shingle roofs with Class A roofs, closing gaps in the roofing that could be a conduit for fire to travel up the eaves and reach inside the structure, insulation between the framing of the walls with a material that fills the spaces completely, installing interior sprinklers, and maintaining fire-resistant or irrigated landscaping 30 to 35 feet around the home, while eliminating accumulation of dead woody debris and other combustible materials in yards.

Tasks:

1. Involve homeowners, insurance companies, agencies and large landowners in Fire Safe Councils so that defensible space around homes is maintained.
2. Department staff should coordinate with Fire Safe Councils and community groups in identifying problem areas and solutions.
3. The Department should encourage local entities or communities to apply for government grants for defensible space projects.

Goal: ***Prohibit the use of prescribed fire for the purposes of reducing fuel loads. Allow use of controlled burns for small scale restoration projects (e.g.: suppression of annual grasses, stimulation of chaparral seed bank for restoration projects).***

Opportunities and Constraints:

No prescribed burns have been conducted on the Reserve. However, several small prescribed burns have occurred on La Purisima State Historic Park and several larger ones have been conducted on Vandenberg Air Force Base. Research on the use of prescribed fires for grassland restoration has occurred on Santa Rosa Plateau Ecological Reserve in Riverside County and at various State Parks. The Nature Conservancy has been successful in spring burning to eliminate non-native seed banks as a precursor to full restoration efforts.

Tasks:

1. Determine the feasibility and need for restoration involving prescribed burning on the Reserve.

2. Conduct literature reviews and research on methodologies, timing, expected results and cost.

3. Request assistance from Fire agencies and potentially work small scale burns into training exercises for both Fire and Wildlife agency personnel.

Goal: ***Implement this Wildfire Response Plan which includes pre-fire planning, during-fire response implementation and post-fire remediation and monitoring.***

Opportunities and Constraints:

In 1994 the California State Board of Forestry and the California Fish and Game Commission adopted a "Joint Policy on Pre, During, and Post Fire Activities and Wildlife Habitat Prefire" (Fish and Game Code, Fish and Game Commission Policies, p 543-546). The Joint Policy describes California's vegetation and multiple measures that both the California Department of Forestry and Fire Protection (CDF) and the Department of Fish and Game should take to protect natural resources as well as the top priority of protecting lives and property. Because CDF has a structural arrangement and agreement that places the County of Santa Barbara Fire Department (County Fire) as the lead fire agency in Santa Barbara County (considered a "contract county"), the Department of Fish and Game will coordinate with County Fire as it would with CDF. This coordination entails annual meetings, sharing of information and contacts, and consultation and coordination on fire-related issues pertaining to Burton Mesa Ecological Reserve.

1. Tasks - Before Fire:

1. Implement and maintain a 100-foot fuel management zone around the perimeter of the Reserve where existing homes are located adjacent to the Reserve boundary. Use the "Menu of Fuel Treatment Methods" provided in the Fuel Management Plan. Do

not use mechanical means to reduce fuel loads and do not disturb the soil surface; use only hand held manual and power tools instead.

2. Encourage neighboring home owners to have fire safe roofs, eliminate landscaping species that have moderate to high flammability (e.g.: pines, eucalyptus, pampass grass), and have a minimum of 30 feet of irrigated drought resistant landscaping around their homes. Encourage the County and insurance companies serving the area to support a roof retrofit program to maximize fire safety.

3. Encourage the County and the City to require newly proposed residential developments to incorporate fuel breaks on private property rather than on the Reserve. These fuel breaks would need to be included in the proposed project's development footprint, analyzed during environmental review and mitigated per development guidelines.

4. Work with County Fire Department personnel on establishing appropriate access to the Reserve for suppression activities at specific locations. In most cases, these will be located on existing roads or trails, existing previously treated fuel break areas, existing vehicle easements, or other disturbed locations (i.e. adjacent athletic fields, agricultural fields). Vehicular access for four wheel drive vehicles will be provided by a basic roadbed of existing soils, on existing grade.

5. Work with County Fire on strategically locating staging areas for equipment and personnel that can be established without causing irreparable damage to the natural environment. Staging areas should be placed where logistically appropriate for Fire personnel, along a paved or well graded dirt road, within an open area and if possible, in an area where electrical and water supplies are present or close by. Agricultural or disturbed fields within the Reserve may be appropriate, as may be adjacent school fields, or existing parking lots.

6. Prepare and provide to County Fire Department a Wildfire Response Plan Map (Figure 32) that includes the following elements:

    - Roads accessible by fire fighting vehicles, with locations of locked gates or other barriers that may cause access problems. (Installation of County Fire locks is appropriate throughout the Reserve.)
    - Existing roads or fuel breaks that can be used to light backfires.
    - Sensitive biological and cultural resources, including streams and wetlands that should be avoided by fire suppression vehicles.
    - Approved equipment and/or personnel staging areas.
    - Location of Fuel Management Zones that have been installed.
    - Pre-Identified, logical, control perimeters based on existing roads or Management Units of the Reserve.

2. Tasks – Wildfire Response During a Fire:

Response during a wildfire depends on the conditions of each specific fire. Measures identified in Pre-Planning Sessions and documents should be implemented to the maximum extent possible. During a Wildfire event, the following recommendations should be applied:

1. Protection of life and property is the highest priority when responding to fire, with careful consideration given to the natural resources present on the site.
2. Notification of appropriate DFG and local Fire Department staff will ensure the pre-planning measures are available to the Incident Commander (IC). Certain Department biologists have been trained by CDF to serve the role of Resource Specialist or Agency Representative through the Incident Command System (ICS) during a fire. Their role would be to provide the Wildfire Response Plan, maps of the property, specifics on resources, and information on access (logistics) to the IC.
3. Attempt to keep wildfires from expanding beyond the identified Control Unit or Management Unit in which they originated, or beyond containment areas identified in the Wildfire Response Plan.
4. Consolidate fire fighting staging areas or incident command centers with adjacent land owners (i.e. Vandenberg Air Force Base, Bureau of Prisons, the Army, La Purisima State Park, and the oil company). If possible, locate such areas outside the reserve.
5. If possible, fire fighting defense areas within the Reserve should be located along roads, in agricultural fields and in annual or ruderal grasslands.
6. Use low impact methods to suppress fire, such as hand crews, water drops, and strategic planning that minimizes mechanical techniques.
7. Avoid using bulldozers in the vicinity of known cultural areas, and in sensitive biological areas, especially in riparian and wetland habitats. When necessary to construct fire lines within riparian areas, construct them as close to a 90-degree angle to the riparian zone as feasible. This will aid in easier, more efficient remediation and reduce the likelihood of erosion.
8. Avoid cutting of mature oak trees except when they pose a direct threat to fire line integrity or the safety of firefighters and the public.
9. Avoid dropping retardant within 200 feet of any riparian and wetland areas.
10. When cutting vegetation during suppression, avoid stock-piling it in natural habitat areas. Instead, place it along roads or previously disturbed areas, or haul off site.

3. Tasks - After Fire:

1. After fire, if slopes appear susceptible to erosion, place rice straw waddels or other water diversion structures perpendicular to the slopes to direct rain water off the slopes and minimize erosion.

2. Do not hydroseed steep slopes or any other areas after a fire due to the risk of introducing non-native seed and impairing natural recovery. There are probably thousands of native seeds already present in the soil that are likely to germinate and protect the hillsides naturally. Refer to the California Native Plant Society's policy opposing the practice of artificially seeding undisturbed burned watersheds (California Native Plant Society 1995).
3. After fire, quickly establish a weed response team to identify potential areas of weed invasion and implement prevention and control measures.
4. Work with other agencies to ensure appropriate and efficient post fire remediation. DFG staff assigned to the fire through the ICS should continue to play a role in the remediation effort by ensuring suppression resources do not leave the area until remediation is adequate and complete.
5. Rehabilitate fire lines and bladed areas disturbed by mechanical activity by ripping swales compacted by equipment, spreading bulldozer berms, reshaping the control lines to match natural contours, installing water bars, mulching (using only material collected at the Reserve), making necessary road repairs, protecting archaeological sites, maintaining or restoring natural drainage patterns, and other activities needed to restore the area.
6. Remove all flagging, litter and equipment.
7. Install temporary fencing or erect barriers to prevent unauthorized motor vehicle entry into burned sites.
8. Identify burned hazard trees near hiking trails which may pose a threat to public safety. If these trees need to be felled, leave them in place, but out of the way, to provide habitat.
9. Conduct a post-incident analysis to apply knowledge gained to pre-fire planning for the next event.
10. Conduct a post-fire briefing with CDF/County Fire, pursuant to the Joint Policy on Fire.

***Goal**: Implement the Burton Mesa Fuel Management Plan (FMP) as described in this document and illustrated in Figure 32). Wildfires will be suppressed in order to protect life and property. Measures on the Reserve, including the Wildfire Response Plan discussed above and Fuel Management Zones proposed here, will help to slow fires enough to aid fire suppression personnel in the protection of lives and property.*

Opportunities and Constraints:

The discussion below offers some of the rationale behind the Department's Fuel Management Plan which follows.

"Fuel Break" vs "Fuel Management Zones"

A fuel break is a strategically located, pre-constructed control line where vegetation is manipulated to produce a permanent area of low volume fuel and provide access for fire suppression activities. They alone are not effective barriers to fire advancement in severe

fire weather conditions (Omi 1977, Dunn and Piirto 1987), but they do provide safe access to suppress fires in more moderate conditions (Anonymous 1962, Davis 1965, Salazar and González-Caban 1987) and may contribute to reducing the size of fires in moderate conditions (Moritz 1997). Herbaceous fuels (also known as "flashy fuels") that grow where shrubs once grew also pose an additional fire hazard in that they are dry much of the year and increase the chances for movement of fire from the urban to the wildland environment (Keeley 2002). Fuel breaks are nearly always eventually dominated by non-native herbaceous species, and have the potential to introduce exotics into wildland areas (Keeley 2002). Further, reduced fuels in fuel breaks result in lower fire intensities that exacerbate the invasive problem by increasing the survivorship of exotic seed banks (Keeley 2002). Fuel breaks also alter the natural dispersion patterns of small mammals (Stavert 1976), and may negatively affect arthropod diversity (Longcore 2003).

A Fuel Management Zone (FMZ) is similar to a fuel break in that it is also a strategically located area where vegetation is altered, resulting in a low volume of fuels to provide increased protection to structures at the urban/wildland interface. Where a FMZ differs from a fuel break is that a FMZ can be manipulated gradually and with a variety of treatments to provide a transition from purely natural habitat to fully urban. The Department generally believes a FMZ can provide the same benefits as a fuel break without the negative long lasting affects to the natural habitat. At Burton Mesa, the Department has devised a strategy that should increase protection of the biological and cultural resources in the event of a wildfire, while providing increased protection of life and property.

Tasks:

1. Annually review the FMP, and update as needed. Prior to each fire season, prioritize which management units and which segments within them are in need of fuel management work.

2. Conduct surveys for sensitive species prior to removal of vegetation.

3. Coordinate with homeowners in the vicinity of the segments to be treated so they know the work is being done to enhance protection of their homes from a potential wildfire situation.

BURTON MESA FUEL MANAGEMENT PLAN

V. BURTON MESA FUEL MANAGEMENT PLAN 265

A. Introduction 265

B. Project Description 265

1. Shrubs: 265
2. Subshrubs/Herbaceous Vegetation: 266
3. Coast Live Oaks 266

C. Timing of Installation 266

D. Menu of Treatment Methods 266

1. Yard Waste Removal 266
2. Removal of Flammable Invasive Vegetation 267
3. Mowing Annual Herbaceous Growth 267
4. Removal of Decadent/Dead Shrubs 267
5. Chipped Material 267
6. Pruning ("Uplifting") of Coast Live Oaks 268
7. Thinning Shrubs and Subshrubs 268
8. Pile Burning 268
9. General Weed Control 268

E. Implementation Practices 269

V. BURTON MESA FUEL MANAGEMENT PLAN

A. Introduction

This Fuel Management Plan has been written and prepared by the Department of Fish and Game who consulted with the Santa Barbara County Fire Department during its development. This plan has been prepared in order to address the wildland-urban interface issues at the Burton Mesa Ecological Reserve (Reserve). It is intended to analyze options and suggest measures to increase the safety of the Reserve and the hundreds of homes immediately adjacent to the vegetation located within the Reserve. The Department intends to create and maintain a fuel management zone, subject to available funding, that is consistent with the following project description.

B. Project Description

Figure 32 shows the 18 fuel management segments to be evaluated and treated under this Fuel Management Plan. Within these segments, the actual treatment area is determined by the location of the Reserve boundary as it relates to a 100 foot distance from structures on adjoining lands. (See Appendix 9 for detailed descriptions of the specific treatments within each of the fuel management zone segments.)

The following describes, in general, the desired conditions within a typical fuel management segment, 100 feet in width. Three general zones will be established, each one being approximately 33 feet wide. Invasive exotic vegetation within each zone will be removed to increase the effectiveness of the fuel management zone strategy. Zone 1 is closest to the existing urban area. The objective is a blended mosaic management zone transitioning from sparse vegetative cover of shrubs to that of naturally occurring density. Vehicular access for emergency fire equipment is included at certain specific locations and will be placed closest to the urban/wildland edge (Zone 1), or will follow existing roads and existing pathways to the maximum extent possible.

1. Shrubs:

Zone 1:
Shrub cover in this zone is to be maintained at around 30% shrub cover, allowing for a maximum 70% cover reduction. (Dense old growth, manzanita-dominated stands are typically around 75-90 percent cover.) All decadent shrubs and decadent larger sub-shrubs would be removed in this zone, except where associated with woodrat dens (unlikely to be present this close to residences in most locations). Pruning of decadent lower branches on retained individuals can occur in this zone. Remaining shrubs may be retained as individuals or in small, spaced groupings. Spacing should be open enough to slow or limit the spread of fire that can usually spread quickly through understory grasses.

Zone 2:

Shrub cover in this zone is to be maintained at around 50% shrub cover, allowing for a maximum of 50% cover reduction. The spacing between retained shrubs can be less, allowing for a closer and a slightly more natural distribution of vegetation. Specific details described for Zone 1 also apply to Zone 2.

Zone 3:
Shrub cover in this zone will transition from 50% cover to fully natural stand conditions at the outer treatment edge (towards the interior of the Reserve). Specific details described for Zone 1 also apply to Zone 3.

2. Subshrubs/Herbaceous Vegetation:

Low growing subshrubs and herbaceous vegetation will generally be left in place, unless invasive or exotic. Decadent subshrubs taller than 16 inches may be removed.

3. Coast Live Oaks

"Uplifting" (pruning the lower limbs) of oak trees will be generally confined to locations within Zone 1. Uplifting of the lower canopy will be confined to a maximum of 5 feet above the ground, or no more than 20% of the total canopy, whichever is less. All oaks will be retained and woodrat dens will be left intact.

C. Timing of Installation

Work will generally proceed outside the bird nesting season and preferably prior to the first soaking rain. Some limited work can occur in the early part of the rainy season (after the first rain, through mid-December provided that at least one week of dry weather occurs). Working from mid-December through the end of February may be feasible at locations lacking sensitive herbaceous plant species and provided that pre-work surveys are done to determine absence of sensitive amphibians and reptiles.

D. Menu of Treatment Methods

1. Yard Waste Removal

Flammable yard wastes previously dumped in the Reserve will be removed in treatment areas by hand crews, carried to chippers and chipped. Chips must be distributed to locations which are already disturbed or weedy and will be identified on a case by case basis by staff biologists. This task is to be accompanied by A) photographic and written documentation of the types of wastes being dumped; and B) written notification to adjacent homeowners indicating that yard wastes have been removed to reduce flammable fuels, and that both the Department enforcement staff and County Fire Department staff will be issuing citations for yard waste dumping.

2. Removal of Flammable Invasive Vegetation

Flammable invasives will be targeted for removal within treatment areas based upon site-specific prescriptions. Examples may include: pampas grass, pine trees, palm trees, Veldt grass. A combination of treatments could include hand cutting, painting of cut individuals with a glycosphate-based herbicide, removal of seed heads to prevent dipersal, or other appropriate methods to prevent regrowth.

3. Mowing Annual Herbaceous Growth

Mechanical mowing will be utilized at fuel management zone locations already dominated by annual herbaceous vegetation. The type and width of equipment needs to be identified. Typically, these represent locations where previous fuel reduction work has occurred. Sometimes, only scattered coast live oaks remain in a matrix of annual, ruderal herbaceous species. No disking will be permitted because it disturbs the soil and increases production of weeds. Mowing will occur annually, between late May and June 15th of each year. Timing may vary, depending upon rainfall and results from biological surveys that may indicate presence of nesting activity. Typically the disturbed areas will not harbor many wildlife species. Timing should take into consideration growth patterns of that year so that mowing only occurs once. Avoiding the need to re-mow due to regrowth of cut material in moister/later rainfall years will reduce staff time and be more efficient. Care should be taken to ensure that equipment is inspected and maintained so that it does not generate sparks and ground should be inspected for rocks and metal objects that could spark or break the machinery, and seeds that could introduce weeds. Iceplant patches present in previously disturbed fuelbreak areas will not be mowed. Scattered individual or small groupings of chaparral shrubs and subshrubs will be retained in mowed areas where feasible and as directed in site-specific prescriptions.

4. Removal of Decadent/Dead Shrubs

Brush which is largely dead or predominantly decadent will be cut with hand tools as directed in site-specific prescriptions to achieve treatment objectives. Following cutting, there is potential for individuals to resprout (based upon observations in the experimental Segment 1 treatment area). Experience in Segment 1 and observations elsewhere in the Reserve suggest that certain species will tend to become decadent sooner than other, more long-lived species. Therefore, this action will tend to focus on certain species such as chamise, black sage, coyote brush and ceanothus.

5. Chipped Material

Cut material will be carried to designated chipping areas. Chips will be placed only on previously disturbed and already weedy locations, or removed from the treatment area and taken elsewhere for chipping. Another alternative for disposal is to place cut brush at existing trail locations where the trail is proposed for closure, to block access, outside the

fuel management zones. This would require vehicular access to reach the area with the material and hand crews to carry and pack the cut brush into the trail location being closed.

6. Pruning ("Uplifting") of Coast Live Oaks

Within Zone 1 only, the lower branches of coast live oaks may be uplifted to reduce fuel ladder effects. Multiple trunks and large limbs lying on the ground will not be removed. Uplifting will be limited to 3 to 5 feet above ground. The amount of uplifting will be reduced where existing oaks are exposed to strong south facing and west facing exposures in order to reduce changing the microclimate beneath the oak. Uplifting will also be avoided near woodrat dens to the extent feasible. No more than 1/5 of the existing oak canopy should be removed. No uplifting will occur on young, brushy coast live oaks. Young oaks/oak seedlings will be conserved where they naturally occur and not removed. The need for pruning of oaks outside of Zone 1 will be determined on a site-specific basis.

7. Thinning Shrubs and Subshrubs

Hand crews will cut and remove targeted living shrubs to achieve site specific prescription requirements. Cut material will be chipped or taken to trails to be closed. Thinning will attempt to retain as many of the rarer shrubs and subshrubs as feasible. To maintain species diversity in treatment areas, the Department will attempt to maintain the range of species present in the treatment area and not single out any particular species for removal.

8. Pile Burning

Allow the use of pile burning on a site specific, case by case basis, where other disposal methods are unavailable. Burn piles will be placed on previously disturbed ground to minimize damage to surrounding habitat and in locations where subsequent weed invasion can be effectively managed. Burn piles may not be placed in areas of wetlands or sensitive habitats.

9. General Weed control

Non-flammable weeds may also be controlled within the treatment areas during fuel reduction work and during periodic fuel break maintenance episodes. An Integrated Pest Management Approach will be used which relies upon a variety of methods including hand removal, seed head removal, and spot treatments with glyphosate-based herbicides. New weed invasions will be prioritized for control efforts within the FMZs. Treatment of established infestations will be reviewed within the context of the larger preserve ecosystem. They may be more problematic to control, and where these occur on the preserve boundary, they would be a lower priority than smaller infestations in interior habitat areas. Some established iceplant patches may be problematic to remove where

they occur on steep sandy slopes abutting residential areas - if removed, some other form of erosion controlling vegetation would need to be installed.

E. Implementation Practices

The following measures will be implemented, as appropriate, whenever any of the previous methods are employed.

Designation of Staging Areas: Staging areas for fuel reduction activities will need to be identified for each treatment area. Staging areas are locations where hand crews and equipment may be concentrated and/or where vehicles may be parked. Staging areas will be placed at locations where minimal damage to natural habitats would occur. This could include existing foot trails, iceplant patches, or previously disturbed sites.

Caution should be taken in locating staging areas in weedy areas. Dispersal of weed seeds into the treatment areas by foot or vehicular traffic should be avoided.

Designation of Chipping Areas: Chipping areas will need to be identified for each treatment area where chipping is needed. Generally, these locations need to be accessible by vehicle in order to transport and operate the chipper. There may be fuel management zone locations where vehicular access does not exist (Segment 9, Segment 11, for instance). In those cases, DFG will need to obtain access through private property or forgo work.

Chip piles can have a variety of adverse effects on the local area. This includes increasing moisture and nutrients in the localized area, smothering of the natural seedbank beneath the chipped pile and damage to existing soil microorganisms. These effects can lead to increased weeds in areas receiving chips. To reduce the likelihood of habitat damage, chips shall not be placed in natural open sand locations supporting native herbaceous open sand habitats. Chips will be spread thinly where feasible and placed in the most disturbed locations. If no feasible location can be found to receive chips, they will be disposed of elsewhere.

Prevent Introduction of Weeds: Fuel reduction work needs to be implemented in a manner which minimizes the spread of invasive weeds. This shall be addressed in several ways.

1) Introduction of weeds from offsite: Vehicles, heavy equipment, chipping machines, etc., need to be inspected and cleaned of previous soil and weed seeds prior to being brought into the Reserve area. This could occur at the local carwash located just west of the intersection of Constellation Drive and Burton Mesa Boulevard. Hand crews shall inspect and clean boots, clothing and equipment of soil and weed seeds from outside the area, prior to entering the Reserve. DFG staff will provide inspection to ensure this occurs before work starts.

2) Prevent spread of weeds in treatment areas: An effort will be made to limit foot and vehicle traffic through weedy areas being treated, in order to prevent weed seeds from being dispersed. For instance, individuals working in less disturbed, interior areas may "hand off" brush to others working in weedier areas.

3) Fuel Treatments in Road Rights of Way:
Roads and the sides of roads ("Rights of Way") are not fuel breaks, but fuel treatments in these areas can reduce fuel load. Detailed descriptions of planned fuel management zone segments are provided in Appendix 9.

a) Roadside Mowing: Mechanical mowing is used along roadsides for approximately ten feet. Mowing is intended to cut annual herbaceous biomass to reduce potential for roadside ignitions. Responsibility for mowing certain roadsides may be delegated to other parties, such as roads that may be mowed by the County or Cal Trans.

b) Roadside Uplifting of Shrubs: Hand crews can cut and remove the lower branches of shrubs to reduce fuel ladder effects and facilitate mowing where annual biomass is present near roadsides. Uplifting shall not remove more than 1/3 of the individual biomass of a given shrub, unless this shrub is largely dead and decadent. Treatment width is 10 feet.

c) Limited Uplifting of Oaks: may be appropriate for oaks abutting the roadway edge. Multiple trunks and large primary limbs lying on the ground would not be removed. Lower branches and dead/decadent branches may be uplifted to three to five feet to facilitate roadside mowing and reduce fuel ladder effects adjacent to roadsides.

Insert Figure 32
Fuel Management Segments

VI. OPERATIONS AND MAINTENANCE SUMMARY

A. Operations and Maintenance Tasks to Implement Plan

A summary of the tasks required to implement the Land Management Plan and their associated estimated costs will be developed as the plan is implemented.

B. Existing Staff and Additional Personnel Needs Summary

It is likely that in order to implement all of the tasks listed in the Land Management Plan the Reserve would require full time staff. If housing is provided on the Reserve at no cost to the Reserve Manager and staff, overall management costs could possibly be reduced. A limited budget could be accommodated in several ways. These include: 1) implementing only high priority items, 2) conducting a careful review of budgets and funding opportunities to maximize the use of any available funds, and 3) working with local groups in establishing a cadre of volunteers to help with weed control, trail maintenance, and habitat restoration implementation.

This page left blank intentionally.

REFERENCES

Anderson, Jim. 2002. Sheriff-Elect. Letter to Mr. and Mrs. Spanne regarding off-road vehicle enforcement on the Burton Mesa Preserve. Santa Barbara County Sheriff's Department. September 22.

Axelrod 1977. Outline History of California Vegetation. Pages 139-194 *in* M.G. Barbour and J. Major (eds.). Terrestrial Vegetation of California. Wiley and Sons, New York.

Banta, B. H. and D. J. Morafka. 1968. An annotated check list of the recent amphibians and reptiles of the Pinnacles National Monument and Bear Valley, San Benito and Monterey counties, California, with some ecological observations. The Wasmann Journal of Biology 26(2): 161-183.

Barbour, M.G. and J. Major 1977. Terrestrial Vegetation of California. Wiley & Sons. Edition 1988, pp. 417-469.

Barbour, M.G. et al. 1993. California's Changing Landscape.

Barbour, R.W. and W.H. Davis 1969. Bats of America. University Press, Lexington, Kentucky. 286 pp.

Bent, A. C. 1942. Life Histories of North American Flycatchers, Larks, Swallows, and Their Allies. *U.S. National Museum Bulletin* 179.

Bent, A. C. 1958. Life Histories of North American Blackbirds, Orioles, Tanagers, and Allies. U. S. *National Museum Bulletin* 211:179-190.

Blakely, E. R. Jim. and Barnette 1985. Historical Overview of the Padres National Forest. United States Forest Service, Goleta California.

Bornyasz, Graham and Allen 2001. Distribution of Quercus agrifolia Mycorrhizae Deep within Weathered Bedrock: A Potential Mechanism for Transport of Stored Water. Fifth Symposium on Oak Woodlands: Oaks in California's Changing Landscape, October 22-25, 2001, San Diego, California.

Breckon, G. J. and M. G. Barbour. 1974. Review of North American Pacific Coast vegetation. *Ma-droño*. (22):333-60.

Berenbroch, Charles, 1988. Ground-Water Quality in the Lompoc Plain, Santa Barbara County, California, 1983, U.S. Geological Survey, Water-Resources Investigation Report 87-4101.

Bolton, H.E. 1927. Fray Juan Crespi Missionary Explorer on the Pacific Coast 1769-1774. University of California Press, Berkeley, California.

Bolton, H.E. 1933. Font's Complete Diary. A Chronicle of the Founding of San Francisco. University of California Press, Berkeley, California.

Boyle, Richard J. 1992. Unocal Corporation District Land Manager. Letter to Kevin Drude, Project Planner, Resource Management Department Energy Division regarding permission for access. Purisima Fee, Property Conveyed to State Lands Commission. Santa Barbara County, California.

Breininger, D. 1988. Survey for Least Bell's Vireo in Riparian Habitat on Vandenberg Air Force Base, Santa Barbara County, CA. NASA Technical Memorandum 100984.

Briggs, Jennifer. Santa Barbara County Parks Director 1997. Santa Barbara County Board Agenda Letter, recommending execution of Grant Deed to the State of California to convey 27 acres and 20 acres of County owned property located in the Vandenberg Village area of Lompoc, California. December 18, 1997.

Brown, P. E. 1980. Distribution of Bats of the Channel Islands. Pp. 751-756, *in* D. M. Power, ed. The California Islands: Proceedings of a Multidisciplinary Symposium. Santa Barbara Museum of Natural History, Santa Barbara, CA.

Brylski, P. V., P. W. Collins, E. D. Pierson, W. E. Rainey, and T. E. Kucera. In review. Mammal Species of Special Concern in California. Draft Final Report Prepared for the California Department of Fish and Game, Wildlife Management Division, Bird and Mammal Conservation Program, Sacramento, CA. Contract FG3146WM. 251 pp.

Burton, Darren 2003. Personal Communication. VAFB Hotshots.

Burton, Katrina, and Elihu Gevirtz. 2003. Fire and Vegetation Management Plan, Providence Landing, Vandenberg Village, California. Prepared for Capital Pacific Homes. Condor Environmental Planning Services, Inc., Santa Barbara, California.

CDC Engineering 1991. Exhibit to Accompany Legal Description for Land Conveyance to the State of California. Prepared for Union Oil Company. Los Angeles.

California Invasive Plant Council 2005. Invasive Plant Inventory Revision. Plant Assessment Forms For Plants Reviewed Through March 2005.
(http://groups.ucanr.org/ceppc/List_Revision/Completed_PAFs.htm)

California Native Plant Society. 1995. Statement of Policy: Seeding After Wildfire. Adopted December 2, 1995. (www.cnps.org)

Carroll, M. C. 1989. Native Oaks of Southern California. Santa Barbara Botanic Garden International Bulletin #6.

Carroll, M. C., Reed, B., Laughrin, L. and Peart, D. 2004. Factors Affecting Seedling Recruitment of Woody Species on Santa Cruz Island. Proceedings of the 6th California Island Symposium.

Chadderdon, T. J. and Martha H. Bowers, 2003. Cultural Resource Investigations at the Federal Correctional Facility, City of Lompoc, Santa Barbara County, California. Prepared for Federal Bureau of Prisons by the Louis Berger Group, Inc. 80 pp plus appendices.

Christensen, N. L., and C. H. Muller. 1975. Effects of Fire on Factors Controlling Plant Growth in Adenostoma Chaparral. *Ecological Monographs* 45:29-55.

Christopher, S. V. 1996. Reptiles and Amphibians of Vandenberg Air Force Base. A Focus on Sensitive Aquatic Species. Prepared for: CES/CEV Natural Resources, Vandenberg Air Force Base and U. S. Department of the Interior, National Biological Services, California Science Center, Piedras Blancas Research Station, San Simeon, CA. University of California, Museum of Systematics and Ecology, Report No. 4. 145 pp. plus appendices.

Christopher, S.V. 2002. Sensitive Amphibian Inventory at Vandenberg Air Force Base, Santa Barbara County, California. Summary of Preliminary Results and Site Maps. Appendix A. Field Survey Data January 1995 through March 2002. Prepared for CES/CEV Natural Resources, Vandenberg Air Force Base.

Christopher, S. 2003. Unpublished Data for Surveys of Amphibians and Aquatic Reptiles Conducted on Vandenberg Air Force Base, California.

Christopher, S.V. 2004. Distribution and abundance of California Red-legged Frogs on Vandenberg Air Force Base: Responses to El Nino and Drought Conditions. Prepared for: CES/CEV Natural Resources, Vandenberg Air Force Base.

Cohen, J.D. 1999. Reducing the Wildland Fire Threat to Homes: Where and How Much? USDA Forest Service General Technical Report. PSW-GTR-173.

Collins, P. W. 2002. Site Assessment for Presence of California Tiger Salamander (*Ambystoma californiense*) and California Red-legged Frog (*Rana aurora draytonii*) – Providence Landing Project Site South Vandenberg Village, Lompoc Valley, Santa Barbara County, California. Prepared for Condor Environmental Planning Services, Inc., Santa Barbara, CA.

Collins, P.W. 2004. Draft Report on the Results of Surveys for California Tiger Salamanders (*Ambystoma californiense*) on Vandenberg Air Force Base, Santa Barbara County, California. Prepared for Vandenberg Air Force Base, 30CES/CEVPN Natural Resources, Vandenberg Air Force Base, CA.

Condor Environmental Planning Services 2003. Biological Assessment of the Waterline Replacement Project: Reservoir 1 to Calle Lindero. Prepared for the Mission Hills Community Services District. May 29, 2003.

Condor Environmental Planning Services 2004a. Lizard Monitoring Report #1 Pre Construction Surveys, Providence Landing, Vandenberg Village, California. Prepared for Capital Pacific Homes, Santa Barbara, CA. July 26, 2004.

Condor Environmental Planning Services 2004b. Construction Monitoring Summary Report. Providence Landing Phases 1 and 2. Vandenberg Village, California. Prepared for Capital Pacific Homes, Santa Barbara, CA. October 1, 2004.

Cooper, W.S. 1967. Coastal dunes of California. Geological Society of America.

Coulombe, H. N., and C. F. Cooper. 1976. Ecological Assessment of Vandenberg Air Force Base, California. Vol I: Evaluation and Recommendations. Final Report: May 1974 – August 1975. Prepared for: U. S. Air Force, Headquarters, SAMSO, AFCEC-TR-76-15. Prepared by: San Diego State University, Center for Regional Environmental Studies. 187 pp.

Coulombe, H. N., and C. R. Mahrdt. 1976. Ecological Assessment of Vandenberg Air Force Base, California. Vol. II: Biological Inventory 1974/75. Prepared for: U. S. Air Force, Headquarters, SAMSO, AFCEC-TR-76-15. Prepared by: San Diego State University, Center for Regional Environmental Studies. 199 pp.

Dames & Moore and Garcia & Associates 1999. Mitigated Negative Declaration. Santa Ynez River Bridge Bicycle Path Project. Prepared for the City of Lompoc. August 17.

Davis, F., Hickson D., and Odion, D. 1988. Composition of Maritime Chaparral Related to Fire History and Soil, Burton Mesa, Santa Barbara County, California. Madrono, Vol. 35, No. 3, pp 169-195.

Davis, F. W., M. I. Borchert, and D. C. Odion. 1989. Establishment of Microscale Vegetation Pattern in Maritime Chaparral after Fire. *Vegetation* 84:53-67.

Davis, F. W. and Hickson, Diana E. and Odion, Dennis C. (undated). Spatial and Temporal Dynamics of Maritime Chaparral on the Burton Mesa, California.Unpublished Report.

Davis, F. W. 2004. Personal Communication. Professor, University of California Santa Barbara.

Davis, L.S. 1965. The economics of wildfire protection with emphasis on fuel break systems. State of California, Resources Agency, Division of Forestry, Sacramento, CA.

Dawson, T.E. 1998. Fog in the redwood forest: ecosystem inputs and use by plants. *Oecologia*. Vol. 117, 476-485.

Dibblee, Thomas W, 1950. Geology of Southwestern Santa Barbara County California, State of California Department of Natural resources, Bulletin 150.

Dibblee, Thomas W., 1988. Geologic Map of the Lompoc and Surf Quadrangles, scale 1:24,000, Dibblee Geologic Foundation.

Dunnn, A.T. 1989. The effects of prescribed burning on fire hazard in the chaparral: toward a new conceptual synthesis. Pages 23-29 *in* N.H. Berg (editor). Proceedings of the symposium on fire and watershed management. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, General Technical Report PSW-109.

Dunn, A.T., and D. Piirto. 1987. The Wheeler Fire in retrospect: factors affecting fire spread and perimeter formation.

Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The Birder's Handbook: a Field Guide to the Natural History of North American birds. Fireside Press, New York.

Engelhardt, Z. Fr. 1932. Mission La Concepcion Purisima. McNally & Loftin 1986, Santa Barbara.

Eriksen, C.H., and D. Belk. 1999. Fairy shrimps of California's puddles, pools, and playas, Mad River Press, Eureka, CA.

Fairchild Aerial Surveys. 1938. Aerial Photographs of Burton Mesa and Surrounding Area.

Farmer, C.A. 1997. Draft Report on the Ecology of Brown-headed Cowbirds and Their Impact on Native Birds at VAFB, Santa Barbara, CA. Dept. of Ecology, Evolution, and Marine Biology, University of California at Santa Barbara.

Fenner, R.L., R, K. Arnold, and C.C. Buck 1955. Area ignition for brush burning. USDA Forest Service, California Forest and Range Experiment Station, Technical Paper No. 10.

Ferren, Wayne R, Jr., Forbes, Holly C., Roberts, Dar A and Smith, Dale M. 1984. The Botanical Resources of La Purisma Mission State Historic Park. The Herbarium. Department of Biological Sciences, University of California, Santa Barbara. Publication Number 3.

Ferren, W. R., P. L. Fiedler, and R. A. Liedy. 1996a. Wetlands of California, part I: History of Wetland Habitat Classification. *Madrono* 43:105-124.

Ferren, W. R., P. L. Fiedler, R. A. Liedy, K. D. Lafferty, and L. A. Mertes. 1996b. Wetlands of California, part II: Classification and Description of Wetlands of Central and Southern California Coast and Coastal Watersheds. *Madrono* 43:125-182.

Ferren, W. R., P. L. Fiedler, R. A. Liedy, K. D. Lafferty, and L. A. Mertes. 1996c. Wetlands of California, part III: Key to and Catalogue of Wetlands of the Central and Southern California Coast and Coastal Watersheds. *Madrono* 43:183-233.

Ferren, Wayne R, Jr. and Sandoval, Christina. 2001. Hybridization and Genetic Pollution: Examples in the Santa Barbara Region. Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara.

Ferren, Wayne R., Jr., 2004 Personal Communication. Botanist, Former Director. Museum of Systematics and Ecology, University of California Santa Barbara.

Florence, M.A. 1985. Successional trends in plant species composition following fall, winter and spring prescribed burnds of chamise chaparral in the central coast range of California. M.S. thesis, California State University, Sacramento, CA.

Gallo, J.A., J.A. Scheeter, M.A. Holmgren, and S.I. Rothstein. 2000. Initiation of a Long Term Ecological Monitoring Project: Avian Point Counts and Habitat Assessment in Riparian Communities in 1998 at Vandenberg Air Force Base, California. University of California, Santa Barbara, Museum of Systematics and Ecology, Environmental Report No. 13.

Garcia and Associates 1999. Natural Environment Study. Santa Ynez River Bridge Bicycle Path. Prepared for Quincy Engineering, Sacramento, Calif., and Caltrans, District 5, San Luis Obispo. August 25.

Garcia and Associates. 1999a. Supplemental survey for biological resources. The Bluffs site, Harris Grade Road, Lompoc, California. Prepared for Martin Farrell Homes, Inc. January 16, 1999.

Garcia and Associates. 2000. V & J Sand Mine. Biological Resources Report. Prepared for V & J Rock Transport, Lompoc, California. August 2.

Garrett, K. and J. Dunn. 1981. Birds of Southern California: Status and Distribution. Los Angeles Audubon Society. 407 pp.

Gevirtz, E. 2004. Memorandum to Santa Barbara County Planning and Development Regarding Construction Monitoring Results at Providence Landing Vandenberg Village, California. Condor Environmental Planning Services, Inc. Prepared for Capital Pacific Homes, Santa Barbara. August 6, 2004.

Gevirtz, E., T. Olson, M. Carroll, K. Burton, P. Collins, A. Nelson 2005. Ecosystem Characterization of La Purisima Mission State Historic Park. Prepared for The State of California Resources Agency, Department of Parks and Recreation. Condor Environmental Planning Services, Inc. Santa Barbara, California.

Gibbs, D. R. 2004. Personal Communication. Santa Barbara County Water Agency.

Gibbs, D. R. 2004. Unpublished Data. Santa Barbara County Water Agency.

Green, L.R. 1981. Burning by prescription in chaparral. USDA Forest Serice, Pacific Southwest Forest and Range Experiment Station, General Technical Report PSW-51.

Grenfell, W. E., Monica D. Parisi, and Darlen McGriff 2003. Complete List of Amphibians, Reptiles, Birds and Mammals in California.
(http://www.dfg.ca.gov/whdab/pdfs/species_list.pdf)

Greenlee, J.M. and J. H. Langenheim. 1990. Historic fire regimes and their relation to vegetation patterns in the Monterey Bay Area of California. American Midland Naturalist 124: 239-253.

Griffin, J. R., and W. B. Critchfield. 1972. The Distribution of Forest Trees in California. U.S. Forest Service Research Paper PSW-82. Pacific Forest and Range Experiment Station, Berkeley, California.

Grinnell, J. and A.H. Miller. 1944. The Distribution of the Birds of California. Pacific Coast Avifauna Number 27. Cooper Ornithological Club, Berkeley, California. Reprinted by Artemisia Press, Lee Vining, California; April, 1986. 617 pp.

Grogan, P., Burns, T. D. and Chapin, F. S. 2000. Fire Effects on Ecosystem Nitrogen Cycling in a California Bishop Pine Forest. *Oecologia* Vol. 122(4) pp. 537-544.

Haidinger, T.L. and J.E. Keeley. 1993. Role of high fire frequency in destruction of mixed chaparral. *Madrono* 40:141-147.

Hall, E.R. 1981. Mammals of North America. 2 vols. Ronald Press, New York, NY.

Hamilton, R. A., and D. R. Willick. 1996. The Birds of Orange County, California. Status and Distribution. Sea & Sage Press, Sea & Sage Audubon Society, Irvine, California.

Harrison, C. 1978. A Field Guide to the Nests, Eggs, and Nestlings, of North American Birds. Stephen Greene Press, Brattleboro, Vermont.

Harrison, H. H. 1979. A Field Guide to Western Birds' Nests. Houghton Mifflin Company, Boston.

Henningson, D., and Richardson (HDR). 1984. Biological Resources of Alternative Processing Facility Sites and Pipeline Routes Proposed by Union Oil Company of California in the Vicinity of Lompoc, Santa Barbara County, California. Prepared for Union Oil Company of California, Orcutt, CA. Prepared by HDR, Santa Barbara, CA 57 pp + Appendices.

Hickman, J. C. 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

Hickson, D. E. 1987. The role of fire and soil in the dynamics of Burton Mesa Chaparral. M.A. Thesis, University of California, Santa Barbara.

Holland, D. C. 1991. A Synopsis of the Ecology and Status of the Western Pond Turtle (*Clemmys marmorata*) in 1991. Unpublished report prepared for United States Fish and Wildlife Service.

Holland, R 1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game.

Holland, V. L. and David J. Keil. 1995. California Vegetation. Kendall/Hunt Publishing Company. Dubuque, Iowa.

Holland, D. 1991. A synopsis of the ecology and status of the western pond turtle (*Clemmys marmorata*) in 1991. Prepared for the U. S. Fish and Wildlife Service, National Ecology Research Center, San Simeon Field Station. 147 pp.

Holland, R. F., and S. Jain. 1988. Vernal pools. Pages 515-533 *In:* M.E. Barbour and J. Major, eds. Terrestrial vegetation of California, new expanded edition. California Native Plant Society, Special Publication Number 9, Sacramento, CA.

Holland, R.F. 1978. The geographic and edaphic distribution of vernal pools in the Great Central Valley, California. California Native Plant Society, Special Publication 4:1-12.

Holland, V.L., Keil, D.J. (1995) California Vegetation, Kendall/Hunt, Dubuque, Iowa.

Holmgren, M. A., and P. W. Collins. 1999. Final Report on the Distribution and Habitat Associations of Six Bird Species of Special Concern at Vandenberg Air Force Base, Santa Barbara County, California. Prepared for Vandenberg Air Force Base, 30CES/CEVN, Natural Resources, Vandenberg Air Force Base, CA. Santa Barbara Museum of Natural History Monographs No. 1. Studies in Biodiversity No. 1. 242 pp + appendices.

Hoover, R. F. 1970. The Vascular Plants of San Luis Obispo County, California. University of California Press, Berkeley.

Howald, Ann, and Frank Davis. 1985. Burton Mesa Chaparral Preserve Site Selection Process.Union Oil Company Point Pedernales Project Permit Condition H-22. Prepared for Dr. Janice Yonekura, Santa Barbara County Energy Division and Mr. Roy W. Martens, Union Oil Company of California.

Human, V. L. No date. Birds of La Purisima Mission. Annotated checklist.

Human, V. L. 2004. A Naturalist at Play in Coastal California and Beyond. Lompoc Valley Botanical and Horticultural Society.

Hunt, L. E., 1993. Origin, Maintenance and Land Use of Aeolian Sand Dunes of the Santa Maria Basin, California. Prepared for The Nature Conservancy, San Luis Obispo, California.

Hunt, Lawrence. E. 1993. Unpublished data. Herpetologist, Santa Barbara, California.

Hunt, Lawrence E. 1997. Letter to Elihu Gevirtz. Summary of the Results of the Cursory Field Survey of the Vernal Wetlands and Freshwater Marsh on the Burton Mesa Ecological Preserve on 24 March 1997.

Hunt, L. E. 2003. Personal Communication. Herpetologist, Santa Barbara, California.

Ingles, L. G. 1965. Mammals of the Pacific States. Stanford University Press, Stanford, CA.

Jennings, M. R. 1988. *Phrynosoma coronatum*. Cat. Amer. Amphib. and Reptiles 428.1-428.5.

Jennings, M. R., and M. P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final report submitted to California Dept. of Fish and Game, Inland Fisheries Division, Rancho Cordova, CA, Contr. No. 8023.

Junak, S. 2005. Botanist, Santa Barbara Botanic Garden. Personal communication.

Keeler-Wolf, T., D. R. Elam, K. Lewis, and S. A. Flint. 1998. California Vernal Pool Assessment Preliminary Report. California Department of Fish and Game, Natural Heritage Division. pp. 57-59

Keeley, J. E. 1987. Role of Fire in Seed Germination of Woody Taxa in California Chaparral. *Ecology* 68(2):434-443.

Keeley, J. 2002. Fire Management of California Shrubland Landscapes. U.S. Geological Survey Western Ecological Research Center. *Environmental Management* 29(3). pp. 395-408.

Keeley, J. 2002. Recruitment of Seedlings and Vegetative Sprouts in Unburned Chaparral. *Ecology* 73(4). pp. 1194-1208.

Keeley, J. E. and P. H. Zedler. 1978. Reproduction of Chaparral Shrubs after Fire: A Comparison of Sprouting and Seeding Strategies. *American Midland Naturalist*, Vol. 99(1) pp. 142-161.

Keeley, J. E. and S. C. Keeley. 1984. Postfire Recovery of California Coastal Sage Scrub. *American Midland Naturalist*, Vol. 111(1) pp. 105-117.

Keeley, J. E., and S. C. Keeley. 1988. Temporal and Spatial Variation in Fruit Production of Chaparral Shrubs. Pages 457-463 *in*: F. di Castri, C. Floret, S. Rambal, and J. Roy (eds.). *Time-Scales and Water Stress*. I.U.B.S., Paris.

Keeley, J. E., B. A. Morton, A. Pedrosa, and P. Trotter. 1985. Role of Allelopathy, Heat, and Charred Wood in the Germination of Chaparral Herbs and Suffrutescents. *Ecology* 73:445-458.

Keeley, S. C., J. E. Keeley, S. M. Hutchinson, A. W. Johnson. 1981. Postfire Succession for Herbaceous Flora in Southern California Chaparral. *Ecology* 62(6):1608-1621.

Keeley, Jon E. 1995. Future of California floristics and systematics: wildfire threats to the California flora. Madrono 42:175-179.

Keeley, J. E., C.J. Fotheringham, Marco Morais. 1999. Reexamining Fire Suppression Impacts on Brushland Fire Regimes. Science Volume 284, 11 June 1999.

Keil, D. J., and V. L. Holland. 1998. Documented Flora of Vandenberg Air Force Base, Santa Barbara County, California. Prepared for the Nature Conservancy and Vandenberg Air Force Base. June 27.

King, C. 1981. The Evolution of Chumash Society. PhD Dissertation, Department of Anthropology, University of California at Santa Barbara.

Klauber, L. M. 1939. Studies of reptiles life in the arid southwest. Part I, Night collecting on the desert with ecological statistics; Part II, Speculations on protective coloration and protective

reflectivity; Part III, Notes on some lizards of the southwestern United States. Bulletin of the Zoological Society of San Diego 14: 1-100.

Lehman, P. E. 1994. The Birds of Santa Barbara County, California. Vertebrate Collections, Museum of Systematics and Ecology, UC Santa Barbara.

Levy, J. N. 2004. Personal Communication. E-mail to Mary Meyer, April 23, 2004.

Longcore, T. 2003. Ecological Effects of Fuel Modification on Arthropods and Other Wildlife in an Urbanizing Wildland. Pages 111-117 *in* K.E.M. Galley, R.C. Klinger, and N.G. Sugihara (editors). Proceedings of Fire Conference 2000: The First National Congress on Fire Ecology, Prevention, and Management. Miscellaneous Publication No. 13, Tall Timbers Research Station, Tallahassee, Florida.

Lowther, P.E., C. Celada, N. K. Klein, C. C. Rimmer, and D. A. Spector. 1999. Yellow Warbler (*Dendroica petechia*), No. 454. *In* The Birds of North America, A. Poole and F. Gill, Eds. Cornell laboratory of Ornithology and The Academy of Natural Sciences. Washington, D. C.

Lynch, G. 1997. A Birder's Guide to the Lompoc Valley. La Purisima Audubon Society.

McCaskie, G., P. De Benedictis, R. Erickson, and J. Morlan. 1979. Birds of northern California, an annotated field list. 2nd ed. Golden Gate Audubon Soc., Berkeley. 84pp.

Medica, P. A. 1975. Catalogue of American Amphibians and Reptiles. *Rhinocheilus* Baird and Girard Long-nosed Snake. Society for the Study of Amphibians and Reptiles.

Mensing, S. A. 1998. 560 years of vegetation change in the region of Santa Barbara, California. Madrono 45:1-11.

Meserve, P. L. 1974. Ecological Relationships of Two Sympatric Woodrats in a California Coastal Sge Scrub Community. Journal of Mammalogy 55(2):442-447.

Montanucci, R. R. 2004. Geographic Variation in *Phrynosoma coronatum* (Lacertia, Phrynosomatidae): Further Evidence for a Peninsular Archipelago. Herpetologica 60(1): 117-139.

Morefield, J. D. 2004. New Taxa and Names in North America *Ancistrocarphus, Diaperia,* and *Logfia* (Asteraceae: Gnaphalieae: Filagininae) and Related Taxa. Novon 14: 463-475. 2004.

Moritz, M.A. 1997. Analyzing extreme disturbance events: fire in the Los Padres National Forest. Ph.D. dissertation, University of California, Santa Barbara.

Mullen, E. 2004. Personal Communication. Consulting biologist, Santa Barbara, California.

Muller, C. H., and R. del Moral. 1966. Soil Toxicity Induced by Volatiles from *Salvia leucophylla*. *Bulletin of the Torrey Botanical Club* 93:225-231.

Muller, W. H. 1965. Volatile Materials Produced by *Salvia leucophylla*: Effects on Seedling Growth and Soil Bacteria. *Botanical Gazette* 126:195-200.

Mulroy, T. 1990. Facilitating The Use of Indigenous Genotypes in Natural Area Revegetation Projects. *in* Restoration '89: The New Management Challenge. First Annual Meeting of the Society for Ecological Restoration. Published by the Society for Ecological Restoration. H.G. Hughes and T.M. Bonnicksen editors. Madison, Wisconsin.

Mulligan, M. J. and J.H. Davies. 1985. Santa Barbara Deer Herd Management Plan. California Department of Fish and Game. Sacramento, California.

Neff, J. A. 1937. Nesting Distribution of the Tri-colored Red-wing. *Condor* 39:61-81.
Odion, Dennis and Frank Davis. 2000. Fire, Soil Heating and the Formation of Vegetation Patterns in Chaparral. *Ecological Monographs* 70(1). pp. 149-169.

Olson, M. 1993. Vernal Wetlands of the Burton Mesa Project Area, Santa Barbara County, California. Report to the Santa Barbara County Planning and Development.

Norris, R. 2003. The Geology and Landscape of Santa Barbara County, California and Its Offshore Islands. Santa Barbara Museum of Natural History Monographs Number 3.

Odion, Dennis C., Diana E. Hickson, and Carla M. D'Antonio. 1992. Central Coast Maritime Chaparral on Vandenberg Air Force Base: an inventory and analysis of management needs for a threatened vegetation association. For the Nature Conservancy.

Odion, Dennis., J. Storrer, and V. Semonsen. 1993. Biological Resources Assessment Burton Mesa Project Area Santa Barbara County, California. Prepared for Santa Barbara County Resource Management Department, Santa Barbara, CA

Odion, D. C. 2000. Seed banks of long-unburned stands of maritime chaparral: Composition, germination behavior and survival with fire. Madroño 47: 195-203.

Odion, D. and C. Tyler 2002. Are Long Fire-free Periods Needed to Maintain the Endangered, Fire-recruiting Shrub *Arctostaphylos morroensis* (Ericacaeae)? Conservation Ecology 6(2): 4.

Ohmart, R. D. 1973. Observations on the breeding adaptations of the roadrunner. Condor 75:140-149.

Olson, M. 1993. Vernal Wetlands of the Burton Mesa Project Area, Santa Barbara County, California. Prepared for Santa Barbara County Resource Management Department.

Omi, P.N. 1979. Planning future fuelbreak strategies using mathematical modeling techniques. *Environmental Management* 3:73-80.

Orme A.R. and V.P. Tchakerian, 1986. Quaterary dunes of the Pacific Coast of the Californias., pp. 149-175, in: Nickling, William. G (ed.). Aeolian geomorphology. Binghampton Symposium in Geomorphology, Int. Series, No. 17, Allen & Unwin, London.

Osland, K. and B. Schuyler 1993. An Archaeological Survey Report for the Draft Burton Mesa Management Plan, Santa Barbara County.

Palmer, K. (L.) 1999. Central Coast Continuum-From Ranchos to Rockets: A Historic Overview for an Inventory and Evaluation of Historic Sites, Buildings, and Structures, Vandenberg Air Force Base, California. 156 pp.

Pavlik, B.M., B.C. Muick, S.G. Johnson, and M. Popper. 1991. Oaks of California. Cachuma Press.

Parker, V.T. 1990. Problems encountered while mimicking nature in vegetation management: an example from a fire-prone vegetation. *In* R.S. Mitchell, C.J. Sheviak, and D. J. Leopold (editors). Ecosystem management: rare species and significant habitats. New York State Museum, Bulletin No. 471, Albany, New York.

Peckersky, B. Freshwater Macro invertebrates of North America, Ithaca: Cornell University Press, 1990.

Pennak, R. W. Freshwater Invertebrates of The United States, 3rd Ed., Protozoa to Mollusca, New York: John Wiley and Sons Inc. 1989.

Philbrick, R. and D. Odion 1988. Analysis of Preserve Sites for Burton Mesa Chaparral. Prepared for Santa Barbara County Resource Management Department.

Philbrick, R., and P. W. Collins. 1997. Biological Resource Evaluation, Vandenberg Clubhouse Estates, Santa Barbara County, California. Report Prepared for Vandenberg Clubhouse Estates, LLC.

Philbrick, R. 1992a. Assessment of Rare Plants and Sensitive Vegetation for Solvang 594. Unpublished Report. Prepared for the County of Santa Barbara.

Philbrick, R. 1992b. Supplemental Botanical Assessment of the Northern Portion of Solvang 594. Unpublished Report. Prepared for the County of Santa Barbara.

Philbrick, R. 1993. Botanical Survey of Three Potential Recreation Sites in the Burton Mesa Management Area. Report to the Santa Barbara County Planning and Development.

Philbrick, R. 2003. Personal Communication. Consulting Botanist.

Pierson, E. D., M. C. Wackenhut, J. S. Altenbach, P. Bradley, P. Call, D. L. Genter, C. E. Harris, B. L. Keller, B. Lengus, L. Lewis, B. Luce, K. W. Navo, J. M. Perkins, S. Smith, and L. Welch. 1999. Species conservation assessment and strategy for Townsend's big-eared bat (*Corynorhinus townsendii townsendii* and *Corynorhinus townsendii pallescens*). Idaho Conservation Effort, Idaho Department of Fish and Game, Boise, Idaho. 67 pp.

Pierson, E. D., P. W. Collins, W. E. Rainey, P. A. Heady, and C. J. Corben. 2002. Distribution, Status and Habitat Associations of Bat Species on Vandenberg Air Force Base, Santa Barbara County, California. Santa Barbara Museum of Natural History Technical Report No. 1.

Pierson, O. P., M.R. Koford, and A.K. Pearson. 1952. Reproduction of the lump-nosed bat (Corynorhinus rafinesquii) in California. J. Mamm. 33:273-320.

Peckersky, B. 1990. Freshwater Macro invertebrates of North America, Ithaca: Cornell University Press.

Pennak, Robert W., 1989. Freshwater Invertebrates of The United States, 3rd Ed., Protozoa to Mollusca, New York: John Wiley and Sons Inc.

Priestaf, R. C. and J. F. Emmel. 1998. An Extraordinary New Subspecies of *Philotiella speciosa* (Lepidoptera: Lycaenidae) From Coastal Santa Barbara County, California. Systematics of Western North American Butterflies. Mariposa Press. Pages 283-286.

Rathbun, G., N. Siepel, and D. Holland. 1991. Nesting behavior and movements of western pond turtles, *Clemmys marmorata*. Southwestern Natur. 37(3): 319-324.

Raven, P. G., and J. I. Axelrod. 1978. Origin and Relationships of the California Flora. *University of California Publications in Botany* 72:1-134.

Reid, Thomas and Murphy, Dennis. 1995. Providing a Regional Context for Local Conservation Action: A Natural Community Conservation Plan for the Southern California Coastal Sage Scrub. *BioScience* Supplement.

Remsen, J. V. 1978. Bird Species of Special Concern in California. California Department of Fish and Game, Wildlife Management, Administrative Report 78-1.

Riverside County 2003. http://www.rcip.org/mshcpdocs/Vol2/appendixB/Sec-02.Birds/43.Yellow BreastedChat.pdf.

Roberts, L. J. 1984. Archeological Investigations on San Antonia Terrace, Vandenberg Air Force Base, California, in Connection with MX Facilities Construction. Chambers Consultants and Planners. Historical Overview of the Study Area. Appendix II

Rundel, P.W., D.J. Parsons, and G.A. Baker 1980. The role of shrub structure and chemistry in the flammability of chaparral shrubs. Pages 248-260 *in* Proceedings of the second conference on scientific research in national parks. Volume 10. Fire ecology. USDI National Park Service, Washington D.C.

SAIC 1993. Final Biological Resources Mitigation Plan for the Mission Hills Extension and Santa Ynez Extension. Prepared for Central Coast Water Authority. Santa Barbara, California.

SAIC 2004. Burton Mesa Mitigation Site Final Project Report. June. Prepared for Central Coast Water Authority. Buellton, California.

(www.saic.com/cover-archive/environ/pdfs)

Salazar, L.A. and A. Gonzalez-Caban. 1987. Spatial relationship of a wildfire, fuelbreaks, and recently burned areas. *Western Journal of Applied Forestry* 2:55-58.

Santa Barbara County 1990. Irrevocable Dedication of Open Space Easement by Union Oil Company of California to the County of Santa Barbara. County Book of Records 141, page 94. (Originally recorded with an error in 1986.).

Santa Barbara County 1999. Comprehensive Plan, Lompoc Area Land Use Element Interpretive Guidelines, Community Benefits, County Action Items. Adopted by the Board of Supervisors November 9, 1999.

Santa Barbara County Fire Department. 1994. Oak Hill Incident Status Summary. Santa Barbara, California.

Santa Barbara County Planning and Development. 1998. Proposed Final Burton Mesa Management Plan. Prepared for California State Lands Commission.

Santa Barbara County Planning and Development. 1997. Draft Environmental Impact Report on the Burton Mesa Management Plan. Prepared for the California State Lands Commission.

Santa Barbara County Planning and Development. 1998. Draft Burton Mesa Management Plan. Prepared for the California State Lands Commission.

Santa Barbara News Press. 1994a. Wildfire Rages Outside Lompoc. October 11.

Santa Barbara News Press. 1994b. Firefighters Use Caution as Blaze Burns Oil Field. October 11.

Santa Barbara News Press. 1994c. Fire Contained, but Black Hills Now Lie Exposed to Winter Rains.

Sawyer, John O. and Keeler-Wolf, Todd 1995. A Manual of California Vegetation. California Native Plant Society 471p.

Schlesinger, W. H., J. T. Gray, and F. S. Gilliam. 1982. Atmosphere Deposition Processes and Their Importance as Sources of Nutrients in a Chaparral Ecosystem of Southern California. *Water Resources Research* 18:623-629.

Schlesinger, W. H., J. T. Gray, D. S. Gill, and B. E. Mahall, B. 1982. *Ceanothus megacarpus* Chaparral: a Synthesis of Ecosystem Processes during Development and Annual Growth. *Botanical Review* 48:71-117.

Schuler-Jones, S. 2004. Personal Communication. State Park Ranger at La Purisma Mission State Historic Park.

Semonsen, V. 2003. Personal Communication. Biologist, Santa Barbara, California.

Shipman, G. E. 1972. Soil Survey of the Northern Santa Barbara Area. United States Department of Agriculture, Soil Conservation Service.

Small, A. 1994. California Birds. Their Distribution and Status. Ibis, Vista, California.

Smith, A. 2005. Personal communication. Farmer. Lompoc, California.

Smith, P. 2005. Personal communication. Farmer. Lompoc, California.

Smith, C. F. 1998. A Flora of the Santa Barbara Region, California 2nd Edition. Santa Barbara Botanic Garden and Capra Press, Santa Barbara, California.

Smith, P. 2004. Personal communication. Farmer. Lompoc, California.

State of California. 1991(a). Exhibit B to Individual Settlement Agreement. Property Agreement by and between Union Oil Company of California and the State of California.

State of California. 1991(b). Certificate of Acceptance and Consent to Recording (#91-038941). Free Recordation Pursuant to Government Code Section 27383.

State of California. 1991(c). Certificate of Acceptance and Consent to Recording (#91-038942) by County of Santa Barbara to the California State Lands Commission. Free recordation Pursuant to Government Code Section 27383.

State of California Department of Fish and Game. 2004. Botanical and Wildlife Surveys in Fuel Management Segments on the Burton Mesa Ecological Reserve (T. Hovey, L. Comrack, M. Meyer, D. Hickson, D. Lawhead).

State of California Fish and Game Commission. 2005. Section 630 Ecological Reserves, Title 14 California Code of Regulations.

State of California Lands Commission 1994. Amendment of General Lease – Public Agency Use and Agreement for Environmental Mitigation. 23.60 acres of permanent lease area of sovereign land located near Vandenberg Village, Santa Barbara County for construction, operation, repair and maintenance of an extension of the State water project aqueduct to deliver treated water within Santa Barbara County. Calendar Item 128. PRC 7762. W 25000. November 15.

State of California Lands Commission 1995. (no date). Calendar Item. WO 24970. General Lease – Public Agency Use to County of Santa Barbara Sheriff's Department of a 3.04 acre parcel of sovereign land within the Burton Mesa Management Area, near Vandenberg Village, Santa Barbara County.

State of California Lands Commission 2002. Staff Report December 16, 2002. Calendar Item C08. Authorize the Expenditure of Kapiloff Land Bank Funds to Prepare Management Plan/EIR and to Operate and Maintain the Burton Mesa Ecological Reserve in Northern Santa Barbara County.

Stavert, D.M. 1976. Rodent utilization of a disturbed habitat: fuelbreaks in the chaparral. M.S. thesis, California State University, Fullerton, California.

Stebbins, R. C. 1954. Amphibians and reptiles of western North America. McGraw-Hill, New York. 536pp

Stebbins, R. C. 1985 Western Reptiles and Amphibians, Second Edition. Houghton Mifflin, Boston.

Storrer, J. 2000. Results of Survey for California Tiger Salamander – Lompoc Federal Prison Property. Memo to Todd Sloat, Jones & Stokes Inc. 6 pp.

Stromberg, M.R., Kephart, P. & Yadon, V. 2001. Composition, invasibility, and diversity in coastal California grasslands. Madrono, 48, 236–252

Suarez, A. V., Bolger, D. T. and Case, T. J. 1998. Effects of Fragmentation and Invasion on Native Ant Communities in Coastal Southern California. *Ecology*, 79(6). pp. 2041-2056.

Suarez, A. V., J. Q. Richmond, and T. J.Case 2000. Prey Selection in Horned Lizards Following The Invasion of Argentine Ants in Southern California. *Ecological Applications*. 10(3). pp 711-725. Ecological Society of America

Svihla, A. 1953. Diurnal retreats of the spadefoot, *Scaphiophus hammondi*.{sic} Copeia 1953(3): 1986.

Sweet S. 2004. Personal Communication. Herpetologist and Professor, University of California, Santa Barbara.

Tartaglia, L., J. F. Romani and J. Schmidt. 1999. Results of Archaeological Extended Phase I and Phase II Testing at CA-SBA-1768, -1769, -1770, -1771, and 1894 for Prime West Homes, Inc., Vandenberg Village, City of Lompoc, California.

Taylor, D. M., and C. D. Littlefield. 1986. Willow flycatcher and yellow warbler response to cattle grazing. American Birds 40: 1169-1173.

The Oak Collaborative. 1990. Burton Mesa Natural Preserve Master Plan and Environmental Assessment. Prepared for the Santa Barbara County Parks Department.

Thomas Olson Biological Consulting. 2001a. Survey Results California Red-legged Frog Surveys Lompoc Airport Runway Extension. Prepared for Skyway Engineering, Santa Maria, CA. 9pp. February 6, 2001.

Thomas Olson Biological Consulting. 2001b. Results of Surveys for Sensitive Species, Identification of trees and Shrubs to be Removed, Lompoc Airport Runway Expansion Project. Prepared for Skyway Engineering, Santa Maria, CA. 35 pp. July 7, 2001.

Thomas Olson Biological Consulting. 2002. Biological Resources Report. Three Parcels Northwest of the "Wye," Lompoc, California. Prepared for Jensen Design and Survey, Inc. November 6.

Thomas Olson Biological Consulting. 1999. Summary of California Red-legged Frog Information Santa Ynez River Bridge Bikepath Project Lompoc, California. Prepared for U. S. Fish and Wildlife Service, Ventura, CA. 5 pp. August 9, 1999.

Timbrook, J., John R. Johnson and David D. Earle. 1982 Vegetation Burning by the Chumash. Journal of California and Great Basin Anthropology 4(2): 163-186.

Tyler, C.M. 1996. Relative importance of factors contributing to postfire seedling establishment in maritime chaparral. Ecology 77 (7):2182-2195.

Tyler, C.M. and D.C. Odion. 1996. Ecological studies of Morro Manzanita (*Arctostaphylos moroensis*). Report prepared for the California Department of Fish and Game, Endangered Plan Program. 46 pp.

Tyler, C.M. 1995. Factors contributing to postfire seedling establishment in chaparral: direct and indirect effects of fire. *Journal of Ecology* 83(6):1009-1020.

Tyler, C.M. and C.M. D'Antonio. 1995. The effects of neighbors on the growth and survivorship of shrub seedlings following fire. *Oecologica* 102:255-264.

United States Department of Agriculture, Forest Service. 2002. BehavePlus: Fire Modeling System 2.0.

United States Fish & Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, and the Vernal Pool Tadpole Shrimp; and Threatened Status for the Vernal Pool Fairy Shrimp. Portland, Oregon.

United States Fish and Wildlife Service. 1995. Migratory Non-game Birds of Management Concern in the United States: the 1995 List. Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Washington, D.C.

U.S. Fish & Wildlife Service. 2003. Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon Vernal pool crustaceans and plants in California and Oregon. (pdf) Portland, Oregon.

U.S. Geologic Survey, 1959 Lompoc Quadrangle, California-Santa Barbara CO>, 7.5 Minute Series (Topographic).

Union Oil. 1986. A Recording of Irrevocable Dedication of Open Space Easement from Union Oil Company to the County of Santa Barbara (dated May 8, 1986).

Unitt, P. E. 1984. Birds of San Diego County. *San Diego Museum of Natural History Memoir* 13.

Upson, J.E., and Thomasson, H.G. Jr., 1951, Geologic and Water Resources of the Santa Ynez River Basin, Santa Barbara County, California, Geologic Survey Water-Supply Paper 1107.

Van Dyke, E. and K. D. Holl and J.R. Griffin 2001. Maritime Chaparral Community Transition in the Absence of Fire.

Vandenberg Air Force Base Cultural Resources. 2000. Historic Sites Management Notebook: Results of an Inventory and Evaluation of Historic Sites, Buildings, and Structures, Vandenberg Air Force Base, California.

Vitt, L. J., and R. D. Ohmart. 1977. Ecology and reproduction of lower Colorado river lizards: ii. Cnemidophorus tigris (Teiidae), with comparisons. Herpetologica 33:223-234

Weathers, K. C. 1999. The importance of cloud and fog in the maintenance of ecosystems. *TREE* vol. 14, no. 6.

Wells, P. V. 1968. New Subspecies of *Arctostaphylos*. *Madrono* 19:197-208.

Wells, P. V. 1969. The Relation Between Mode of Reproduction and Extent of Speciation in Woody Genera of the California Chaparral. *Evolution* 23:264-257.

Western Regional Climate Center. 2003. Period of Record Monthly Climate Summary, Lompoc, California (Station No. 045064). (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?calomp+sca).

Wilken, D. H. 2005. Letter to Barbara Fosbrink, Technical Services Chief, Channel Coast District Department of Parks and Recreation, regarding comments on the draft La Purisima Ecosystem Characterization Report. March 28. Central Coast Center for Plant Conservation, Santa Barbara Botanic Garden. Santa Barbara, California.

Williams, D. F. 1986. Mammalian species of special concern in California. Calif. Dept. Fish and Game, Wildlife Div. Admin. Report, 86-1.

Wright, A. H., and A. A. Wright. 1957. Handbook of Snakes of the United State and Canada. Volume II. Comstock Publishing Associates, Ithaca, New York.

Wunder, M. B., and F. L. Knopf. 2003. The Imperial Valley of California is Critical to Wintering Mountain Plovers. *Journal of Field Ornithology* 74:74-80.

Zarn, M. 1974. Burrowing Owl, *Speotyto cunicularia*. Habitat Management Series for Unique or Endangered Species, U. S. Department of Interior, Bureau of Land Management, Technical Note 11. Denver, Colorado.

Zedler, P.H., C.R. Gautier, and G.S. McMaster. 1983. Vegetation change in response to extreme events: the effect of a short interval between fires in California chaparral and coastal scrub. Ecology 64:809-818.

Zeiner, D. C., et al. (compiling eds.). 1990. California's Wildlife. Volume III. Mammals. Calif. Dept. Fish and Game, Sacramento, CA.

Zeiner, D. C., et al. (compiling eds.). 1988. California's Wildlife. Vol. I. Amphibians and Reptiles; Vol. III. Mammals. Calif. Dept. Fish and Game, Sacramento, CA.

Zeiner, D. C., W., F. Laudenslayer, Jr., K. E. Mayer, M. White. Editors. 1990. California's Wildlife. Volume 2. Birds. State of California, Department of Fish and Game. Sacramento, California.