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**PUBLIC REVIEW DRAFT
RESOURCE DOCUMENT**



Multiple Species Conservation Program (MSCP)

Volume II: Appendix A - Biological Resources

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City of San Diego

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- 4S Kelwood General Partnership. 1993. Personal communication from Dennis M. Moser re 4S Ranch Property. May 5.
- A.D. Hinshaw Associates. 1992. Draft environmental impact report for phase II of the Sweetwater Reservoir urban runoff diversion system. Prepared for Sweetwater Authority. November.
- Abel Parra, Planning Consultant. 1989. Environmental impact study for Dave Martin sand pit, Upper San Diego River at State Highway 67 bridge. Prepared for Dave Martin Trucks & Supplies, Inc. November.
- Affinis. 1989. Draft environmental impact report for the Mast Boulevard extension. Prepared for City of Santee. November. 111 pp.
- Affinis. 1991. Vegetation and sensitive species maps of the East Elliott area.
- Affinis. 1992. Biological resources report for the North City water reclamation plant, San Diego, California. Prepared for The Butler/Roach Group. August. 66 pp.
- Affinis. 1993. Personal communication from JoAnne Smith re miscellaneous projects. May 27.
- Affinis. 1993. Personal communication from Michael Busdosh re Otay Ranch. June 4.
- American Ornithologists' Union. 1983. Checklist of North American Birds. 6th Edition. American Ornithologists' Union, Washington, D.C.
- American Ornithologists' Union. 1986. Thirty-fourth supplement to the A.O.U. Checklist of North American birds. *The Auk* 99(3).
- American Ornithologists' Union. 1989. Thirty-seventh supplement to the A.O.U. Checklist of North American birds. *The Auk* 106 (3): 532-538.
- American Pacific Environmental Consultants. 1980. Rancho Cielo technical appendices Volume II. Prepared for Rancho Cielo Property Owners Association. September.
- Anne E. Debevoise. 1993. Personal communication re Rancho Penasquitos Farm. July 22.
- ASI. 1988. Historic sensitive species data compiled onto Otay Ranch field survey maps.
- Ault, Deuprey, Jones & Gorman. 1993. Personal communication from Robert Coffin re Mt. Israel Reservoir. May 28.
- Bailey, E. 1991. Personal communication of sensitive species data.
- Barbour, M.G. and J. Major, eds. 1977. Terrestrial vegetation of California. California Native Plant Society. 1002 pp.

- Bauder, E.T. 1986. San Diego vernal pools, recent and projected losses; their condition; and threats to their existence 1979-1990. U.S. Fish and Wildlife Service, Office of Endangered Species.
- Beauchamp, R.M. 1972. Floral diversity of San Diego County, California. M.A. thesis, California State University, San Diego.
- Beauchamp, R.M. 1979. San Diego vernal pool study. California Department of Fish and Game, nongame wildlife investigations, endangered plant program, 145. Job II-1.0.
- Beauchamp, R.M. 1986. A Flora of San Diego County. Sweetwater River Press. 241 pp.
- Brian F. Mooney Associates. 1989. Final program environmental impact report for the water distribution plan. Prepared for the San Diego County Water Authority. June.
- Brian F. Mooney Associates. 1991. Biological survey and report for the Rancho Peñasquitos SoPac property (Paraiso Cumbres), San Diego County, California. Prepared for SoPac Real Estate Group. November. 18 pp.
- Brian F. Mooney Associates. 1991. Draft supplemental environmental impact report for Rancho San Diego tentative map TM4740 Jamacha Village West. July. 151 pp.
- Brian F. Mooney Associates. 1992. Personal communication from Gary Royle re Madura Property in Del Dios area. June 3.
- Butler/Roach Group, Inc. 1987. Draft environmental impact report for the proposed Stonecrest specific plan. Prepared for City of San Diego Planning Department. September. 223 pp.
- California Coastal Conservancy and California Department of Fish and Game. 1987. Famosa Slough plan. December.
- California Department of Fish and Game (CDFG). 1965. California fish and wildlife plan. The Resources Agency, volume 3(c):908.
- California Department of Fish and Game, Endangered Plant Program. 1985. Maps of the vegetation of San Diego.
- California Department of Fish and Game. 1974. Natural resources of Los Peñasquitos Lagoon and recommendations for use and development. March. 75 pp.
- California Department of Fish and Game. 1991. California Natural Diversity Data Base.
- California Department of Forestry and Fire Protection. 1991. Environmental impact report for the compartment analysis and management plan of the Coochama Experimental Forest (a.k.a. Wentz Property, California Department of Forestry, San Diego County, California), Unit 5, Compartment #39 and 40 of the Laguna-Morena demonstration area. 19 pp.

- California Department of Parks and Recreation, California Resources Agency. 1982. Sycamore Canyon proposed State vehicular recreation area feasibility study. March. 51 pp.
- California Department of Parks and Recreation. 1984. San Diego Coastal State Park System general plan, Torrey Pines State Beach and State Reserve. July. 119 pp.
- California Department of Transportation (Caltrans). 1982. Biological resource analysis for proposed State Route 52, Interstate 805 to Santo Road. October. 114 pp.
- California State Polytechnic University, Pomona, Department of Landscape Architecture. 1989. A management framework for the Tijuana River Valley. June. 107 pp.
- CalMat Co. 1990. CalMat-Poway reclamation plan--1990. August.
- Caltrans. 1986. Biological resource analysis for State Route 52, Santo Road to State Route 67. June. 95 pp.
- Caltrans. 1988. Endangered species consultation biological assessment for State Route 52 East. November. 34 pp.
- Caltrans. 1989. Final environmental impact report and final section 4(F) evaluation, Santo Road to State Route 67. July.
- Caltrans. 1991. I-5 widening and interchange improvements in San Diego, final environmental impact statement. March.
- Cinti and Associates. 1986. Rice Canyon design study, revised draft. Prepared for Rancho del Rey Partnership. December. 7 pp.
- City of Chula Vista. 1992. Personal communication from Gordon Harand re San Miguel Ranch. May 1.
- City of Del Mar. 1992. Personal communication from Monica Tuchscher re wetland/aquatic habitats/City of Del Mar. May 18.
- City of La Mesa Planning Commission. 1988. Resolution No. 15978, approving final supplemental environmental impact report for the Eastridge specific plan.
- City of Poway. 1992. Personal communication from Jim Nessel re Poway Detailed Biological Assessment. April 21.
- City of San Diego Planning Department. 1983. Sorrento Hills community plan environmental impact report.
- City of San Diego Planning Department. 1985. Los Peñasquitos Lagoon enhancement plan. 136 pp.
- City of San Diego Planning Department. 1986. Environmental impact analysis for North City West town center. Prepared by RBR & Associates. April.
- City of San Diego Planning Department. 1986. Tijuana wastewater defensive measure project, alternative 1D, final environmental impact report.

- City of San Diego Planning Department. 1987. Environmental impact report Carmel Del Mar Neighborhoods 5 & 6 precise plan amendment. Prepared by P&D Technologies. November.
- City of San Diego Planning Department. 1987. Environmental impact report for the Calle Cristobal/Camino Santa Fe Assessment District. Prepared by RECON. September.
- City of San Diego Planning Department. 1987. Environmental impact report for the Gateway Fair Otay Mesa community plan amendment, planned commercial development, rezone, and conditional use permit. Prepared by RECON. December.
- City of San Diego Planning Department. 1987. Environmental impact report for the Mission Trails Apartment project. Prepared by RECON. April.
- City of San Diego Planning Department. 1987. Hempe Hills negative declaration. Planning Department, EQD 87-0115. October.
- City of San Diego Planning Department. 1987. Revised environmental impact report for Scripps Miramar Ranch community plan amendment and annexation. April.
- City of San Diego Planning Department. 1988. City-wide generalized vegetation map. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. 1989. Environmental impact report for Mission Bay Park shoreline stabilization and restoration project plan and natural resource plan. December.
- City of San Diego Planning Department. 1989. Environmental impact report for the amendment to the Shaw/Lopez Rim tentative map and planned residential development permit. November.
- City of San Diego Planning Department. 1989. Sunroad Mesa Gateway environmental impact report. Prepared by Pacific Southwest Biological Services. October.
- City of San Diego Planning Department. 1990. Carmel Valley (North City West) Neighborhoods 8A and 10 biological resource maps. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. 1990. Environmental impact report for the East Mission Gorge interceptor-pump station and force main project. August.
- City of San Diego Planning Department. 1990. Environmental impact report for the Fairbanks Highlands planned residential development and vesting tentative map EQD No. 88-1041. March. 124 pp.
- City of San Diego Planning Department. 1990. Jackson Drive alignment survey. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. 1990. Point Loma sludge pipeline replacement project initial study. Prepared by The Development and Environmental Planning Division. July.

- City of San Diego Planning Department. 1990. Supplemental environmental impact report for the Monarch Estates vesting tentative map and planned residential development. June.
- City of San Diego Planning Department. 1990. U.S. Fish and Wildlife Service National wetlands inventory maps. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. 1991. North City future urbanizing area maps. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. 1991. Notice of preparation of a draft supplemental environmental impact report for the Carmel Valley pump station, trunk sewer and water main improvements. Prepared by the Development and Environmental Planning Division. December.
- City of San Diego Planning Department. 1991. Resource Protection Ordinance (RPO) guidelines. Planning report No. 90-057.
- City of San Diego Planning Department. 1991. Secondary treatment system and associated sludge management facilities. March. Volumes 1-6.
- City of San Diego Planning Department. 1991. Torrey Pines community plan resource analysis maps. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. 1992. Final environmental impact report for the Los Peñasquitos Canyon Preserve master plan. Prepared by the Development and Environmental Planning Division. November. 227 pp.
- City of San Diego Planning Department. No date. Cal Terraces biological resources map. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. No date. Dennery Ranch biological resources map. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. No date. Hidden Trails biological resources map. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. No date. Otay Ranch biological resources map. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. No date. South Palm biological resources map. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego Planning Department. No date. Spring Canyon biological resources map. Prepared by the Long Range Division, Resource Management Section.
- City of San Diego. 1991. Personal communication from Cathy Cibit re miscellaneous projects. December 20.
- City of San Diego. 1992. Personal communication from Don Prisby re miscellaneous projects. April 21.

- City of San Diego. 1992. Personal communication from Jim Brown re Water Utilities Department Properties. April 30.
- City of Santee. 1992. Personal communication from Douglas Williford re miscellaneous projects. April 30.
- Cooper, E. and R. E. Webster. 1984. Bird surveys of Los Peñasquitos Lagoon, March through July of 1984. Prepared for Woodward-Clyde Consultants. July. 22 pp.
- County of San Diego. 1980. Conservation element (Part X) of the County general plan. Planning Department, GPA-80-61.
- County of San Diego. 1988. Las Colinas detention facility expansion final environmental impact report. February.
- County of San Diego. 1990. Draft environmental impact report, Valley Center community plan update. May. 156 pp.
- Cowardin, L.M., F.C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, U.S. Department of Interior, December.
- Craig R. Lorenz and Associates. 1987. Revised biological report of TPM 19241. Prepared for County of San Diego Department of Planning and Land Use. December.
- Craig R. Lorenz and Associates. 1988. Report of a biological resources analysis and focused California black-tailed gnatcatcher study for the Quail Canyons Estates, Phase 3, San Diego County, California TM4627. Prepared for Jaric Enterprises, Inc. July.
- Craig R. Lorenz and Associates. 1989. Biological survey report for TPM 19319. Prepared for County of San Diego Department of Planning and Land Use. September. 22 pp.
- Crother, B. 1991. Personal communication of sensitive species data.
- Dames & Moore. 1991. Final environmental assessment for ordinance clearance of Mission Trails Regional Park, San Diego, California. Submitted to U.S. Army Engineer Division. September.
- Dice, J. C. 1988. Systematic studies in the *Nolina bigelovii-N. parryi* (Nolinaceae) complex. A thesis presented to San Diego State University. 203 pp.
- Dillon Development Inc. 1993. Personal communication from Julie Dillon re North City West. April 28.
- Dillon Development, Inc. 1992 Personal communication from Julie Dillon re East Elliot. May 7.
- Dudek & Associates. 1990. Sensitive Plant Species Survey Report, Otay Ranch-Proctor Valley/Jamul Mountains Area, San Diego County, California. Prepared for The Baldwin Company. August. 24 pp.

- Dudek & Associates. 1991. Biological resources assessment report for 4S Ranch concept plan area, San Diego County, California. Prepared for 4S Partners. June.
- Dudek & Associates. 1991. Phase 1 Otay Ranch resource management plan. Prepared for Baldwin Vista Associates L.P. November. 180 pp.
- Dudek & Associates. 1992. Personal communication from Harold Wier re Otay Ranch. May 4.
- Dudek & Associates. 1992. Report on the Flora of the Otay Ranch Vernal Pools, 1990-1991, San Diego County, California. Prepared for Baldwin Vista Associates. March.
- Eastlake Development Company. 1993. Personal communication from Katy Wright re Orange Avenue. April 19.
- Eastlake Development Company. 1993. Personal communication from Katy Wright re Olympic Training Center. April 20.
- Environmental Development. 1993. Personal communication from Bruce Tabb re Old Coach Road Property. May 25.
- ERB Engineering, Inc. 1989. Draft environmental impact report for Luelf Ranch specific plan area. GPA case No. PAA-22-86. Prepared for Golden California Securities Group. April. 47 pp.
- ERC Environmental and Energy Services Co. (ERCE). 1989. Draft environmental impact report, City of Escondido draft general plan. Prepared for City of Escondido. December.
- ERCE and Sweetwater Environmental Biologists. 1991. Biological technical report: Rancho San Miguel general development plan. Prepared for City of Chula Vista. August. 78 pp.
- ERCE. 1989. Eastlake III / Olympic Training Center draft environmental impact report. Prepared for City of Chula Vista. May.
- ERCE. 1989. Salt Creek Ranch annexation/general development plan/pre-zone draft environmental impact report. Prepared for City of Chula Vista. September.
- ERCE. 1989. Sunbow Phase II draft environmental impact report. Prepared for City of Chula Vista. April.
- ERCE. 1990. A biological resources survey report for the Mesa Top subdivision project, TM 4836. Prepared for Mesa Top Association. July. 34 pp.
- ERCE. 1990. Addendum to environmental assessment for the proposed land sales and exchanges south of California State Route 52, Naval Air Station Miramar, San Diego County, California. Prepared for Department of the Navy. October.
- ERCE. 1990. Biological constraints analysis: Sunset Cliffs Natural Park. Prepared for Van Dyke and Associates. September. 9 pp.

- ERCE. 1990. Biological resources technical report, Navy training course complex P-190, Naval Air Station Miramar, San Diego, CA. Prepared for Tectonics. April. 32 pp.
- ERCE. 1990. Biological survey report for the Hidden Valley Estates Property. Prepared for County of San Diego. August.
- ERCE. 1990. Biological technical report for Campo Village South TM 4749. Prepared for Home Capital Corporation. May. 77 pp.
- ERCE. 1990. Biological technical report for the Mission Valley water reclamation project. Prepared for City of San Diego. August. 131 pp.
- ERCE. 1990. Biology report for the Peñasquitos substation 230/KV addition. Prepared for San Diego Gas & Electric. February. 24 pp.
- ERCE. 1990. Environmental assessment: FY92 training course complex, P-192, Naval Air Station Miramar, San Diego County, California. Prepared for Department of the Navy. October.
- ERCE. 1990. Phase I report: Amber Ridge California gnatcatcher study. Prepared for Weingarten, Siegel, Fletcher Group, Inc. April. 31 pp.
- ERCE. 1990. Phase II report: Amber Ridge California gnatcatcher study. Prepared for Weingarten, Siegel, Fletcher Group, Inc. September. 15 pp.
- ERCE. 1990. Supplemental environmental impact report for Rancho San Diego TM 4773 Jamacha Village West. Prepared for Home Capital Development Group. December.
- ERCE. 1991. Biological Survey of the Highway 94-Campo Road Expansion Project Area. Prepared for Rancho San Diego Partners. October. 20 pp.
- ERCE. 1991. Biological technical report for Daley Rock Quarry Jamul Valley, San Diego. Prepared for Lettieri-McIntyre and Associates for submittal to the County of San Diego. October. 38 pp.
- ERCE. 1991. Biological technical report for Jamacha Village West 2, TM 4773. Prepared for Home Capital Corporation. January. 48 pp.
- ERCE. 1991. Biological technical report for the Soledad Canyon Second Track project. Prepared for Myra L. Frank and Associates. September. 45 pp.
- ERCE. 1991. Biological technical report: Paradise Creek bridge replacement project. Prepared for Metropolitan Transit Development Board. July. 23 pp.
- ERCE. 1991. Brown Field Border Patrol Station environmental assessment. August.
- ERCE. 1991. Checkprint draft program environmental impact report for Otay Ranch. Prepared for Otay Ranch Joint Planning Project. August.
- ERCE. 1991. Detailed biological assessment for the City of Poway. Prepared for City of Poway. April.

- ERCE. 1991. Draft supplemental environmental impact report: Hidden Trails precise plan/UTM/PRD. Prepared for Robert L. Childers Co., Inc. July.
- ERCE. 1991. Focused California gnatcatcher resource study for the City of Poway. Prepared for City of Poway Planning Department. September. 32 pp.
- ERCE. 1991. Letter report on the survey for Cleveland's Golden Star (*Muilla clevelandii*) on the Tech Business Center in Poway, California. June.
- ERCE. 1991. Second annual report for the San Diego Thorn-Mint (*Acanthomintha ilicifolia*) biological mitigation plan for the Westview planned residential development. Prepared for Pardee Construction Company for submittal to the California Department of Fish and Game. 37 pp.
- ERCE. 1991. Sensitive animal sightings (non-raptor) from Otay Ranch raptor study.
- ERCE. 1991. The Mission Valley West Light Rail Transit project: Biological resources technical report. Prepared for Metropolitan Transit Development Board. July.
- ERCE. 1991. Wetland mitigation plan for Campo Village South TM 4749. Prepared for Rancho San Diego Partners. July. 63 pp.
- ERCE. 1992. Biological Technical Report for Daley Rock Quarry, Jamul Valley, San Diego County. Prepared for Daley Enterprises. April. 58 pp.
- ERCE. No date. Unpublished California gnatcatcher location data maps for San Diego County.
- ERCE. No date. Unpublished data for the Baldwin raptor study on the Otay Ranch property.
- ERCE. No date. Unpublished data for the East Otay Mesa specific plan environmental impact report.
- ERCE. No date. Unpublished data for the Skyline Church California gnatcatcher report.
- Estrada Land Planning. 1988. San Dieguito River Valley Regional Park draft analysis report. Prepared for City of San Diego. December. 155 pp.
- Ferreira, J. 1982. Plant life. Torrey Pines State Reserve and State Beach. Prepared for Natural Heritage Section, Resource Protection Division. October.
- Ferren W.R., Jr., D.G. Capralis, and D. Hickson. 1987. University of California, Santa Barbara, Campus wetlands management plan. Part I - Technical report on the botanical resources of West and Storke Campuses. Department of Biological Sciences, University of California, Santa Barbara. Environmental report No. 12.
- General Dynamics Corp. 1993. Personal communication from Richard Hadinger re Sycamore Canyon. May 27.
- George S. Nolte & Associates. 1988. National City local coastal program land use plan.
- Graves Engineering. 1993. Personal communication from Paul Ross re Skyline Wesleyan Church. May 21.

- Graves Engineering. 1993. Personal communication from Timothy J. Graves re Clark Ranch. June 11.
- Grishaver, M. 1991. Personal communication of sensitive species data.
- Haas, B. 1991. Personal communication of California gnatcatcher data for the Tierrasanta ordinance removal project.
- Hayworth, A. 1990. Biological survey of the proposed Dulzura Flume renovation. Prepared for The Butler Research Group, Inc. March. 49 pp.
- Holland, R.F. 1986. Preliminary descriptions of the terrestrial natural communities of California. State of California, The Resources Agency.
- J. A. Smith Biological Services. 1989. Biological survey report for Winston Liu Property, San Diego, California. Prepared for Great Real Estate Company, Inc. April.
- J. L. Elder Corp. 1993. Personal communication from Jerry Elder re Via Panacea (formerly Parkview Estates). May 5.
- James Dobbin Associates Inc. 1986. Tijuana River National Estuarine Sanctuary management plan. Prepared for State of California Coastal Commission and U.S. Department of Commerce, National Oceanic and Atmospheric Administration Sanctuary Programs Division, and Tijuana River National Estuarine Sanctuary Management Authority. February. 184 pp.
- JBF & Associates. 1989. Existing conditions report, Otay Ranch, San Diego, California. Prepared for City of Chula Vista, and County of San Diego. October. 183 pp.
- JBH Biological Surveys. 1990. Letter report for TPM 19628, Ramona, California. Prepared for Mr. and Mrs. Fugua. September. 23 pp.
- Jennings, M.R. 1983. An annotated checklist of the amphibians and reptiles of California. California Department of Fish and Game 69(3):151-171.
- Jones, B., and D. Knoll. 1983. Riparian revegetation techniques for the Pamo Dam project. Prepared for Dr. Charles Cooper.
- Jones, J.K., Jr., R.S. Hoffman, D.W. Rice, C.J. Jones, R.J. Baker, and M.D. Engstrom. 1982. Revised checklist of North American mammals north of Mexico, 1991. Occasional Papers of the Museum Texas Tech University 146:1-23.
- Kay, I. 1989. State Route 56-East. Report on biological resources occurring in the project area. Prepared for Caltrans District 11. September. 52 pp.
- Keller Environmental Associates, Inc. 1990. Draft Camino Ruiz/Black Mountain Road environmental sensitivity study. Prepared for County of San Diego, KEA #89-21. August.
- Keller Environmental Associates, Inc. 1990. Draft SA 680/SF 728 environmental sensitivity study. Prepared for County of San Diego. August.

- Kellogg, J. No date. Miramar Naval Air Station vegetation map.
- Kelly, D. 1991. Personal communication of sensitive species data.
- King, D. 1991. Personal communication of sensitive species data.
- Kus, B.E. 1993. Least Bell's vireo location data. September.
- Lawrence Consulting Group. 1987. A biological survey report for the Robinhood Ridge study area. December. 32 pp.
- Los Peñasquitos Lagoon Foundation and the State Coastal Conservancy. 1985. Los Peñasquitos Lagoon enhancement plan and program. October. 131 pp.
- Lovio, J. 1991. Personal communication of sensitive species data.
- Loy, M., County of San Diego. 1987. Biological survey report: Peñasquitos Canyon Reserve. November. 33 pp.
- MBA. 1989. Biological resources survey report, Otay Ranch-Proctor Valley area, San Diego County, California. Prepared for The Baldwin Company. September. 83 pp.
- MBA. 1989. Environmental impact report for The Pointe.
- MBA. 1989. Sensitive animal species field survey maps for Otay Ranch (Proctor Valley parcel).
- MBA. 1989. Sensitive plant species field survey maps for Otay Ranch (Proctor Valley parcel).
- MBA. 1990. Biological resources survey report for San Marcos landfill expansion project. Prepared for County of San Diego Department of Public Works. June. 55 pp.
- MBA. 1990. Biological survey report for Las Montañas Resort, Jamul, California. Prepared for City of Chula Vista. August. 78 pp.
- MBA. 1990. Preliminary draft vernal pool management plan, Naval Air Station Miramar. Prepared for Engineering Field Division, Southwest. June.
- MBA. 1990. Sensitive animal data gap survey maps for Otay Ranch (Proctor Valley parcel).
- MBA. 1990. Sensitive plant species spring survey maps for Otay Ranch (Proctor Valley parcel).
- MBA. 1990. Volume II: Resources atlas, birds of San Diego Bay: Historical data and 1988 and 1989 surveys. In: San Diego Bay enhancement plan. Prepared for San Diego Unified Port District and California State Coastal Conservancy. March. 6 volumes.
- MBA. 1991. Scripps Ranch North Phase III, Supplement to EQD#85-0100, SEIR #90-0898. Prepared for McMillin Communities, Inc.

- MBA. 1992. Carmel Highlands Biological and Wetland Jurisdictional Report. Prepared for Pardee Construction Company. May.
- MBA. No date. Letter report on a biological constraints survey for the City of Poway bike trail. Prepared for Bradley-Holloway Associates, Inc. 3 pp.
- McMillin Communities. 1992. Personal communication from Craig Fukuyama re Rancho del Rey. April 6.
- McMillin Communities. 1992. Personal communication from Craig T. Fukuyama re Rancho del Rey. April 6.
- McMillin Communities. 1992. Personal communication from Kimberly K. Elliott re Miramar Ranch North. April 9.
- McMillin Communities. 1993. Personal communication from Craig Fukuyama re Rancho del Rey. April 26.
- McMillin Scripps, Inc. 1993. Personal communication from Kimberly Elliott re Miramar Ranch North. June 1.
- Michael Brandman & Associates, Inc. (MBA). 1986. Foothill transportation corridor, Cristianitos segment, environmental baseline study. Prepared for Orange County Environmental Management Agency. September.
- Miramar. 1992. Personal communication from Tommy Wright re NAS Miramar. May 17.
- Mock, P. 1991. Personal communication of sensitive species data.
- Mooney & Associates. 1990. Biological survey and report for Sky Mesa Ranch. Prepared for James LaForce. October.
- Mooney-Lettieri and Associates. 1983. Volume II: Draft environmental impact report/environmental assessment for the Pamo Reservoir. Prepared for San Diego County Water Authority. November.
- Mooney-Lettieri and Associates. 1984. Feasibility study for Ranch and Harris properties. October. 46 pp.
- Mooney-Levine & Associates. 1986. California black-tailed gnatcatcher survey for Bonita Hills Ranch Phase V. Prepared for Cameo Development. December.
- Mooney-Levine & Associates. 1986. Draft environmental impact statement for the Pamo Dam and Reservoir project. Prepared for U.S. Army Corps of Engineers. October.
- MSA, Inc. 1982. Biological resources of the U.S. Naval Radio Station "R," Imperial Beach, California. Prepared for the Department of Navy, Western Division. October. 143 pp.
- MTDB. 1992. Personal communication from MTDB re miscellaneous projects. April 15.

- Munz, P.A. 1974. A flora of southern California. University of California Press, Berkeley. 1086 pp.
- Newland California. 1992. Personal communication from James Whalen re Park Trade, Torrey Reserve, Carmel Estates. May 20.
- Newland California. 1993. Personal communication from James E. Whalen re miscellaneous projects. July 7.
- Oberbauer, T. 1979. Distribution and dynamics of San Diego County grasslands. Unpublished M.A. thesis, San Diego State University, San Diego, California.
- Oberbauer, T. 1991. Terrestrial vegetation communities in San Diego County based on Holland's descriptions. Prepared for SANDAG Vegetation Classification Subcommittee of the Regional Open Space Committee.
- Oberbauer, T.A. 1979. Report on the Status and Distribution of the Dehesa Nolina NOLINA INTERRATA GENTRY (Agavaceae). Prepared for California Department of Fish and Game, Wildlife Management Branch. May.
- Ogden Environmental and Energy Services (Ogden). 1992. Biological resources technical report for the SA680/SF728 opportunities and Constraints analysis. Prepared for Keller Environmental Associates, Inc. March.
- Ogden. 1992. Biological survey report for the Cordtz Poway Partnership site. Prepared for Mr. Byron F. White, Cordtz Poway Partnership. October. 25 pp.
- Ogden. 1992. Biological survey report for the Hidden Trails tentative map/precise plan. Prepared for Robert L. Childers, Inc. June.
- Ogden. 1992. Draft biological technical report for Fanita Ranch. Prepared for Phillips Brandt Reddick. June.
- Ogden. 1992. Fanita Ranch: Fanita Parkway extension biological resources report. Prepared for Phillips Brandt Reddick. May. 19 pp.
- Ogden. 1992. Letter report on the biological assessment of the 17 acre property in Poway. Prepared for Mr. Darioush Parniani. March.
- Ogden. 1993. Biological technical report for Sewer Pump Station 24 on Whispering Sands Beach - task No. 33. Prepared for City of San Diego Engineering Division, Water Utilities Department. July. 21 pp.
- Ogden. 1993. Biological technical report for the Del Mar Heights Road extension. Prepared for City of San Diego Engineering and Development Department. July.
- Ogden. 1993. Biological technical report for the North Mission Valley Interceptor Sewer (NMVIS) II project. Prepared for City of San Diego Engineering Division Water Utilities Department. May.
- Ogden. 1993. Biological technical report for the proposed Alvarado Water Filtration Plant expansion and rehabilitation. Prepared for City of San Diego Engineering Division Water Utilities Department. August.

- Ogden. 1993. Biological technical report for Water and Sewer Group 472 in Montclair Park Canyon - task No. 26. Prepared for City of San Diego Engineering Division, Water Utilities Department. February. 21 pp.
- Ogden. 1993. Final report of the First San Diego River Improvement Project (FSDRIP), sixth annual biological monitoring report. Prepared for City of San Diego Planning and Parks and Recreation Departments. April.
- Ogden. 1993. Lakeside mitigation site, San Diego County, California, annual report--year four. Prepared for Homart Development Company for submittal to U.S. Army Corps of Engineers. February. 32 pp.
- Ogden. 1993. Letter report on the focused California gnatcatcher surveys for the Ashwood Street widening project. Prepared for County of San Diego Department of Public Works. June. 9 pp.
- Ogden. 1993. Letter report on the focused least Bell's vireo surveys for the Ashwood Street bike lanes project. Prepared for County of San Diego Department of Public Works. August. 26 pp.
- Ogden. 1993. Letter report on the focused least Bell's vireo surveys for the Central Avenue/Briarwood Road bridge replacement project. Prepared for County of San Diego Department of Public Works. August. 12 pp.
- Ogden. 1993. Letter report on the focused least Bell's vireo surveys for the Kitchen Creek bridge replacement project. Prepared for County of San Diego Department of Public Works. August. 12 pp.
- Ogden. 1993. Letter report on the focused least Bell's vireo surveys for the South Santa Fe Avenue road widening/realignment project. Prepared for County of San Diego Department of Public Works. August. 9 pp.
- Ogden. 1993. Second annual report on the Home Capital borrow pit riparian mitigation. Prepared for Home Capital Development Group. February.
- Ogden. 1993. South County Landfill Project EIR for East Otay (in progress). Prepared for City of San Diego.
- Ogden. 1993. South County Landfill Project EIR for North Otay Valley (in progress). Prepared for City of San Diego.
- Ogden. 1993. South County Landfill Project EIR for Oak Canyon (in progress). Prepared for City of San Diego.
- Ogden. 1993. South County Landfill Project EIR for Upper Sycamore Canyon (in progress). Prepared for City of San Diego.
- Ogden. 1993. South County Landfill Project EIR for Wolf Canyon (in progress). Prepared for City of San Diego.
- Ogden. No date. Unpublished data for the Krutoff property California gnatcatcher survey.
- Ogden. No date. Unpublished data for the LBMC Poway biological survey.

- Ogden. No date. Unpublished data for the Los Peñasquitos Canyon interceptor sewer alignment biological survey.
- Ogden. No date. Unpublished data for the Otay Water District reservoir site survey.
- Ogden. No date. Unpublished data for the South Poway Parkway extension environmental impact report.
- Ogden. No date. Unpublished data for the Torrey Reserve property California gnatcatcher survey.
- Ogden. No date. Unpublished data for the Valencia Parkway California gnatcatcher survey.
- Ogden. No date. Unpublished data for the Waggaman property California gnatcatcher survey.
- P&D Technologies, Inc. 1987. Revised draft environmental impact report: Willow Glen Drive borrow site project. Prepared for Willow Glen Development Company. September. 89 pp.
- P&D Technologies, Inc. 1989. Draft environmental impact report: Chula Vista Auto Centre. Prepared for the City of Chula Vista. June.
- P&D Technologies, Inc. 1989. Draft environmental impact report: City of Chula Vista general plan update. Prepared for the City of Chula Vista. March.
- P&D Technologies. 1990. Final supplemental environmental impact report, Rancho Del Rey sectional planning area (SPA) III plan. Prepared for City of Chula Vista. November.
- P&D Technologies. 1990. San Elijo Ranch technical appendices. Prepared for City of San Marcos. January.
- P&D Technologies. 1992. Freshwater marsh mitigation and monitoring program for the SR-56 Roadway Extension project. Prepared for Presley of San Diego. January.
- Pacific Cielo Development, Inc. 1993. Personal communication from Mark Middlebrook re Rancho Cielo. April 15.
- Pacific Southwest Biological Services (PSBS). 1979. Report of a sensitive plant survey of the Black Mountain-Lusardi Canyon area, Palomar District, Cleveland National Forest. Prepared for Cleveland National Forest. July.
- Padre Dam Municipal Water District. 1988. Evaluation of wastewater treatment alternatives, Santee reclamation facility, proposed expansion to 4.0 MGD. October.
- Pardee Construction. 1992. Personal communication from Leonard Frank re SD Future Urbanizing, Carmel Valley. May 13.
- PIA Sports Properties. 1992. Personal communication from Lance Burris re Black Mount Ranch. May 1.

- PIA Sports Properties. 1992. Personal communication from Lance Burris re North City Future Urbanizing, Black Mountain Ranch. April 27.
- POD, Inc. 1990. San Pasqual Trail feasibility study. Prepared for City of San Diego Park Development and Open Space Division. April.
- PRC Engineering, Inc. 1986. Preliminary draft environmental impact report for the Balboa Park development and management plan. Prepared for the San Diego Parks and Recreation Department. June. 217 pp.
- PRC Engineering. 1984. Draft environmental impact report for 4-S Ranch specific plan and general plan amendment. Prepared for 4-S Ranch Company. June.
- Project Design Consultants. 1987. Robinhood Ridge precise plan. Prepared for Robinhood Homes. December.
- PSBS. 1985. Report of a biological survey of the 440 acre Canyon Creek Country Club site. Prepared for A. D. Hinshaw Associates. December.
- PSBS. 1987. Biological report: West and north dewatering sites and alternative sites at Miramar. Prepared for The Butler/Roach Group. November. 36 pp.
- PSBS. 1989. Report of a biological assessment of the proposed Gatchall Road/Cabrillo Road realignment, Point Loma, California. Prepared for A.D. Hinshaw Associates. December.
- PSBS. 1989. Report of a biological survey of the 12.3 acre Kirk Property, San Dieguito, CA. Prepared for Curtis Kirk. January.
- PSBS. 1989. Report of a biological survey of the G. D. Heller Property, TPM 19280. Prepared for Steven's Planning Group. January. 14 pp.
- PSBS. 1990. Report of a biological assessment of the Lubavitch Property. Lawson Valley area. Prepared for Crew Engineering & Survey. January. 25 pp.
- PSBS. 1990. Report of a biological assessment of the proposed Hilleary Park site. Prepared for City of Poway. November.
- PSBS. 1991. Report of a biological assessment of Rancho Jamul Estates. Prepared for HCH Partners. January. 25 pp.
- PSBS. 1991. Report of a biological assessment of the 153.55 acre Del Dios/Flynn site. Prepared for Mr. Michael W. Flynn. August. 42 pp.
- PSBS. 1991. Report of a biological assessment of the San Diego Water Authority optimal storage study site, San Vicente Reservoir. Prepared for Woodward-Clyde Consultants. February.
- PSBS. 1992. Carmel Valley utilities improvement project, report of biological impact assessment, Los Peñasquitos Lagoon, San Diego, California. Prepared for Engineering-Science, Inc. May. 29 pp.

- PSBS. 1992. Report of a biological assessment of the Wuest property, Miramar Ranch North, San Diego County, California. Prepared for Curtis Scott Englehorn and Associates. July. 36 pp.
- PSBS. 1992. Report of a biological survey of a 3.41 acre parcel and proposed off-site road near Nobel Drive, La Jolla Village-University City area (Golden Triangle Business Center). Prepared for A.D. Hinshaw Associates. September. 23 pp.
- Purer, E.A. 1939. Ecological study of vernal pools, San Diego County. Ecology 20:217-229.
- Rancho Santa Fe Association. 1988. Draft supplemental environmental impact report for an amendment to the San Dieguito community plan GPA 88-02. March. 73 pp.
- RECON. 1978. Draft environmental impact report for Lake Murray, Cowles, and Fortuna Mountain Regional Park.
- RECON. 1987. Sensitive species map for the Eastridge project.
- RECON. 1988. A biological technical report for Black Mountain Park. Prepared for Mr. Jerry D. Williams, City of San Diego Department of Parks and Recreation. October.
- RECON. 1988. Biological impact analysis and mitigation plan for the SPA-2 development unit of the El Rancho del Rey specific plan. Prepared for Rancho del Rey Partnership. September. 13 pp.
- RECON. 1988. Biological survey report for South Poway Parkway. Prepared for City of Poway. December.
- RECON. 1988. Biological technical report for SR-125 from SR-54 to Telegraph Canyon Road. Prepared for City of Chula Vista. February.
- RECON. 1988. Biological technical report for the East Elliott community plan area. Prepared for Turrini and Brink. October. 32 pp.
- RECON. 1988. Draft environmental impact report for State Route 125 from Otay Lakes Road to SR 54. Prepared for City of Chula Vista. April. 146 pp.
- RECON. 1988. Draft environmental impact report for the Bonita Meadows rezoning and annexation. Prepared for the City of Chula Vista. February. 80 pp.
- RECON. 1988. Draft environmental impact report for the San Dieguito Valley planned residential development. EQD No. 87-0998. Prepared for R.B. Collins, Inc. July. 84 pp.
- RECON. 1988. San Diego River biological resource study for the Padre Dam 4 MGD stream discharge project. Prepared for Orville P. Ball & Associates. July. 24 pp.
- RECON. 1989. Biological constraints analysis of the Peñasquitos West Property in Peñasquitos, California. Prepared for Mr. David Pool, Pardee Construction Company. September.

- RECON. 1989. Draft biological impact analysis and mitigation plan for the SPA-3 development unit of the El Rancho del Rey specific plan. Prepared for Rancho del Rey Partnership. May. 6 pp.
- RECON. 1989. Draft environmental impact report for Rancho Montana TM 4796 Property. Prepared for Mr. Russell E. Sande. December.
- RECON. 1989. Sensitive animal species field survey maps for Otay Ranch (Otay River and San Ysidro parcels).
- RECON. 1989. Sensitive plant species field survey maps for Otay Ranch (Otay River and San Ysidro parcels).
- RECON. 1989. Spring biological survey of Poway Corporate Center. Prepared for Newland California. July.
- RECON. 1990. Biological impact analysis and mitigation plan for Sycamore Valley Ranch, TM 4758. Prepared for Signal Landmark, Inc. May.
- RECON. 1990. Biological inventory for Black Mountain Ranch in San Diego, California. Prepared for Potomac Investment Associates. May. 37 pp.
- RECON. 1990. Biological mitigation analysis (Task 8) for the Clean Water Program, City of San Diego. Prepared for the City of San Diego Clean Water Program. September. 45 pp.
- RECON. 1990. Biological resources survey for the Newland California/290-acre Park Trade Properties. Prepared for Newland California. April.
- RECON. 1990. Biological technical report for Rancho Montana tentative map 4796 and approximate 1400-foot segment of SC 1960. Prepared for Mr. Russell Sande. September. 26 pp.
- RECON. 1990. Biological technical report for the South Palm precise plan, Palm Ridge IV TM/PRD and South Palm Vista VTM/PRD. Prepared for Rick Engineering Company. September.
- RECON. 1990. California gnatcatcher surveys at Poway Corporate Center. Prepared for Newland California. June.
- RECON. 1990. Environmental impact report for water reclamation and reuse conceptual master plan and City of San Diego ordinance number 0-17327. Prepared for City of San Diego. February. 295 pp.
- RECON. 1990. Neighborhood 8A precise plan.
- RECON. 1990. Sensitive plant species spring survey maps for Otay Ranch (Otay River and San Ysidro parcels).
- RECON. 1990. Sensitive species maps for the McGinty Mountain project.
- RECON. 1991. Biological resources survey for the Mission Trails Regional Park visitor center, San Diego, California. Prepared for Martinez and Wong Associates. August.

- RECON. 1991. North City West precise plan and Parkview Development Company tentative map.
- RECON. 1991. Supplemental draft environmental impact report for Scripps Ranch North Phase 3 vesting tentative map and planned residential development. January.
- RECON. 1992. Biological technical report for Skyline Congregation of Jehovah's Witnesses in San Diego, California. Prepared for Skyline Congregation of Jehovah's Witnesses, and Greene Construction. May. 22 pp.
- RECON. 1992. Biological technical report for the Torrey Reserve property in San Diego, California, replacement vesting tentative map No. 85-0824. Prepared for American Assets. October. 27 pp.
- RECON. 1992. Technical analysis of potential noise effects on California gnatcatcher habitat adjacent to future Orange Avenue. Prepared for Eastlake Development Company. March. 24 pp.
- RECON. No date. Coastal sage scrub map of San Diego County.
- Reinen, R.H. 1978. Notice of exercise of Section 404 jurisdiction over certain streams and wetlands in California. Los Angeles District, Corps of Engineers. July 15.
- Rieger, J. P. and R. M. Beauchamp. 1975. An inventory and survey of the marine and terrestrial biological resources of Mission Bay Park. March. 152 pp.
- San Diego Association of Governments (SANDAG). 1990. Final San Diego River habitat conservation plan. July. 176 pp.
- San Diego Biodiversity Project. 1993. Personal communication from David Hogan re Carmel Mountain. August 17.
- San Diego National Sports Training Foundation. 1993. Personal communication from David Armstrong re Olympic Training Center. April 27.
- San Diego State University (Sierra Club). 1992. Personal communication from Paul H. Zedler re miscellaneous projects. May 18.
- San Diego Unified Port District. 1975. Chula Vista boat basin/wildlife reserve draft environmental impact report. November. 120 pp.
- SANDAG. 1990. Final Sweetwater River habitat conservation plan. July. 112 pp.
- SANDAG. 1991. City of San Diego vegetation ownership map. January.
- Scatolini, S. 1991. Personal communication of sensitive species data.
- Scheidt, V. 1988. A biological survey report for the Calmat Border Highlands Property. Prepared for New Horizons Planning Consultants, Inc. December.
- Scheidt, V. 1990. A biological resources survey report for the Padre Transit-Mix, Inc. conditional use permit site, City of Poway. Prepared for CalMat Corporation. April.

- Scheidt, V. 1991. Personal communication of sensitive species data.
- Scheidt, V. 1991. Results of biological survey and resources assessment for the 84-acre Nodes Tentative Parcel Map property, City of Poway. Prepared for Dr. Thomas A. Nodes. November.
- Sea Science Services. 1980. Report on environmental baseline studies for the San Dieguito Lagoon enhancement plan, Del Mar, California. Prepared for City of Del Mar. March. 250 pp.
- Smith Properties. 1992. Off-site mitigation land located for purchase by Home Depot, Encinitas. Prepared by Glenn L. Smith.
- Smith, J.P. and K. Berg. 1988. Inventory of rare and endangered vascular plants of California. California Native Plant Society, special publication No. 1, 4th edition.
- State of California Department of Fish and Game. 1992. Personal communication from Julie Vanderwier re Otay Mesa Quad, Otay Ranch (Dudek), Bladwin Vista, Spooner's Mesa, Del Mar Quad. April 15.
- Stone Development Co. 1988. Extended initial study for Jamul Highlands subdivision. Prepared for San Diego Department of Planning and Land Use. August.
- Sweetwater Environmental Biologists, Inc. 1992. Report on the least Bell's vireo monitoring and cowbird removal program for 1992. Final Report. Prepared for California Department of Fish and Game. June.
- Sweetwater Environmental Biologists. 1991. Biological Assessment of Pointe Mitigation Parcel. Prepared for Pointe Builders. January.
- Sweetwater Environmental Biologists. 1991. Biological Assessment of San Miguel Mountain Area. Prepared for Southwest Diversified, Inc. August.
- Sweetwater Environmental Biologists. 1991. Biological Resources Report for the Triple Crown Estates Project, Poway, California. Prepared for Edwin Krutoff. May.
- Sweetwater Environmental Biologists. 1992. Biological Resources Report for the Panorama Ridge Property, San Diego, California. Prepared for Brian Mooney Associates. September.
- Sweetwater Environmental Biologists. 1992. Biological Resources Report of Santa Fe Views, San Diego, California. Prepared for J.P. Engineering. January.
- Sweetwater Environmental Biologists. 1992. Biological Resources Report of Torrey Pines Summit, San Diego, California. Prepared for J.P. Engineering. January.
- Sweetwater Environmental Biologists. 1993. California gnatcatcher survey data. September.
- The Nature Conservancy. No date. Sensitive species map for the McGinty Mountain Preserve.

- Thirtieth Street Architects, Inc. 1989. Modjeska Historic Park, draft resources management plan. Prepared for County of Orange. July.
- Thorne, R.F. 1976. The vascular plant communities of California. Pages 1-31 in J. Latting (ed.), Plant communities of southern California. California Native Plant Society Special Publication No. 2.
- TMI Environmental Services. 1984. Supplemental draft environmental impact report for Vista Grande Highlands.
- Tuckwell, J. 1990. Proposal for the management, preservation and expansion of the Kendall-Frost Mission Bay Marsh Natural Reserve. May. 12 pp.
- U.S. Department of the Navy. 1982. Navy outlying landing field, Imperial Beach, California master plan. March.
- U.S. Department of the Navy. 1986. Naval Air Station Miramar, master plan. June.
- UCSD Campus Planning Office and ERC Environmental and Energy Services Co. (ERCE). 1989. Draft environmental impact report: UCSD revised long range development plan. August.
- United States Department of Agriculture. 1973. Soil survey maps of San Diego, California. Prepared by the Soil Conservation Service and Forest Service.
- United States Department of Agriculture. 1976. The distribution of forest trees in California. Prepared by the Forest Service.
- United States Department of Agriculture. 1981. Soil-vegetation and timber stand maps for the Cleveland National Forest. Prepared by the Forest Service, and the Soil Conservation Service.
- United States Department of Agriculture. 1993. California gnatcatcher location data for the upper San Diego River. Information sent by John Stephenson, Palomar Ranger District, Forest Service Region 5--Pacific Southwest Region. May.
- United States Fish and Wildlife Service. 1985. A field survey of biological resources of specific canyon habitats of NAS Miramar. A planning aid report. Prepared for U.S. Department of the Navy, Western Division. September. 80 pp.
- United States Fish and Wildlife Service. 1990. National wetlands inventory maps.
- Unitt, P. 1984. *The Birds of San Diego County*. Memoir 13, San Diego Society of Natural History. 276 pp.
- University of California, San Diego, Natural Reserves Office. 1989. The Kendall-Frost Mission Bay Marsh : Significant features and detrimental impacts expected from property development in Mission Bay, San Diego. December. 9 pp.
- University of California, San Diego, Scripps Institution of Oceanography. 1991. Unpublished species list from the Kendall-Frost Reserve. September. 7 pp.
- University of California, San Diego. 1987. Open space planning study, UCSD. September. 89 pp.

- University of California, San Diego. 1990. Unpublished species list from the UCSD Natural Reserve System. March.
- University of California. 1991. Final report of the Natural Reserve System Steering Committee on Long-Range Planning. June. 49 pp.
- Valle De Oro Community Planning Group. 1993. Personal communication from Jack Phillips re Valle de Oro. May 26.
- Vissman, S. 1991. Personal communication of sensitive species data.
- Vitt, L. J. No date. Evaluation of the Kendall-Frost Mission Bay Marsh Reserve. 8 pp.
- Weaver, K. 1991. Personal communication of sensitive species data.
- WESTEC Services, Inc. 1976. Biological reconnaissance of the Monte Vista Ranch, Ramona, San Diego County. Prepared for Charles A. LeMenager. December. 47 pp.
- WESTEC Services, Inc. 1980. Constraint analysis for Sorrento Hills. Prepared for Turrini and Brink. July. 13 pp.
- WESTEC Services, Inc. 1981. Biological report on the California Least Tern (*Sterna albifrons brownii*) at Naval Air Station, North Island. Prepared for the Department of the Navy. May. 101 pp.
- WESTEC Services, Inc. 1981. Final environmental assessment for the petroleum oil lubricant line (POL) and land acquisition-project P-043, Naval Station, San Diego, California. Prepared for the Department of the Navy.
- WESTEC Services, Inc. 1982. Natural resources inventory of the Naval Amphibious Base, Coronado, San Diego, California. WESTNAVFACENGCOM, San Bruno, California. December. 132 pp.
- WESTEC Services, Inc. 1983. Sycamore Canyon State Vehicular Recreation Area acquisition: Final EIR letters of comment and responses. Prepared for State of California Department of Parks and Recreation, Office of Highway Vehicle Recreation. October.
- WESTEC Services, Inc. 1985. Southern California Edison mitigation survey: Valley substation westward through Cleveland National Forest, 500 kV transmission line--rare plant survey. Prepared for Southern California Edison Co. July.
- WESTEC Services, Inc. 1986. Preliminary international wastewater alternative 1D draft environmental impact report. Prepared for Luke-Dudek, Civil Engineers, Inc., and City of San Diego Water Utilities Department. May.
- WESTEC Services, Inc. 1987. A biological survey of the Home Avenue PRD project site, San Diego, California. Prepared for Quest Equities. February. 26 pp.
- WESTEC Services, Inc. 1987. Biological survey for Bel Air Estates (TM-87-7), Chula Vista. Prepared for Louis S. Cohen & Associates, Los Angeles, CA. February. 17 pp.

- WESTEC Services, Inc. 1987. Biological survey of the Brock/Kimball Property, Escondido, California. Prepared for M.J. Brock & Sons, Inc. September. 30 pp.
- WESTEC Services, Inc. 1987. Biological survey report for Las Montañas Resort, Jamul, California. Prepared for Graves Engineering, Inc. December.
- WESTEC Services, Inc. 1987. Biological survey report for the Black Mountain Road and associated roadways project. Prepared for Pardee Construction Co., Los Angeles, CA. April. 50 pp.
- WESTEC Services, Inc. 1987. Biological survey report for the San Pasqual water reclamation site. Prepared for City of San Diego. December. 36 pp.
- WESTEC Services, Inc. 1987. City of Escondido general plan amendment 87-02, final environmental impact report. Prepared for City of Escondido. September.
- WESTEC Services, Inc. 1987. Rancho del Sur draft appendices. Prepared for City of Chula Vista. April.
- WESTEC Services, Inc. 1987. Singing Hills specific plan amendment draft supplemental environmental impact report. Prepared for County of San Diego Department of Planning and Land Use. February. 39 pp.
- WESTEC Services, Inc. 1988. Biological resources update for the University of California, San Diego. Prepared for University of California, San Diego. November. 14 pp.
- WESTEC Services, Inc. 1988. Biological survey report for the proposed Rancho Bernardo Lake course. Prepared for the J.W. Colachis Company, La Jolla, CA. September. 57 pp.
- WESTEC Services, Inc. 1988. Carroll Canyon Creek business Park planned industrial development permit: draft environmental impact report. Prepared for Mr. Edward J. Wong. July.
- WESTEC Services, Inc. 1988. City of El Cajon Parkway Plaza expansion draft environmental impact report (EIR #51). Prepared for the Hahn Company, San Diego, California. January.
- WESTEC Services, Inc. 1988. East Mesa detention facility supplemental environmental impact report, draft. Prepared for County of San Diego Office of Special Projects. May.
- WESTEC Services, Inc. 1988. Report of a biological survey of the Roger Brown Property, Alpine, California. Prepared for Inojim Investments. February. 22 pp.
- WESTEC Services, Inc. 1988. Singing Hills specific plan amendment, draft supplemental environmental impact report. Prepared for County of San Diego Department of Planning and Land Use. February. 39 pp.
- WESTEC Services, Inc. 1988. Spring Canyon precise plan biological survey report. Prepared for Patrick J. O'Kelly, Service Corporation International. October. 42 pp.

- WESTEC Services, Inc. No date. Amber Ridge EIR.
- WESTEC Services, Inc. No date. Unpublished data for the Goodan Ranch site.
- Wier Biological. 1984. Biological survey report and revegetation plan for the Atlas Hanalei and Town & Country sites, San Diego, California. Prepared for PRC Engineering. June.
- Wier Biological. 1985. A letter report for biological impacts of the Eastridge project. Prepared for Martha B. Wiley, Environmental Manager, Nasland Engineering. July. 5 pp.
- Wier Biological. 1985. Biological survey report of the Green Valley Ridge Property, Poway, CA. Prepared for Environmental Perspectives. August.
- Wier, H. A. 1986. Biological survey report of the Singing Hills specific plan, McGinty Mountain, San Diego County, California. Prepared for McGinty Ranch General Partnership, San Diego, California.
- Wier, H. A. 1991. McGinty Mountain sensitive species maps.
- Woodward-Clyde Consultants. 1981. Maps of sensitive plant locations, sensitive wildlife sightings and habitats and small mammal live-trapping grid locations, and plant community types and dominant plant species on Point Loma Navy Property, San Diego. Prepared for Department of the Navy, Naval Facilities Engineering Command, Naval Ocean Systems Center. August.
- Woodward-Clyde Consultants. 1981. Terrestrial biological survey and inventory of Navy Property on Point Loma, San Diego, California. Prepared for the Officer in Charge of Construction, NOSC, San Diego. November. 55 pp.
- Worley, Schwartz, Garfield & Rice. 1993. Personal communication from Donald Worley re Navy Family Housing - Eucalyptus Hills. May 19.
- Zedler, P.H. 1987. The ecology of southern California vernal pools: A community profile. U.S. Fish and Wildlife Biol. Rep. 85(7.11). 136 pp.

APPENDIX A-2

**MSCP VEGETATION MAPPING KEY
AND MAPPING CATEGORIES**

MSCP VEGETATION MAPPING KEY

| Mapping Code | Vegetation Type | Equivalent Holland Codes |
|--------------|----------------------------------|--------------------------|
| 10 | Southern Foredunes | 21230 |
| 20 | Southern Coastal Bluff Scrub | 31200 |
| 30 | Coastal Sage Scrub | 32500 |
| 40 | Maritime Succulent Scrub | 32400 |
| 50 | Chaparral | CU 31720 + 37200 |
| 60 | Southern Maritime Chaparral | 37C30 |
| 70 | Coastal Sage/Chaparral Scrub | 37G00 |
| 80 | Grassland | 42000 |
| 90 | Southern Coastal Saltmarsh | 52120* |
| 100 | Freshwater Marsh | 52400* |
| 110 | Riparian Forest | 61330 + 61320 |
| 120 | Riparian Woodland | 62400 |
| 130 | Riparian Scrub | 63300 |
| 140 | Oak Woodland | 71100 |
| 150 | Dense Phase | 71160 + 71182 |
| 160 | Sparse Phase | 71181 |
| 170 | Torrey Pine Forest | 83140 |
| 180 | Southern Interior Cypress Forest | 83330 |
| 190 | Eucalyptus Woodland | --- |
| 200 | Open Water | --- |
| 210 | Disturbed Wetlands | --- |
| 220 | Natural Floodchannel/Streambed | --- |
| 240 | Disturbed habitat | --- |
| 250 | Developed | --- |
| 260 | Beach | --- |
| 270 | Saltpan | --- |
| 280 | Oak Riparian Forest | 61310 |

* Includes small areas of 52310.

***Disturbed vegetation (other than 240): last digit will be a 1. Examples: Disturbed riparian scrub = 131; disturbed oak woodland, dense phase = 151.

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MSCP VEGETATION/MAPPING CATEGORIES

| MSCP VEGETATION CATEGORIES | EQUIVALENT HABITAT TYPES ¹ | CRITERIA |
|------------------------------|---|--|
| BEACH | -- | Unvegetated, flat, sandy areas along immediate coastline. |
| SALTPAN | -- | Unvegetated to sparsely vegetated flat, alkaline areas near coast; subject to tidal influence. Potential inclusions: saltmarsh, disturbed wetland, mudflat. |
| SOUTHERN FOREDUNES | Southern Foredunes (H) Unconsolidated Shore (C) | Sandy, open habitat between the area of direct tidal influence and stabilized substrate supporting typically inland vegetation. On Coronado and Penasquitos Lagoon; I.D. from existing information and field-checking. May be sparsely vegetated. Potential inclusions: marsh, beach. |
| SOUTHERN COASTAL BLUFF SCRUB | Southern Coastal Bluff Scrub (H) | Mappable on Point Loma and Torrey Pines with background data. Potential inclusions: southern maritime chaparral, coastal sage scrub, grassland, beach. |
| COASTAL SAGE SCRUB | Diegan Coastal Sage Scrub (H) Maritime Succulent Scrub (H) | Predominantly Diegan sage scrub; may contain some maritime succulent scrub near the coast (i.e., Point Loma, etc.). The latter type may be distinguishable, to some degree, based on known localities and position relative to coast. Potential inclusions: southern coastal bluff scrub, chaparral, grassland, disturbed habitat. |

MSCP VEGETATION/MAPPING CATEGORIES (Continued)

| MSCP VEGETATION CATEGORIES | EQUIVALENT HABITAT TYPES¹ | CRITERIA |
|-------------------------------------|---|--|
| CHAPARRAL | <p>Southern Maritime Chaparral (H) Southern Mixed Chaparral (H) Chamise Chaparral (H) Scrub Oak Chaparral (H) Ceanothus Chaparral (H)</p> | <p>Primarily southern mixed chaparral and chamise chaparral, with smaller amounts of other chaparral types. Southern maritime chaparral will be differentiated, to the degree feasible, by known localities, position relative to coast, soil type, and occurrence of sensitive plant species. Potential inclusions: coastal sage scrub, oak woodland, Tecate cypress forest, grassland.</p> |
| COASTAL SAGE/CHAPARRAL SCRUB | <p>Coastal Sage-Chaparral Scrub (H)</p> | <p>Post-fire successional community; intermediate between scrub and chaparral. Potential inclusions: coastal sage scrub, chaparral, grassland.</p> |
| GRASSLAND | <p>Valley Needlegrass Grassland (H) Annual Grassland (H)</p> | <p>Includes areas dominated by native bunchgrasses and previously disturbed areas dominated by nonnative grasses and other annual species. Potential inclusions: coastal sage scrub, chaparral, disturbed habitat.</p> |
| VERNAL POOLS | <p>San Diego Mesa Hardpan Vernal Pool (H) San Diego Mesa Claypan Vernal Pool (H)</p> | <p>Vernal pools will be mapped onto USGS maps from existing documentation and NWI maps. Potential inclusions: chaparral, coastal sage scrub, grassland, disturbed habitat).</p> |
| SOUTHERN COASTAL SALTMARSH | <p>Southern Coastal Saltmarsh (H) Cismontane Alkali Marsh (H)? Emergent Wetland (C)</p> | <p>Primarily southern coastal saltmarsh, with smaller amounts of alkali marsh, saltpan, mudflats, disturbed wetlands, and disturbed upland habitat. Mapping will utilize aerials, NWI maps, soils maps, position relative to coast, and existing documentation.</p> |

MSCP VEGETATION/MAPPING CATEGORIES (Continued)

| MSCP VEGETATION CATEGORIES | EQUIVALENT HABITAT TYPES ¹ | CRITERIA |
|----------------------------|---|--|
| FRESHWATER MARSH | Coastal and Valley Freshwater Marsh (H) Cismontane Alkali Marsh (H)? Palustrine Persistent Emergent Wetland (C) | Primarily freshwater marsh with smaller amounts of alkali marsh. Mapping will utilize aerials, NWI maps, soils maps, position relative to coast, and existing documentation. |
| RIPARIAN FOREST | Southern Cottonwood-Willow Riparian Forest (H) Palustrine Forested Wetland (C) | Riparian forest communities that are generally > 20 ft. high, and dominated by winter-deciduous trees. Dominated by willows and cottonwoods; sycamores generally lacking or at least not dominant. Generally occupies broader drainages or floodplains; includes open and closed canopies. Potential inclusions: oak riparian forest, riparian woodland, riparian scrub, oak woodland, eucalyptus woodland, and marsh. |
| OAK RIPARIAN FOREST | Southern Coast Live Oak Riparian Forest (H) | Mixed riparian forest dominated by oaks but including willows and/or cottonwoods. Oaks often occur at edges of habitat, with riparian species toward center. Potential inclusions: riparian forest, riparian woodland, riparian scrub, oak woodland, eucalyptus woodland, and freshwater marsh. |
| RIPARIAN WOODLAND | Southern Sycamore Alder Riparian Woodland (H) Palustrine Forested Wetland (C) | Riparian woodland communities that are generally > 20 ft. high, and dominated by winter-deciduous trees; sycamores are the indicator species but may occur with other riparian tree species (i.e., San Clemente Canyon). Occupies broader drainages or floodplains; rarely forms closed canopies; may appear as trees scattered within a shrubby matrix. Potential inclusions: riparian forest, oak riparian forest, riparian scrub, oak woodland, eucalyptus woodland, and marsh. |

MSCP VEGETATION/MAPPING CATEGORIES (Continued)

| MSCP VEGETATION CATEGORIES | EQUIVALENT HABITAT TYPES¹ | CRITERIA |
|-------------------------------------|---|--|
| RIPARIAN SCRUB | Mulefat Scrub (H) Southern Willow Scrub (H) Scrub-Shrub Wetland (C) | Riparian habitat < 20 ft high; dominated by willows and/or mulefat. Generally occurs in narrow bands in drainages. Potential inclusions: riparian forest, oak riparian forest, riparian woodland, freshwater marsh. |
| OAK WOODLAND DENSE PHASE | Coast Live Oak Woodland (H) Dense Engelmann Oak Woodland (H) | Evergreen (coast live oak) or "tardily deciduous" (Engelmann oak) woodland communities. Includes open and closed canopies. Potential inclusions: riparian forest, oak riparian forest, riparian woodland, eucalyptus woodland, chaparral, grassland, southern interior cypress forest. |
| SPARSE PHASE | Open Engelmann Oak Woodland | "Tardily deciduous" woodland community with widely-spaced trees. Potential inclusions: grassland, coastal sage scrub, chaparral. |
| TORREY PINE FOREST | Torrey Pine Forest (H) | Coniferous forest restricted to the coast near Torrey Pines State Park. Mapping will utilize aeriels and existing data. Potential inclusions: coastal sage scrub, chaparral, eucalyptus woodland. |
| SOUTHERN INTERIOR CYPRESS FOREST | Southern Interior Cypress Forest (H) | Coniferous forest in southeast portion of study area. Dominated by <i>Cupressus forbesii</i> . Potential inclusions: chaparral, riparian forest, oak riparian forest, riparian woodland/scrub. |
| ADDITIONAL CATEGORIES: | | |
| EUCALYPTUS WOODLAND | - | Discrete stands of woodland dominated by <i>Eucalyptus</i> spp. Potential inclusions: riparian forest, oak riparian forest, riparian woodland, riparian scrub, oak woodland, other exotic trees. |

MSCP VEGETATION/MAPPING CATEGORIES (Continued)

| MSCP VEGETATION CATEGORIES | EQUIVALENT HABITAT TYPES ¹ | CRITERIA |
|----------------------------|---|---|
| OPEN WATER | Palustrine or Lacustrine Unconsolidated Bottom (C) | Includes reservoirs, lakes, and ponds. Potential inclusions: estuaries, mudflats. |
| DISTURBED WETLANDS | Palustrine or Lacustrine Emergent Wetland (C) | Wetlands that have been recently cleared or are dominated by herbaceous, nonnative plant species. Potential inclusions: marsh, grassland, and disturbed habitat. |
| NATURAL FLOOD CHANNEL | Streambed (C) Rock Bottom (C) Unconsolidated Bottom (C) | Unvegetated or sparsely vegetated drainages outside area of tidal influence. Generally considered "waters of the U.S." Supplemental information from NWI maps, USGS maps (blue-line drainages), and existing documentation. Potential inclusions: riparian forest, oak riparian forest, riparian woodland, riparian scrub, freshwater marsh, coastal sage scrub, chaparral. |
| DISTURBED HABITAT | [Ruderal] | Includes areas that have been physically disturbed or invaded by nonnative species; may have the potential to support native vegetation and/or sensitive species, either at the present time or in the future. This category can be used by itself, or in association with any of the native habitats above. Potential inclusions: grassland, exotic trees, developed area. |
| DEVELOPED | - | Includes urbanized areas, agricultural areas, and areas which have been graded or otherwise altered so that they would not be expected to support any vegetation other than ruderal species. Potential inclusions: disturbed habitat. |

¹H = Holland (1986)
C = Cowardin (1979)

APPENDIX A-3
MSCP VEGETATION MAPPING DECISION RULES

MSCP DECISION RULES

A. GENERAL RULES

- Make sure all polygons are closed and labelled.
- Match edges between maps.
- Where lines of one polygon get so close that they appear to form separate polygons (e.g., linear features), label both ends with one number and 2 arrows or lines. For two separate but adjacent polygons, label separately.

B. VEGETATION CATEGORIES AND MAPPING SYMBOLS

- See vegetation key for a list of vegetation types and mapping codes, and table for equivalent habitat types and definition criteria (including potential inclusions).
- To indicate disturbed vegetation types (other than category 240), a 1 is used as the last digit of the code. Example: undisturbed Diegan coastal sage scrub would be mapped as 30, whereas disturbed Diegan coastal sage scrub would be mapped as 31.

C. MINIMUM MAPPING UNITS

- Minimum mapping units are provided below. A range is provided in several cases, which will result in some variability in minimum mapping unit size. The decision will be left up to the interpreter and will therefore be somewhat subjective. In general, however, if the proposed polygon is isolated from similar and/or undisturbed habitat, the interpreter will tend toward the larger unit, whereas smaller units will be used if the polygon is adjacent to or near potentially important habitat areas.

| VEGETATION TYPE | MINIMUM MAPPING UNIT (acres) |
|---|------------------------------|
| Saltpan | 1.5 |
| Beach | 1.5 |
| Southern Foredunes | 1.5 |
| Southern Coastal Bluff Scrub | 1.5-5 |
| Coastal Sage Scrub (including maritime succulent scrub) | 5-10 |
| Chaparral (including southern maritime chaparral) | 5-10 |
| Coastal Sage/Chaparral Scrub | 5-10 |
| Grassland | 5-10 |
| Vernal Pools | N/A |
| Southern Coastal Saltmarsh | 1.5 |
| Freshwater Marsh | 0.5-1 |
| Riparian Forest | 0.5-1.5 |
| Oak Riparian Forest | 0.5-1.5 |
| Riparian Woodland | 0.5-1.5 |
| Riparian Scrub | 0.5-1.5 |
| Oak Woodland | 1.5 |
| Torrey Pine Forest | 0.5 |
| Southern Interior Cypress Forest | 5-10 |

| | |
|---------------------|------|
| Eucalyptus Woodland | 10 |
| Open Water | 0.5 |
| Disturbed Wetlands | 5-10 |
| Floodplain | 5-10 |
| Streambed | 5 |
| Disturbed Habitat | 5-10 |
| Developed | 5-10 |

D. VEGETATION DELINEATION

GENERAL RULES:

- If you can't distinguish between CSS, CHP, and CSS/CHP (after exhausting all possible methods), lump into CSS.
- Wetlands: Check with NWI and soils maps prior to mapping; may also help in distinguishing oak woodlands from riparian habitats.
- Disturbed associations (in addition to the "disturbed" category): Consider an association disturbed if there is evidence of mechanical disturbance (brushing, orv's, etc.) that has resulted in a reduced canopy cover or habitat fragmentation. Areas with a high proportion of nonnative species may also be considered disturbed (i.e., riparian scrub dominated by *Arundo donax* would be mapped as disturbed riparian scrub - 131). The exception is nonnative or annual grassland, which is dominated by nonnatives but is indistinguishable at this mapping scale from native grassland. Disturbed grassland (81) will be differentiated from grassland (80) by mechanical disturbance only.
- Red shrubby vegetation in canyon bottoms: consider it upland vegetation (i.e., coastal sage scrub or chaparral) if adjacent slopes are steep, the canyon bottom is narrow, and color of shrubs is intermediate between bright pink/red of riparian associations and dark red of oak woodlands (i.e., a dull red color). Also, cross-reference with NWI maps to further rule out the presence of wetland vegetation.

SPECIFIC RULES:

Saltpan: High saline, tidal flat areas that are periodically covered with tidal water. On color infrared photographs, these areas appear stark white versus dark green to brown color of saltmarsh vegetation. Soils = Tf (tidal flats).

Beach: Sandy, flat, unvegetated areas along immediate coastline.

Southern foredunes: Sandy dune areas; may be sparsely vegetated; verify against existing documentation and field-checking. Primarily on Coronado and at Penasquitos Lagoon (one small location on Pt. Loma).

Southern coastal bluff scrub: Scrub habitat on Torrey Pines and bluffs on Point Loma; distinguishable only with background documentation and/or ground-truthing; see coastal sage scrub for further descriptors.

Coastal sage scrub: Canopy open to dense; light or dark green vegetation; reddish tinge minimal or none or restricted to large, widely-spaced shrubs (e.g., *Malosma*), often on south-facing slopes. Distinguish maritime succulent scrub based on known localities and position relative to the coast, to the degree feasible.

Chaparral: Canopy dense; dark green to black vegetation on slopes (often with reddish tinge). Identify southern maritime chaparral by LvF3 soils + coastal position near Del Mar + sensitive species. Note: southern maritime chaparral also occurs inland to Del Dios area on metavolcanics.

Coastal sage scrub/chaparral: Scattered to dense shrub cover and no obvious disturbances other than fire. Successional community. Not mappable from photos; intention is to use this category for post-fire areas that contain both scrub and chaparral species.

Grasslands: Light to dark green, smooth texture; few to no shrubs or trees (< 20-30%); nonhydric soils or vegetation; generally not on immediate coast; no evidence of recent disturbance (i.e., active or fallow agriculture, brushing, etc.).

Vernal pools: Not mapped from aerials.

Southern coastal saltmarsh: Red to brownish-green + coastal position (sw County) + hydric, tidal soils (Tf).

Freshwater marsh: Generally narrow; bright pink; in drainage; smooth texture.

Riparian forest: Bright to dark red; dominated by willows and cottonwoods (sycamores not dominant); occupies broader drainages or floodplains and is generally at least several hundred feet wide; canopy can be open or closed.

Disturbed riparian forest (i.e., *Arundo donax*, *Eucalyptus* spp.): Light-colored or brownish trees or large shrubs in drainage or floodplain.

Oak riparian forest: Generally characterized by a central band of riparian forest species (bright pink/red) bordered by oaks (maroon or dark red), although intermixing can also occur. Oaks are the key indicator species. Distinguished from oak woodland by the presence of additional riparian tree species.

Riparian woodland: Bright red; dominated by sycamores, although other riparian tree species can be present; occupies broader drainages or floodplains; rarely forms closed canopies; may appear as trees scattered within a shrub matrix in a floodplain situation. Minimum cover for tree species = 30%.

Riparian scrub: Bright red; between 6-20 ft high; generally occurs in narrow bands in drainages.

Oak woodland (dense phase): Coast live oaks or Englemann oaks; generally dark red on photos, although Englemann oak is lighter in color. Occurs in upland areas or drainages; consider oak riparian forest if additional riparian tree species (i.e., cottonwoods, willows, sycamores) are present and NWI maps and/or soils maps indicate hydric vegetation or soils. Not considered dense phase if canopy cover < 50%; scattered or individual coast live oaks should be incorporated into other vegetation types.

Oak woodland (sparse phase): Englemann oaks that occur scattered in a matrix of grassland or scrub.

Torrey pine forest: Coniferous forest restricted to the coast near Torrey Pines State Park. Cross-reference with existing data.

Southern interior cypress forest: Coniferous forest in southeast portion of study area. May need to field-check these areas; can be difficult to distinguish from chaparral on slopes and riparian vegetation in drainages.

Eucalyptus woodland: Discrete stands of woodland at least 10 acres in size; often with a brownish tinge to trees.

Open water: Include reservoirs, lakes, and ponds.

Disturbed wetlands: Areas that resemble grassland or disturbed habitat, but have a reddish tinge and occur near a drainage or other obvious wetland.

Natural Floodchannel/Streambed: Unvegetated or sparsely (<30% cover of shrubs or trees) vegetated natural floodchannel or streambed; hydric soils may or may not be present. Includes channel or drainage that is a blue line (USGS map) drainage &/or appears on NWI maps as an intermittent streambed &/or shows evidence of scouring (sandy, unvegetated areas) or banks & appears different with respect to vegetative type than adjacent uplands. May not support other wetland vegetation.

Disturbed habitat: Physical disturbance (other than agriculture) evident (i.e., brushing, invasion by nonnatives, etc.); vegetation and/or the potential for recovery present.

Developed (excluding urbanized areas, which will be mapped by SANDAG): Areas which have been graded or altered and are not expected to support vegetation other than ruderal species. Generally appears white on photos; may have well-developed road network.

APPENDIX A-4

**MSCP RARE PLANT SURVEY METHODOLOGY
AND SURVEY PROTOCOL**

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MSCP SENSITIVE PLANT SURVEYS SURVEY METHODOLOGY

The following methodology is proposed for focused rare plant surveys for the Clean Water Program's Multiple Species Conservation Program (MSCP) in San Diego County, California.

I. SPECIES "GUILDS"

Fifty-two target plant species have been identified for the MSCP project. In order to effectively survey these taxa, it is necessary to group the species into "guilds" according to edaphic, habitat, and/or geographic affinities. The guilds are not entirely exclusive, i.e., a species in one guild may also occur in another guild. All but two species on the list can be easily incorporated into one of the proposed guilds. Each guild is briefly described below; guilds and their incumbent species are depicted in Table 1.

Clay Soils. Clay soils occur throughout the western portion of the study area and are often associated with grasslands, vernal pools, and coastal sage scrub. A large number of sensitive plant species are associated with clay soils. For the purposes of this survey effort, species associated strictly with vernal pools are not included in this guild. Of the seven species in this guild, three are state-endangered and one is state-rare.

Gabbro-derived Soils. The highest degree of endemism in San Diego County occurs on gabbro soils, which are derived from basic intrusive rocks. The parent material has a high magnesium content, which is limiting to many plant species. Gabbroic exposures occur on a few peaks in the study area, including McGinty and Iron mountains. Some of the species in this guild are also found on Otay Mountain, which has metavolcanic soils (Beauchamp 1986). Gabbro soils can also occur in association with clay lenses (thus, the presence of *Acanthomintha ilicifolia* in both guilds). Of the eight species in this guild, two are considered state-endangered and three are state-rare.

Vernal Pools. Vernal pools (e.g., basin and mima-mound formations) occur on mesas that characteristically have clay soils underlain by a hardpan formation. The basins fill with water during winter rains, then dry by evaporation or transpiration in spring (Beauchamp 1986), and are dry during the later spring, summer, and fall months. These particular growing conditions (and specifically, the long period of inundation) have restricted most

common plant species from occurring in vernal pools. However, several species have adapted to these conditions and are associated primarily with vernal pools or are endemic to the pools. Vernal pools in the county have been surveyed in detail (Beauchamp 1979; Bauder 1986), and most of the larger vernal pool complexes have likely been identified. Most of these pools occur in areas subject to development (i.e., mesas), but receive some degree of protection under wetland and endangered species regulations. This guild, along with the gabbro guild, contains the most sensitive species. Of the eight species included in this group, five are listed as state-endangered; one of the state-endangered species is also listed as federally-endangered and another is proposed for listing as federally-endangered.

Coastal Dunes/Bluffs/Saltmarsh. Species in this guild are strictly coastal and highly restricted in distribution in the county because of the relative paucity of appropriate and/or undisturbed habitats that remain. Coastal dunes are best represented at Border Field State Park, the Silver Strand, and the south end of Coronado; coastal bluffs occur at Point Loma and Torrey Pines; and saltmarsh is found in the Tijuana Estuary and at the mouths of the larger rivers. Five species are included in this guild, including one federally- and state-endangered species and a state-endangered species.

Coastal Sage Scrub. This guild includes those species that occur in coastal sage scrub in the coastal lowland areas of the county. Six species occur in this guild; none is listed as endangered or rare at the federal or state level.

Chaparral. Chaparral is a relatively common habitat throughout the county and the study area. Only four of the target species are associated primarily with chaparral that shows no other distinguishing characteristics (e.g., potentially-limiting edaphic factors). Most of these species are restricted to specific geographic regions, which will allow some focusing of the survey effort. The only state-endangered species in this group, *Mahonia nevinii*, is known from northern San Diego County and is considered to have a very low potential for occurrence in the MSCP study area.

Alluvial Washes. Only one target species occurs in this guild: *Monardella linoides* ssp. *viminea*. This brings into question the practicality of a "guild" for a single species. However, recognition of and subsequent surveys for this species appear to be warranted based on its sensitivity (state-endangered), restriction to a well-defined habitat, and occurrence in areas that would likely be considered valuable wildlife corridors. Although

Mahonia nevinii occurs in alluvial washes in Riverside County, it is not known from similar habitat within the MSCP study area.

Del Mar Mesa Area (including LvF3 Soils). This guild is restricted primarily to weathered sandstone near Del Mar, but scattered occurrences may reach as far inland as Lake Hodges. Species in this guild occur in southern maritime chaparral or on bare sandstone terraces. Many of the species in this guild occur in Torrey Pines State Reserve. Of the seven target species in this guild, three are state-endangered.

Southeast Mountains. This guild includes many of the species listed by Beauchamp (1986) in the Otay Mountain Floral District. All of the species in this guild are found in the Otay Mountain region or in mountainous areas to the north or east. It should be noted that these mountains actually occur in the southwest portion of the county, but the southeast part of the MSCP study area; hence, the guild descriptor "southeast mountains." Most of the species in this guild have a highly restricted distribution, occurring primarily in chaparral on peaks of metavolcanic rock, and reaching their northernmost distributional limit in San Diego County (Beauchamp 1986). A few species, such as *Diplacus aridus*, *Fremontodendron mexicanum*, *Hemizonia floribunda*, and *Monardella hypoleuca* ssp. *lanata* are not necessarily restricted to peaks or metavolcanic soils, but are included in this group based on geographical distribution. Of the 13 species in this guild, 3 are listed as state-rare.

Other. Two target species do not fit neatly into any of the above-mentioned guilds: *Dudleya viscida* and *Rosa minutifolia*. The former taxon generally occurs on cliffs or steep slopes in canyons, and is best surveyed for by using topographic predictors in the northern portion of the study area. The latter species has only one known occurrence in the U.S., and this is in disturbed habitat (probably formerly coastal sage scrub) on a mesa in the southwest portion of the study area. This taxon probably does not represent a good MSCP target species. Nonetheless, representative surveys of coastal sage scrub in this area should be adequate to assess the presence or absence of any significant populations of *R. minutifolia* in the study area. Neither species is listed as endangered or rare at the federal or state level.

II. SURVEY PRIORITIZATION

Because of the large study area and large number of MSCP target plant species, it is necessary to prioritize survey efforts in order to adequately assess sensitive plants within the timeframe and scope of this project. For the most part, prioritization efforts will focus on the guilds described in the previous section. Therefore, survey efforts will focus primarily on edaphic conditions, habitat types, or particular geographic areas rather than on individual species occurrences. Guilds will be prioritized according to degree of protection and/or imminent threats, overall sensitivity, and potential for occurrence within core MSCP preserve areas (e.g., coastal sage scrub).

Guilds perceived as receiving some degree of protection by (a) inclusion in a recognized preserve, (b) federal or state wetland regulations (i.e., those protecting wetlands and vernal pools), and/or (c) occurrence in "undevelopable" areas will be given a lower survey priority than guilds that have no protection and that are imminently threatened by development. A lower survey priority does not denote a lower overall importance for a particular guild.

Overall guild sensitivity may be a factor in prioritization categories (i.e., medium or low) in which 100% surveys of accessible lands are not expected. Guild sensitivity is based on (a) diversity or number of target plant species within a guild and (b) sensitivity of the species within a guild, with increased values given to federally- or state-listed species. Based on these factors, a sensitivity ranking system was developed for the proposed guilds (Table 2).

Finally, guilds that are expected to be included in core MSCP preserve areas may receive a lower survey priority than guilds removed from core areas. Based on these guidelines, the following prioritization hierarchy is proposed.

HIGH PRIORITY GUILDS

The highest survey priority shall be given to those guilds that are not adequately or only partially protected in a preserve system or by federal or state wetland regulations, and which are imminently threatened by development. Subject to access constraints, all areas that fall within this category shall be surveyed at the appropriate time of year and according to the proposed survey methodology (below) unless substantial data have already been collected. Guilds in this classification include:

- Clay Soils
- Del Mar Mesa Area

MEDIUM PRIORITY GUILDS

Medium priority survey areas include (a) those guilds that are not adequately protected in a preserve system or by federal or state wetland regulations, but which are not imminently threatened by development and (b) guilds that are expected to be central to a preserve design based on biological factors other than sensitive plant species. The first scenario includes many of the large blocks of habitat in the eastern portion of the study area, while the second scenario refers primarily to coastal sage scrub that supports California gnatcatchers and/or cactus wrens and, perhaps, riparian or woodland areas that function as major wildlife corridors. All guilds within this category will be surveyed at the appropriate time of year, according to the proposed survey methodology (below). However, because of time constraints, it is probable that not all lands included in this category will be surveyed. Rather, a representative sample will be chosen, with efforts focused on those areas that are known or suspected to support target species (i.e., *Ceanothus cyaneus* in the Lakeside/Barona Valley area) and for which data gaps exist. Guilds in this category include:

- Gabbro-derived Soils
- Southeast Mountains
- Alluvial Washes
- Chaparral
- Coastal Sage Scrub

Overall guild sensitivity and potential inclusion in a preserve system will be factored into survey expenditure calculations, such that the highest survey efforts are expected for gabbro-derived soils, followed by the southeast mountains, alluvial washes, and chaparral (in descending order). The lowest allocation of survey effort in this category is expected for coastal sage scrub, which supports no federally- or state-endangered species, and which will be the major inclusion in the MSCP preserve design.

LOW PRIORITY/GUILDS

Low priority survey areas include those guilds that (a) receive some protection in a preserve system, through federal or state regulations, and/or by occurrence in undevelopable areas and (b) for which a substantial amount of distributional information exists. This category includes wetlands or other lands in the coastal zone that would be difficult to develop from a regulatory or topographic perspective (i.e., coastal dunes/bluffs/saltmarsh), and vernal pools. Limited and highly focused surveys will be conducted for guilds in this category, and will rely primarily on predictive tools and data gaps to narrow the study area. Prioritization will occur according to overall threats and sensitivity of the guild, such that the greatest survey effort is expected for potential vernal pool areas. Low priority guilds include:

- Vernal Pools
- Coastal Dunes/Bluffs/Saltmarsh

Of the two species that did not fit into any of the above-mentioned guilds, surveys for *D. viscida* will be highly localized and determined on the basis of topography. *Rosa minutifolia* is highly restricted in the study area and in the U.S. (one known locality), and focused surveys will not be conducted specifically for this species. However, existing or proposed (i.e., MSCP) surveys in slopes, canyons, and mesas in southwestern San Diego County should adequately assess the presence and importance of *R. minutifolia* in the study area.

III. SURVEY METHODOLOGY

The objective of the focused rare plant surveys is to provide the proper level of survey coverage to conclusively determine the presence (or absence) and relative population sizes of the target species in order to assess undeveloped lands for their importance and potential inclusion in a preserve system. Ogden proposes the following methodology to achieve this objective.

Background Information. All 52 target plant species are either candidates for federal listing, proposed or listed as federally-endangered, and/or listed as state-endangered. Background information on the known distribution and habitat affinities of these species within the MSCP study area has been compiled from a variety of sources, including the

California Natural Diversity Data Base (CNDDDB), environmental documentation (EIR's, EA's, technical reports, natural resource inventory reports and publications, etc.), discussions with local botanists, and the vernal pool data base (Bauder 1986; Beauchamp 1979). This information, in conjunction with predictive tools such as soils and habitats, will be used in identifying gaps in the data base and subsequently directing the focused survey efforts within prioritized survey areas.

Regular contact will be maintained with the appropriate agencies and biologists to keep abreast of additional information that may influence preserve selection, such as new localities for sensitive plant species as a result of unrelated environmental work in or near the MSCP study area or changes in the taxonomic or regulatory status of any target plant species.

Survey Teams. Ogden will conduct rare plant surveys using a team approach to ensure that each "guild" is surveyed at the optimal time for detection of the target plant species. Each team will consist of a team leader, who is a botanist with demonstrated and extensive knowledge of the common and sensitive plants of the study area. Team leaders will be responsible for training team members and ensuring that the quality and intensity of coverage is adequate for detection of the sensitive species. All team members will be qualified biologists who possess some or all of the following qualifications (Nelson 1984):

- experience as a botanical field investigator with experience in field sampling design and field methods;
- taxonomic experience and a knowledge of plant ecology;
- familiarity with plants of the area, including rare species;
- familiarity with the appropriate state and federal statutes related to rare plants and plant collecting.

Survey Team Training. Although all field team members will be qualified botanists with experience with the sensitive plant species of San Diego County, not all team members will have direct experience with every target plant in the study area. Therefore, the following measures will be implemented to ensure that each field botanist has the proper species-specific search image prior to initiating field studies:

- Each team member without previous experience with a particular target species will be required to review this species at any herbaria or field museum which

has representative specimens or to review high-quality photographs of the species or, where feasible, to visit known locations prior to the survey to familiarize themselves with the species and its habitat;

- Each team member will receive a package of background material which will include technical descriptions, line illustrations (if available), and other pertinent information (ecology, distribution, recent taxonomic work) for each sensitive species of concern.

Survey Methodology. Rare plant surveys will follow a modified floristic approach which embodies the following floristic concepts: (a) an attempt will be made to examine all taxa in the study area within the timeframe of this contract and according to the prioritization hierarchy outlined above; (b) each species encountered will be identified to a level sufficient to determine its rarity; and (c) selected areas will be surveyed more than once due to the variable phenologies of the potentially-occurring annual and herbaceous perennial species. The advantage of a floristic approach is that it allows a thorough coverage of the focused study area and encourages detection of new localities for sensitive species (Nelson 1986). This is also the approach recommended by the California Department of Fish and Game (CDFG) and other regulatory agencies (CDFG 1984; Nelson 1986) to ensure the most complete examination possible and thus an adequate survey. Aspects of targeted or focused sensitive species survey methods will be incorporated into the study plan through the use of existing records and other predictive tools (soils, habitat, topography) to further prioritize search efforts and survey intensities in selected areas.

Systematic survey efforts will be conducted for target species. Within each focused study area or guild, a generalized transect methodology will be followed in the initial survey effort in an attempt to cover the area as thoroughly as possible with as little overlap as possible (Nelson 1986). The transects will be roughly parallel lines which allow for some meandering to accommodate changes in habitat or topography. Deviations from this transect methodology generally occur on extremely steep slopes or in dense, impenetrable habitats. In accessible areas, the distance between transect lines will vary according to the particular species of concern. For example, transects will be closer together in areas where diminutive annuals are expected versus herbaceous perennials or shrubs.

In addition to the prioritization hierarchy discussed above, additional prioritization will occur within guilds according to level of habitat disturbance. Within each guild, the highest

priority and most intensive efforts will be given to habitats that are undisturbed or show only moderate levels of disturbance, while highly disturbed habitats may receive little or no survey efforts beyond the initial reconnaissance. Although some native species proliferate under conditions of moderate disturbance (i.e., roadcuts, burns, clearings in dense vegetation), few sensitive species are expected in areas subject to repeated disturbance such as agricultural activities, due largely to soil displacement and destruction of the seed bank. For example, fallow agricultural areas may have been mapped as undifferentiated grassland in the initial MSCP mapping effort and may support clay soils. However, the presence of surface disturbance (i.e., deep furrows) and a high cover of nonnative species indicate a low potential to support any of the target species.

Collection/Verification Procedures. In order to verify plant identification and/or obtain an accurate record of occurrence, voucher specimens of target plant species will be made where this does not jeopardize the continued existence of the population, and in accordance with federal and state regulations and guidelines governing the collection of listed species. Decisions on species collections will be made by the team leader. As a guideline, no more than 10 percent of any population will be collected. In most cases, but particularly where collection is not appropriate due to small population size, photography will be employed to document plant identification and habitat. In cases where the population is too small to warrant collection of voucher specimens but some collection is required to determine species identity, the minimum number of plants possible will be collected. Each field crew will have access to a plant press, and collections will be field-pressed to ensure the highest quality specimens. Collections will be deposited at a recognized public herbarium for future reference.

In addition to recording all plant species observed, each team will carry California Native Species Field Survey Forms for recording sensitive plant occurrences. These are standardized forms prepared by the California Department of Fish and Game for data entry into the Natural Diversity Data Base. For each population detected, a survey form will be filled out in the field, and include such information as population size, extent, habitat, topography, aspect, soils, and associated species. In addition, the population location will be mapped on USGS topographical maps (scale: 1" = 2000'). This information will be transferred onto the existing GIS sensitive species maps (1" = 2000') and input into the GIS.

Survey Schedule. Table 3 provides a list of target plant species according to guild, and their typical flowering periods. Although factors such as temperature and precipitation may influence the actual blooming period, this table indicates the need for at least two survey periods to ensure that the study area is adequately covered. The first survey period is expected in April and May, and the second survey period will be in June. Species in Table 3 that bloom during fall (September) are shrubs that are identifiable during the earlier survey periods, based on habit. As indicated in Table 3, the greatest survey intensity is expected during the first survey period, while the second period will be restricted to fewer guilds.

Table 1
MSCP SENSITIVE PLANT SURVEYS
SPECIES "GUILDS"

| GUILD | SPECIES | STATUS |
|--|--|--------|
| CLAY SOILS | <i>Acanthomintha ilicifolia</i> | C1/CE |
| | <i>Brodiaea filifolia</i> | C1/CE |
| | <i>Brodiaea orcuttii</i> | C2/-- |
| | <i>Calochortus dumii</i> | C2/CR |
| | <i>Dudleya variegata</i> | C2/-- |
| | <i>Hemizonia conjugens</i> | C2/CE |
| | <i>Muilla clevelandii</i> | C2/-- |
| GABBRO-DERIVED SOILS | <i>Acanthomintha ilicifolia</i> | C1/CE |
| | <i>Calochortus dumii</i> | C2/CR |
| | <i>Caulanthus stenocarpus</i> | C3b/CR |
| | <i>Nolina interrata</i> | C1/CE |
| | <i>Senecio ganderi</i> | C2/CR |
| | <i>Tetracoccus dioicus</i> | C2/-- |
| VERNAL POOLS | <i>Brodiaea filifolia</i> | C1/CE |
| | <i>Brodiaea orcuttii</i> | C2/-- |
| | <i>Eryngium aristulatum</i> var. <i>parishii</i> | FE/CE |
| | <i>Myosurus minimus</i> ssp. <i>apus</i> | C2/-- |
| | <i>Navarretia fossalis</i> | PE/-- |
| | <i>Orcuttia californica</i> | FE/CE |
| | <i>Pogogyne abramsii</i> | FE/CE |
| | <i>Pogogyne nudiuscula</i> | FE/CE |
| COASTAL DUNES/BLUFFS/ SALTMARSH | <i>Agave shawii</i> | C2/-- |
| | <i>Aphanisma blitoides</i> | C2/-- |
| | <i>Astragalus tener</i> var. <i>titi</i> | C1/CE |
| | <i>Cordylanthus maritimus</i> | FE/CE |
| | <i>Erysimum ammophilum</i> | C2/-- |
| | <i>Lotus nuttallianus</i> | C2/-- |
| COASTAL SAGE SCRUB | <i>Ambrosia pumila</i> | C2/-- |
| | <i>Astragalus deanei</i> | C2/-- |
| | <i>Cordylanthus orcuttianus</i> | C2/-- |
| | <i>Ericameria palmeri</i> | C2/-- |
| | <i>Ferocactus viridescens</i> | C2/-- |
| | <i>Opuntia parryi</i> var. <i>serpentina</i> | C2/-- |
| CHAPARRAL | <i>Ceanothus cyaneus</i> | C2/-- |
| | <i>Githopsis diffusa</i> ssp. <i>filicaulis</i> | C2/-- |

Table 1 (Continued)
MSCP SENSITIVE PLANT SURVEYS
SPECIES "GUILDS"

| GUILD | SPECIES | STATUS |
|---------------------|---|--------|
| ALLUVIAL WASHES | <i>Monardella linoides ssp. viminea</i> | C2/CE |
| DEL MAR MESA AREA | <i>Arctostaphylos glandulosa</i> var. <i>crassifolia</i> | PE/-- |
| | <i>Baccharis vanessae</i> | PE/CE |
| | <i>Ceanothus verrucosus</i> | C2/-- |
| | <i>Chorizanthe orcuttiana</i> | PE/CE |
| | <i>Corethrogyne filaginifolia</i> var. <i>linifolia</i> | PT/-- |
| | <i>Dudleya brevifolia</i> | PE/CE |
| | <i>Pinus torreyana</i> | C2/-- |
| SOUTHEAST MOUNTAINS | <i>Arctostaphylos otayensis</i> | C2/-- |
| | <i>Calochortus dunnii</i> | C2/CR |
| | <i>Cupressus forbesii</i> | C2/-- |
| | <i>Fremontodendron mexicanum</i> | C2/CR |
| | <i>Hemizonia floribunda</i> | C2/-- |
| | <i>Lepetchinia cardiophylla</i> | C2/-- |
| | <i>Lepetchinia ganderi</i> | C2/-- |
| | <i>Senecio ganderi</i> | C2/CR |
| | <i>Solanum tenuilobatum</i> | C2/-- |
| OTHER | <i>Dudleya viscida</i> | CV/-- |
| | <i>Rosa minutifolia</i> | C2/CE |

¹Federal/State Status:

Federal Status: FE = Federally-listed, endangered; PE = Proposed for listing as federally-endangered; PT = Proposed for listing as federally threatened; C1 = Category 1 candidate for listing; C2 = Category 2 candidate for listing; C3b = Do not represent distinct taxa; C3c = Too widespread and/or not threatened.
 State Status: CE = State-listed, endangered; CR = State-listed, rare.

Table 2
GUILD SENSITIVITY RANKINGS

| Guild | % Of MSCP Target Species Within Guild ¹ | % Of FE, PE, PT/CE, CR Species Within Guild ^{1,2} | Sensitivity Ranking ³ |
|--------------------------------|---|---|-------------------------------------|
| Gabbro-derived Soils | 12.5 (5) | 83.3 (2) | 2 |
| Vernal Pools | 16.7 (2) | 75.0 (3) | 1 |
| Clay Soils | 14.6 (3) | 57.1 (5) | 4 |
| Del Mar Mesa | 14.6 (3) | 71.4 (4) | 2 |
| Southeast Mountains | 18.8 (1) | 33.3 (7) | 4 |
| Alluvial Washes | 2.1 (10) | 100.0 (1) | 6 |
| Coastal Dunes/Bluffs/Saltmarsh | 12.5 (5) | 33.3 (7) | 7 |
| Chaparral | 4.2 (8) | 0 (9) | 10 |
| Coastal Sage Scrub | 12.5 (5) | 0 (9) | 9 |
| Other | 4.2 (8) | 50.0 (6) | 8 |

¹ First number indicates percentage (totals exceed 100% because species can occur in more than 1 guild); number in parentheses indicates overall guild ranking within category.

² FE = Federally-endangered species; PE = Proposed for listing as federally endangered; PT = Proposed for listing as federally threatened; CE = State-endangered species; CR = State-rare species.

³ Sensitivity rankings are in descending order, with 1 = highest sensitivity and 10 = lowest sensitivity. Overall sensitivity rankings are based on diversity or number of target plant species within a guild and the sensitivity of the target species within that guild.

Table 3
 MSCP SENSITIVE PLANT SURVEYS
 PROPOSED SURVEY PERIODS¹

**CLAY SOILS:
APRIL-MAY**

*Acanthomintha ilicifolia*²
*Brodiaea filifolia*²
*Brodiaea orcuttii*²
Muilla clevelandii
*Dudleya variegata*³
*Hemizonia conjugens*³

JUNE

*Calochortus dunnii*²

SEPTEMBER

**GABBRO-DERIVED SOILS:
APRIL-MAY**

*Acanthomintha ilicifolia*²
Caulanthus stenocarpus
Nolina interrata
*Senecio ganderi*²
Tetracoccus dioicus

JUNE

*Calochortus dunnii*²

SEPTEMBER

**DEL MAR MESA AREA:
APRIL-MAY**

Arctostaphylos glandulosa
 var. *crassifolia*
Ceanothus verrucosus
*Chorizanthe orcuttiana*⁴
*Dudleya brevifolia*³
Pinus torreyana

JUNE

Corethrogyne filaginifolia
 var. *linifolia*

SEPTEMBER

Baccharis vanessae

**SOUTHEASTERN MOUNTAINS:
APRIL-MAY**

Arctostaphylos otayensis
Cupressus forbesii
Fremontodendron mexicanum
Lepechinia cardiophylla
*Senecio ganderi*²
Solanum tenuilobatum^{2,4}

JUNE

*Calochortus dunnii*²
Lepechinia ganderi

SEPTEMBER

Hemizonia floribunda

Table 3 (Continued)

MSCP SENSITIVE PLANT SURVEYS
PROPOSED SURVEY PERIODS

COASTAL SAGE SCRUB:
APRIL-MAY

JUNE

SEPTEMBER

*Ambrosia pumila*³
Astragalus deanei
*Cordylanthus orcuttianus*³
Ferocactus
viridescens
Opuntia parryi
var. serpentina
Solanum tenuilobatum^{2,4}

Ericameria palmeri

VERNAL POOLS/GRASSLANDS:
APRIL-MAY

JUNE

SEPTEMBER

*Brodiaea filifolia*²
*Brodiaea orcuttii*²
*Eryngium aristulatum var. parishii*³
*Myosurus minimus ssp. apus*⁴
*Navarretia fossalis*³
*Orcuttia californica*³
*Pogogyne abramsii*³
*Pogogyne nudiuscula*³

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COASTAL DUNES/BLUFFS/SALTMARSH:
APRIL-MAY

JUNE

SEPTEMBER

Agave shawii
Aphanisma blitoides
Astragalus tener var. titi
*Cordylanthus maritimus*³
Erysimum ammophilum
Lotus nuttallianus

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--

CHAPARRAL:
APRIL-MAY

JUNE

SEPTEMBER

Ceanothus cyaneus
Githopsis diffusa
*ssp. filicaulis*³

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--

WASHES:
APRIL-MAY

JUNE

SEPTEMBER

--

Monardella linoidea
ssp. viminea

--

Table 3 (Continued)

MSCP SENSITIVE PLANT SURVEYS
PROPOSED SURVEY PERIODS

| OTHER: <u>APRIL-MAY</u> | <u>JUNE</u> | <u>SEPTEMBER</u> |
|--|--------------------|-------------------------|
| <i>Dudleya viscida</i> | -- | -- |
| <i>Rosa minutifolia</i> | | |

-
- 1 Species which are detectable outside the given survey period, based on habit, are highlighted in bold print.
 - 2 Species also occurs in other categories.
 - 3 Annual or herbaceous perennial species that may bloom beyond the April-May survey period and potentially can be surveyed later in the season, as well.
 - 4 Species should be surveyed in April or earlier.
-

MSCP SENSITIVE PLANT SURVEY PROTOCOL FIELD PERSONNEL

A. FIELD FORMS

Cover page. One cover page per day per study area is required (i.e., if you move to a new study area, a separate cover page will be required).

UTM coordinates. To be used only if legal description does not exist for the area (i.e., Spanish land grants).

Vegetation form. A minimum of one vegetation form per day per study area is required (i.e., if you move to a new study area, separate vegetation forms will be required). Use blank forms for additional information, as needed. Refer to additional handouts for MSCP vegetation codes, vegetation descriptions, minimum mapping units, mapping criteria, and vegetation key.

Blank field pages. To be used for field notes (vegetation descriptions, plant species lists, notes on sensitive species locations, wildlife observations, etc.).

CNPS forms. To be carried and filled out as completely as possible in the field!

Wildlife forms. To be carried in the field and filled out as appropriate. Emphasis will be on identifying areas worth further investigation by wildlife personnel, not conducting wildlife studies per se.

All forms will be available from team leaders.

B. FIELD NOTES

Vegetation. Please provide characterizations of vegetative associations in the study area, focusing on factors indicated on the vegetation form. The purpose of these characterizations is to be able to describe habitats within the study area in a general sense, rather than document every minute variation or phase.

Changes to vegetation maps should be described in greater detail, and coded to changes on the photostat maps. We will use a consecutive coding system for vegetation changes as follows: V-1, V-2, V-3, etc. This code would be placed in the proper polygon (along with the new vegetation code number) and also referenced in the field notes. Because we will be using new field maps on a daily basis and all maps are keyed to a distinct set of notes, the codes will start over at V-1 each day. Please highlight vegetation changes in notes.

Sensitive plant species. All information on the CNPS forms will be required to document each sensitive plant population. All plant locations will be mapped on the USGS maps, using the two-letter code in the sensitive species table (included in package), followed by the population size (Example: a population of 73 plants of *Opuntia parryi* var. *serpentina* = OP 73). Use polygons or points, as appropriate. Use the same code (i.e., OP 73 in the former example) as a cross-reference in notes and please highlight sensitive species occurrences in notes.

It is critical that population size be documented to the degree feasible. At a minimum, if the population size is under 100, plants should be counted individually. Populations between 100 and 1000 should use fairly refined estimates, while populations over 1000 individuals can use a grosser estimate. We need to be as precise as we can within our scope and budget, and as consistent as possible in our methods of estimating plants because preserve selection will consider relative population sizes.

Wildlife Observations. If your notes contain any significant wildlife information beyond that which can be transferred to the wildlife form, then these notes should be copied and given to your team leader. The team leader will transfer these notes to the appropriate wildlife coordinator on a weekly basis.

Plant Species List. The minimum requirements of a floristic survey are to identify each plant to a level sufficient to determine its rarity. For practical purposes, this means that a relatively small amount of time will be required (and has been allotted) for keying plants. Nonetheless, we do want species lists to be as detailed as possible, and the majority of taxa should be identified to specific level. The general rule is that sensitive, potentially sensitive, or uncommon plants should be keyed, as necessary. We expect a certain level of proficiency with the common species from field botanists. This may require some keying on your own time to "hone" your skills.

C. FIELD MAPS

Vegetation Maps. Vegetation mapping will be done on 1" = 2000' xerox copies of aerial photographs (photostats) that show the original mapping polygons for this project. Our objective is to verify the polygon label and correct any major polygon boundary problems. Please refer to the information in the vegetation package for mapping codes, vegetation community descriptions, and minimum mapping units. The original color aerial photographs will be available for cross-reference, but should not be carried into the field (they can make it as far as the field vehicle). No action need be taken if the polygon is correct; refer to the section above under Field Notes-vegetation for mapping protocol.

USGS 7.5' topographical quadrangles. Xerox copies of USGS quads will be used for documenting sensitive plant locations.

Survey Routes. Please document survey routes on USGS maps. Label each route as follows: S-1, S-2, S-3, etc. Start the sequence over for each new study area and/or each new USGS quad.

MSCP VEGETATION MAPPING/SENSITIVE PLANT SURVEY FORM
Ogden Environmental and Energy Services Co.

Investigator _____ Date _____

Assisted By _____

Study Area Number _____ Vegetation Map Number(s) _____

USGS Quad Name _____

Township _____ Range _____ Section _____ 1/4 Section NW NE SW SE

UTM coordinates: N-S _____ to _____, E-W _____ to _____

Weather Conditions: start: Temp. _____ Wind _____ Sky _____

end Temp. _____ Wind _____ Sky _____

General Location _____

Onsite Land Uses _____

Surrounding Land Uses:

North _____

South _____

East _____

West _____

Sensitive Species Detected yes no CNPS Form Attached yes no

Species Name (if yes) _____

Photos Taken yes no Voucher Specimen(s) Collected yes no

Survey Route Map/Topographical Map Number(s) _____

Wildlife Form yes no

07799

APPENDIX A-5

FIELD PROTOCOL FOR MSCP WILDLIFE SURVEYS

07802

FIELD PROTOCOL FOR MSCP WILDLIFE SURVEYS

Prepared by Ogden Environmental and Energy Services Co., Inc.

April 16, 1992

BIOLOGICAL SURVEY FIELD REPORT

In order to collect complete and organized data in the field and streamline the compilation of data at the office, the biological survey field report has been developed. The report consists of a site map and a series of survey forms bound in a manila folder. The report is carried and filled out in the field. The report will then be filed as a permanent record at the office. A separate report must be logged for each person for each site visited. Prepared report folders with forms and maps will be available at the office before each survey.

Wildlife surveys will be conducted for the MSCP program from April 1 through July 31. There will be a one-time survey conducted at each site. After each site has been surveyed once, sites will be evaluated and prioritized regarding need for repeat surveys.

The surveys will be conducted as a walk-through approach rather than a transect or grid approach. This will allow us to survey more area at the level of detail available for surveys conducted in other portions of the MSCP study area. Surveys routes will be recorded on USGS topo quads.

Existing Conditions Page

The person who eventually analyzes the data sheet may have never visited the site. This first page of the data sheet should describe the location, condition, habitats and connectivity of the site in enough detail that it can be evaluated for potential inclusion in the MSCP land acquisition. All lines should be filled in on the first visit to a site. If you are making a return visit to the same area of a site, bring a new survey form and mark the "revisit" line. Only the information which would vary day to day, such as temperature, wind and arrival time, needs to be entered on the new Existing Conditions page.

The field forms will be organized by 7.5 minute USGS quad, township, range, section and quarter sections back at the office. It is therefore important that the site location information be filled out completely before the data is turned in. For areas such as land grants and ranchos with no section numbers, fill in the Universal Trans-Mercator (UTM) coordinates for the site. Be sure to include a nearby land mark, i.e. a mountain, town, creek, that will aid in identifying the location of the site on a map. If only a portion of the site is covered, mark the portion of the site covered on the map and describe on the Project Name line.

All habitats occurring within the study area should be ranked according to area covered in the General Habitat section. Dominant plant species should be listed for each habitat, using the back of the page if necessary. This is especially important for coastal sage scrub (suitability as gnatcatcher habitat), chaparral (chamise, southern mixed, etc.) and grassland (native/non-native).

Dominance refers to those species whose removal would result in the greatest impact on the ecosystem. In woodland and shrub communities, these plants are generally the tallest and cover the largest area. Dominance is usually a result of size of the plant (coverage), number of the plants (density), and distribution of the plants in an area (frequency). Some communities have only a single dominant species; other communities have several codominants. Occasionally, communities are so diverse that no dominance is apparent. A

community is almost always composed of many more subordinate (or associate) species than dominant species.

Fire history should include estimated time since burn, notes on successional growth, etc.

Onsite land uses could include grazing, off-road vehicle trails, agriculture, houses, quarries, firebreaks, abandoned buildings, migrant worker camps or any other human-related activity. Estimate the proportion of the survey area affected by these land uses.

The surrounding land uses/habitats information will be used in analyzing connectivity as well as impacts of offsite activities on the site and should always be filled out in as much detail as possible. Include categories such as "spaced rural development," "active sand mine," or "busy freeway with a 7' diameter pipe leading about 600' to a large area of natural open space" when describing the land uses.

Sensitive species pages

These pages act as a reference to the sensitive species potentially occurring in the MSCP area. The columnar format will aid in the entry of the information into the computer database. Species marked with an asterisk are the MSCP target species. Species marked with a plus are additional species USFWS has suggested as priority species. All sensitive species should be recorded, counted, and mapped.

As sensitive species are observed, the number of individuals are tallied in the "Total Indivs" column. At the same time, separate tallies of the number of males, females, etc. of the species are kept in the appropriate columns. If the age and sex of an individual cannot be determined, record the sighting in the "Total Indivs" column only. Tallies of tracks and scat of the species are kept in the appropriate columns. If return visits are made, continue the tally, referring to the previous mapping to avoid double counting. Comments on the specific sightings such as markings, unusual behavior or breeding behavior, or microhabitat descriptions (rock outcropping, under rotting logs, etc.) can be recorded in the "Comments" column. If necessary, write more extensive comments on the back of the page or in the field notes page at the end of the form and link them with a number to the "Comments" column.

Geological Formations, Sign, and Wildlife Microhabitats Page

A number of the target species will probably not be directly observed during the surveys. Signs such as bones, feathers, nests, prey species, host plants, or suitable microhabitats such as rock outcroppings, caves or rotting logs can indicate the potential for a species on a site. All microhabitats and signs on the list should be recorded if found.

- An asterisk in the "Map" column indicates that the occurrence should be mapped on the site map. An asterisk in the "Collect" column indicates that a sample should be taken if a positive identification can not be made in the field.
- In the "H/M/L" column, rank overall abundance on the site as high, medium or low.
- Record details in the "Comments" column. Link comments to map if necessary, using the time of observation. Note extent, numbers, size, diagnostic characteristics or other information which may be useful to someone analyzing the data.

Gnatcatcher/Cactus Wren Sighting Form

Detailed information on all gnatcatcher and cactus wren sightings must be recorded on this page. Each individual is recorded on a separate line.

- GIS #: Leave this blank, it will be filled in by the GIS team.
- Species, Time, Elevation, % slope, Habitat, Dom. plants: Fill these columns out completely at the time of the sighting.
- UTM coordinates: will be filled in by GIS team.
- Age/sex checkboxes: Record age and sex of individual, or "?" if unknown.
- Gnatcatcher characteristics checkboxes (eyebrow, partial cap, etc.): Check these for characteristics observed.
- Nests, comments: Include breeding, territorial or unusual behavior, as well as any additional comments in this column or on the back of the page, linked to this column with a number.
- At the end of the survey, fill in the total number of individuals and pairs for each species at the bottom of the page.

Field Notes Pages

Use these pages to log your general impression of the site, comments or observations not covered by the field forms, interviews with locals, or any other information which would help to characterize the site. Comments can be numbered and linked to data on the form and map if necessary. If this information is recorded in your personal field notebook, xerox the pages and attach them here.

Species List:

All species identified, rare or not, should be recorded on this page. A bird species list is included for reference.

Map

Maps that have a scale of 1 in.=2,000 feet will be carried in the field for each site. The information linking the map to the data form should be filled out completely. Sensitive species should be recorded. Use the code from the "Code" column of the sensitive species tally sheet and record the time of the sighting. The time can be used to link comments to the individual sighting and to help avoid double counting on overlapping surveys. Also mark your survey route on the map as a reference to others continuing the survey later and as an indication of the thoroughness of the survey. The map should be attached to the inside front cover of the field report before it is turned in. If rare plants are observed record them and map them for the botany group as soon as possible.

Collecting samples: Samples of sign marked as "collect" on the survey form should be collected if a positive identification can not be made in the field. Vials and plastic bags should be carried to assure the safe transport of the samples. Tadpoles are identifiable and should be collected and keyed out if not identified in the field. Butterflies matching the

description of the target species should be collected if possible. Good examples of animal sign including scat, tracks, bones, dens, etc. should be photographed or collected for the Ogden reference collection.

Gnatcatcher Survey Protocols

Generalized SRP guidelines will be used to conduct gnatcatcher surveys. We will be surveying (15) 300 acre plots within coastal sage scrub for the California gnatcatcher. Surveys will be conducted in habitats with high potential for gnatcatcher suitability, based on characteristics of vegetation, topography, and proximity to riparian habitat. Suitable habitat will be surveyed with the aid of taped vocalizations. Areas of suitable habitat surveyed between 1100 and 1500 hours should be revisited in the morning if no gnatcatchers are detected. Gnatcatcher surveys should not be performed in very cold, hot, or windy conditions. Plot the original point of contact on the map along with the code CAGN, the time of initial detection and number of birds detected. Record other data on the the gnatcatcher/cactus wren survey form page of the survey report.

Cactus Wren Survey Protocol

All suitable habitat (cactus patches over 3 feet in height) should be surveyed for cactus wrens with the aid of taped vocalizations. Habitat should also be searched for nests. Cactus patches should be surveyed as soon as possible after arriving at a site as the peak activity period is early in the morning.

Special Survey Techniques

Most other species can be surveyed for while performing the walk-through type surveys for gnatcatcher and cactus wren. A number of species, however, would not be detected with this type of survey. By implementing additional survey techniques, we will detect more of the difficult-to-detect species. Potential for the occurrence of species not detected during the surveys can be implied if certain indicators are recognized and recorded.

Aquatic habitats should be checked for fish and tadpoles and amphibian egg masses if the water is clear. Several tadpoles or eggs can be sampled and keyed out at the office without significant impacts to the local population. Also note depth of pools, water quality, and/or flow, and note protruding objects suitable for turtle basking.

Rocks, trash, logs and debris should be turned over and searched for snakes, lizards and small mammals. Dig around in the soil beneath the object with a stick to uncover burrowing species. Use caution when turning objects to avoid snake or spider bites. Always return objects to their original orientation and position before leaving.

In boulder piles and rock outcroppings, use a flashlight and mirror and peer into cracks and holes and beneath exfoliating flakes of rock (it will be thousands of years before flakes are replaced if they are removed) to search for rock dwelling species, denning sites, droppings and bones. Note whitewash (bird droppings) on top of rocks (a sign of a potential raptor perch).

Note the extent (and disturbance level) of caves and mines and evaluate the potential for bats and denning sites.

Note sandy streambeds or washes as they are important habitat for a number of reptile species.

Identify populations of the plant species listed on the survey form. Some are potentially important as host plants for rare butterflies and should be mapped. Large patches of cholla or prickly-pear should be surveyed for cactus wrens (using the taped vocalization) and searched for nests. Groves of trees should be searched for raptor nests and whitewash. Evaluate willow thickets for least Bell's vireo habitat value.

Colonies of harvester or wood ants should be noted as a potential horned lizard indicator, and should be searched for the characteristic capsule-shaped droppings composed of ant bodies left by the lizards.

Check wood for signs of termite damage and note termite castings around debris on the ground. Termites are the preferred prey of whiptail lizards.

_____ Hours

MSCP WILDLIFE SURVEY FORM

Ogden Environmental and Energy Services Co.

Investigator _____ Date _____
Assisted By _____

Survey Area Number _____ Vegetation Map Number(s) _____

USGS Quad Name
T _____ R _____ S _____ 1/4 Sect NW NE SW SE S _____ 1/4 Sect NW NE SW SE

USGS Quad Name _____
T _____ R _____ S _____ 1/4 Sect NW NE SW SE S _____ 1/4 Sect NW NE SW SE

UTM coordinates: N-S _____ to _____, E-W _____ to _____

Elevation: Max: _____ Min: _____

Time: Start _____ Stop _____ Wind: Min _____ Max _____
Sky: Start _____ Stop _____ Temp: Min _____ Max _____

General Location (County, Nearest City/Landmark) _____

Onsite Land Uses _____

Surrounding Land Uses:
North _____
South _____
East _____
West _____

- General Habitat: (Rank according to area covered)
- | | | |
|------------------------------------|-----------------------------------|--------------------------|
| _____ Coastal Sage Scrub | _____ Oak Riparian Forest | _____ Disturbed Wetlands |
| _____ Chaparral | _____ Oak Woodland, sparse | _____ Open Water |
| _____ Coastal Sage Scrub/Chaparral | _____ Oak Woodland, dense | _____ Beach |
| _____ Southern Maritime Chaparral | _____ Torrey Pines Forest | _____ Southern Foredunes |
| _____ Maritime Succulent Scrub | _____ So. Interior Cypress Forest | _____ Saltpan |
| _____ So. Coastal Bluff Scrub | _____ Eucalyptus Woodland | _____ Grassland |
| _____ Riparian Scrub | _____ So. Coastal Salt Marsh | _____ Disturbed Habitat |
| _____ Riparian Woodland | _____ Freshwater Marsh | _____ Developed |
| _____ Riparian Forest | _____ Nat. Floodchannel/Streambed | |

Habitat (1) Dominant species: _____
Habitat (2) Dominant species: _____
Habitat (3) Dominant species: _____

Fire History: _____

Wildlife Corridors within/through: _____

4/16/92

07808

USGS Quad _____

MSCP AREA

Date _____

| Observer | Date | Observer | Nests | Adults | Juvs | Males | Females | Total Indivs. | Code | Birds |
|----------|------|----------|-------|--------|------|-------|---------|---------------|------|--------------------------------|
| | | | | | | | | | COLO | Common loon |
| | | | | | | | | | AWPE | American white pelican |
| | | | | | | | | | BRPE | Brown pelican |
| | | | | | | | | | DCCO | Double crested cormorant |
| | | | | | | | | | REEG | Reddish egret |
| | | | | | | | | | WFIB | White-faced ibis |
| | | | | | | | | | CAGO | Canada goose |
| | | | | | | | | | GOEA | Golden eagle |
| | | | | | | | | | BAEA | Bald eagle |
| | | | | | | | | | NOHA | Northern harrier |
| | | | | | | | | | SSHA | Sharp-shinned hawk |
| | | | | | | | | | COHA | Cooper's hawk |
| | | | | | | | | | SWHA | Swainson's hawk |
| | | | | | | | | | FEHA | Ferruginous hawk |
| | | | | | | | | | OSPR | Osprey |
| | | | | | | | | | MERL | Merlin |
| | | | | | | | | | PRFA | Prairie falcon |
| | | | | | | | | | PEFA | Peregrine falcon |
| | | | | | | | | | CLRA | Light-footed clapper rail |
| | | | | | | | | | SNPL | Western snowy plover |
| | | | | | | | | | MOPL | Mountain plover |
| | | | | | | | | | LBCU | Long-billed curlew |
| | | | | | | | | | LETE | Least tern |
| | | | | | | | | | BLTE | Black tern |
| | | | | | | | | | ELTE | Elegant tern |
| | | | | | | | | | BUOW | Burrowing owl |
| | | | | | | | | | LEOW | Long-eared owl |
| | | | | | | | | | SEOW | Short-eared owl |
| | | | | | | | | | WIFL | Willow flycatcher |
| | | | | | | | | | HOLA | California horned lark |
| | | | | | | | | | CAGR | Coastal cactus wren |
| | | | | | | | | | BGGN | Blue-gray gnatcatcher |
| | | | | | | | | | CAGN | California gnatcatcher |
| | | | | | | | | | WEBL | Western bluebird |
| | | | | | | | | | LOSH | Loggerhead shrike |
| | | | | | | | | | BEVI | Least Bell's vireo |
| | | | | | | | | | GRVI | Gray vireo |
| | | | | | | | | | YEWA | Yellow warbler |
| | | | | | | | | | YBCH | Yellow-breasted chat |
| | | | | | | | | | GRSP | Grasshopper sparrow |
| | | | | | | | | | SASP | Belding's savannah sparrow |
| | | | | | | | | | LBSS | Large-billed savannah sparrow |
| | | | | | | | | | SASP | Bell's sage sparrow |
| | | | | | | | | | RCSP | So. Ca. rufous-crowned sparrow |
| | | | | | | | | | TRBL | Tri-colored blackbird |

USGS Quad

SENSITIVE SPECIES MSCP AREA

Date

| GIS # | Amphibians & Reptiles | Code | Total indivs. | Males | Females | Juvs | Adults | Tracks | Observer | Scat | Comments |
|-------|------------------------------|------|---------------|-------|---------|------|--------|--------|----------|------|----------|
| | Large-blotched ensatina | LE | | | | | | | | | |
| | Arroyo toad | AT | | | | | | | | | |
| | Calif. red-legged frog | RF | | | | | | | | | |
| | Western pond turtle | PT | | | | | | | | | |
| | San Diego horned lizard | HL | | | | | | | | | |
| | San Diego banded gecko | BG | | | | | | | | | |
| | So. sagebrush lizard | SL | | | | | | | | | |
| | Coronado skink | CS | | | | | | | | | |
| | Orange-throated whiptail | OW | | | | | | | | | |
| | Coastal western whiptail | WW | | | | | | | | | |
| | Granite spiny lizard | SL | | | | | | | | | |
| | Coastal rosy boa | RB | | | | | | | | | |
| | San Diego ring-necked snake | NS | | | | | | | | | |
| | San Diego mountain kingsnake | MK | | | | | | | | | |
| | Two-striped oarler snake | GS | | | | | | | | | |
| | No. red diamond rattlesnake | RS | | | | | | | | | |
| | Coast patch-nosed snake | PS | | | | | | | | | |
| | W. spadefoot toad | ST | | | | | | | | | |
| | Mammals | | | | | | | | | | |
| | California leaf-nosed bat | CLB | | | | | | | | | |
| | Mexican long-tongued bat | MLB | | | | | | | | | |
| | California mastiff bat | TMB | | | | | | | | | |
| | Townsend's w. big-eared bat | BEB | | | | | | | | | |
| | SD black-tailed jackrabbit | BTJ | | | | | | | | | |
| | Pacific pocket mouse | LPM | | | | | | | | | |
| | N. W. San Diego pocket mouse | NPM | | | | | | | | | |
| | Dulzura Ca. pocket mouse | DPM | | | | | | | | | |
| | Stephens' kangaroo rat | SKR | | | | | | | | | |
| | Southern grasshopper mouse | SGM | | | | | | | | | |
| | San Diego desert woodrat | SDW | | | | | | | | | |
| | American badger | AMB | | | | | | | | | |
| | Mule deer | MUD | | | | | | | | | |
| | Mountain lion | MOL | | | | | | | | | |
| | Invertebrates | | | | | | | | | | |
| | Riverside fairy shrimp | RFS | | | | | | | | | |
| | Vernal pool fairy shrimp | VFS | | | | | | | | | |
| | Harbison's dun skipper | HDS | | | | | | | | | |
| | Salt marsh skipper | SMS | | | | | | | | | |
| | Quino checkerspot butterfly | QCS | | | | | | | | | |
| | Thorne's hairstreak | THH | | | | | | | | | |
| | Hermes copper butterfly | HCB | | | | | | | | | |

*MSCP Target Species
#USFWS Special Interest

FIELD OBSERVATIONS

Geologic/Habitat

| Map | Collect | H/M/L | Comments |
|-----|---------|-------|--|
| X | | | |
| | | | Rock formations (talus, boulders, exfoliating granite) |
| | | | Rocky outcroppings |
| | | | Caves |
| | | | Mines |
| | | | Abandoned buildings |
| | | | Standing water (rock pools, reservoirs, ponds) |
| | | | Flowing water (intermit. stream, perenn. stream, spring) |
| | | | Alkali meadow |
| | | | Vernal pool toxicograph |
| | | | Marsh (fresh, salt, brackish) |
| | | | Sandy washes |
| | | | Snags, nesting cavities |
| | | | Logs (describe level of decay) |
| | | | Debris |
| | | | Loose, friable soil |
| | | | Sign |
| | | | Dens |
| | | | Burrows |
| | | | Raptor nests |
| | | | Bird nests |
| | | | Woodrat nests |
| | | | Feathers |
| | | | Pellets |
| | | | Whitewash |
| | | | Skeletons |
| | | | Carcasses |
| | | | Snakeskins |
| | | | Ant mounds |
| | | | Termite |
| | | | Small mammal prey species |
| | | | Amphibian egg masses/tadpoles |
| | | | Plants |
| | | | Cactus patches--Cholla, Prickly Pear (Cactus Wren) |
| | | | Plantains--Plantago sp. (Quino checker spot) |
| | | | Redberrv--Rhamnus crocea (Hermes copper butterfly) |
| | | | San Diego sedae--Carex spissa (Harbison's dun skinner) |
| | | | Tecate cypress (Thorne's Hairstreak) |
| | | | Groves of trees |
| | | | Willow thickets |

USGS Quad

Date

Observer

FIELD NOTES

(Use this page or attach xerox of field notebook)

COMPLETE SPECIES LIST

USGS QUAD _____

DATE _____

OBSERVER _____

AMPHIBIANS

REPTILES

MAMMALS

- LOONS**
- ___ Red-throated Loon
- ___ Pacific Loon
- ___ Common Loon
- GREBES**
- ___ Pied-billed Grebe (B)
- ___ Horned Grebe
- ___ Red-necked Grebe *
- ___ Eared Grebe (B)
- ___ Western Grebe (B)
- ___ Clark's Grebe (B)
- ALBATROSSES**
- ___ Short-tailed Albatross *
- ___ Black-footed Albatross
- ___ Laysan Albatross *
- FULMARS & SHEARWATERS**
- ___ Northern Fulmar
- ___ Cook's Petrel
- ___ Pink-footed Shearwater
- ___ Flesh-footed Shearwater *
- ___ Buller's Shearwater
- ___ Sooty Shearwater
- ___ Short-tailed Shearwater
- ___ Black-vented Shearwater
- STORM-PETRELS**
- ___ Wilson's Storm-Petrel *
- ___ Fork-tailed Storm-Petrel *
- ___ Leach's Storm-Petrel
- ___ Ashy Storm-Petrel
- ___ Band-rumped Storm-Petrel *
- ___ Black Storm-Petrel
- ___ Least Storm-Petrel
- TROPICBIRDS**
- ___ Red-billed Tropicbird
- ___ Red-tailed Tropicbird *
- BOOBIES**
- ___ Masked Booby *
- ___ Blue-footed Booby *
- ___ Brown Booby *
- PELICANS**
- ___ American White Pelican
- ___ Brown Pelican
- CORMORANTS**
- ___ Double-crested Cormorant (B)
- ___ Brandt's Cormorant (B)
- ___ Pelagic Cormorant
- DARTERS**
- ___ Anhinga *
- FRIGATEBIRDS**
- ___ Magnificent Frigatebird
- BITTERNS & HERONS**
- ___ American Bittern
- ___ Least Bittern (B)
- ___ Great Blue Heron (B)
- ___ Great Egret (B)
- ___ Snowy Egret (B)
- ___ Little Blue Heron (B)
- ___ Tricolored Heron
- ___ Reddish Egret
- ___ Cattle Egret (B)
- ___ Green-backed Heron (B)
- ___ Black-crowned Night-Heron (B)
- ___ Yellow-crowned Night-Heron *
- IBISES & SPOONBILLS**
- ___ White Ibis *
- ___ White-faced Ibis (B)
- ___ Roseate Spoonbill *
- STORKS**
- ___ Wood Stork
- SWANS, GEESE & DUCKS**
- ___ Fulvous Whistling-Duck *
- ___ Tundra Swan
- ___ Greater White-fronted Goose
- ___ Snow Goose
- ___ Ross' Goose
- ___ Brant
- ___ Canada Goose
- ___ Wood Duck
- ___ Green-winged Teal (B)

- ___ Mallard (B)
- ___ Northern Pintail (B)
- ___ Blue-winged Teal
- ___ Cinnamon Teal (B)
- ___ Northern Shoveler (B)
- ___ Gadwall (B)
- ___ Eurasian Wigeon
- ___ American Wigeon
- ___ Canvasback
- ___ Redhead (B)
- ___ Ring-necked Duck
- ___ Greater Scaup
- ___ Lesser Scaup
- ___ King Eider *
- ___ Harlequin Duck *
- ___ Oldsquaw
- ___ Black Scoter
- ___ Surf Scoter
- ___ White-winged Scoter
- ___ Common Goldeneye
- ___ Barrow's Goldeneye *
- ___ Bufflehead
- ___ Hooded Merganser
- ___ Common Merganser
- ___ Red-breasted Merganser
- ___ Ruddy Duck (B)
- AMERICAN VULTURES**
- ___ Turkey Vulture (B)
- ___ California Condor (E)
- KITES, EAGLES & HAWKS**
- ___ Osprey
- ___ Black-shouldered Kite (B)
- ___ Mississippi Kite *
- ___ Bald Eagle
- ___ Northern Harrier (B)
- ___ Sharp-shinned Hawk
- ___ Cooper's Hawk (B)
- ___ Northern Goshawk *
- ___ Harris' Hawk *
- ___ Red-shouldered Hawk (B)
- ___ Broad-winged Hawk
- ___ Swainson's Hawk
- ___ Zone-tailed Hawk (B)
- ___ Red-tailed Hawk (B)
- ___ Ferruginous Hawk
- ___ Rough-legged Hawk
- ___ Golden Eagle (B)
- FALCONS**
- ___ American Kestrel (B)
- ___ Merlin
- ___ Peregrine Falcon (B)
- ___ Prairie Falcon (B)
- PHEASANTS, TURKEYS & QUAIL**
- ___ Ring-necked Pheasant (I)
- ___ Wild Turkey (I)
- ___ Gambel's Quail (B)
- ___ California Quail (B)
- ___ Mountain Quail (B)
- RAILS, GALLINULES & COOTS**
- ___ Black Rail
- ___ Clapper Rail (B)
- ___ Virginia Rail (B)
- ___ Sora
- ___ Purple Gallinule *
- ___ Common Moorhen (B)
- ___ American Coot (B)
- CRANES**
- ___ Sandhill Crane *
- PLOVERS**
- ___ Black-bellied Plover
- ___ Lesser Golden-Plover
- ___ Snowy Plover (B)
- ___ Wilson's Plover *
- ___ Semipalmated Plover
- ___ Killdeer (B)
- ___ Mountain Plover
- OYSTERCATCHERS**
- ___ American Oystercatcher *
- ___ Black Oystercatcher
- STILTS & AVOCETS**
- ___ Black-necked Stilt (B)
- ___ American Avocet (B)
- SANDPIPERS & PHALAROPES**
- ___ Greater Yellowlegs

- ___ Lesser Yellowlegs
- ___ Spotted Redstart
- ___ Solitary Sandpiper
- ___ Willet
- ___ Wandering Tattler
- ___ Spotted Sandpiper
- ___ Whimbrel
- ___ Long-billed Curlew
- ___ Bar-tailed Godwit
- ___ Marbled Godwit
- ___ Ruddy Turnstone
- ___ Black Turnstone
- ___ Surf-bird
- ___ Red Knot
- ___ Sanderling
- ___ Semipalmated Sandpiper
- ___ Western Sandpiper
- ___ Rufous-necked Sandpiper
- ___ Least Sandpiper
- ___ Baird's Sandpiper
- ___ Pectoral Sandpiper
- ___ Sharp-tailed Sandpiper
- ___ Dunlin
- ___ Curlew Sandpiper
- ___ Stilt Sandpiper
- ___ Buff-breasted Sandpiper
- ___ Ruff
- ___ Short-billed Dowitcher
- ___ Long-billed Dowitcher
- ___ Common Noddy
- ___ Wilson's Phalarope
- ___ Red-necked Phalarope
- ___ Red Phalarope
- SKUAS, GULLS, TERNS & SKIMMERS**
- ___ Pomarine Jaeger
- ___ Parasitic Jaeger
- ___ Long-tailed Jaeger
- ___ South Polar Skua
- ___ Laughing Gull
- ___ Franklin's Gull
- ___ Little Gull *
- ___ Com. Black-headed Gull
- ___ Bonaparte's Gull
- ___ Heermann's Gull
- ___ Mew Gull
- ___ Ring-billed Gull
- ___ California Gull
- ___ Herring Gull
- ___ Thayer's Gull
- ___ Iceland Gull *
- ___ Yellow-footed Gull *
- ___ Western Gull (B)
- ___ Glaucous-winged Gull
- ___ Glaucous Gull
- ___ Black-legged Kittiwake
- ___ Sabine's Gull
- ___ Gull-billed Tern (B)
- ___ Caspian Tern (B)
- ___ Royal Tern (B)
- ___ Elegant Tern (B)
- ___ Sandwich Tern *
- ___ Common Tern
- ___ Arctic Tern
- ___ Forster's Tern (B)
- ___ Least Tern (B)
- ___ Sooty Tern *
- ___ Black Tern
- ___ Black Skimmer (B)
- AUKS, MURRETS & PUFFINS**
- ___ Common Murre
- ___ Pigeon Guillemot *
- ___ Marbled Murrelet *
- ___ Kittitz's Murrelet *
- ___ Xmas' Murrelet
- ___ Craven's Murrelet
- ___ Ancient Murrelet
- ___ Cassin's Auklet
- ___ Parakeet Auklet *
- ___ Rhinoceros Auklet
- ___ Tufted Puffin *
- ___ Horned Puffin
- PIGEONS & DOVES**
- ___ Rock Dove (I)
- ___ Band-tailed Pigeon (B)
- ___ Spotted Dove (I)
- ___ White-winged Dove
- ___ Mourning Dove (B)
- ___ Inca Dove *
- ___ Common Ground-Dove (B)
- ___ Ruddy Ground-Dove *

APPENDIX A-6

DESCRIPTIONS OF 1992 FIELD SURVEY AREAS

CUCKOOS & ROADRUNNERS

- ___ Yellow-billed Cuckoo *
- ___ Greater Roadrunner (B)

BARN OWLS

- ___ Barn Owl (B)

TYPICAL OWLS

- ___ Flammulated Owl
- ___ Western Screech-Owl (B)
- ___ Great Horned Owl (B)
- ___ Northern Pygmy-Owl (B)
- ___ Burrowing Owl (B)
- ___ Spotted Owl (B)
- ___ Long-eared Owl (B)
- ___ Short-eared Owl
- ___ Northern Saw-whet Owl (B)

GOATSUCKERS

- ___ Lesser Nighthawk (B)
- ___ Common Nighthawk *
- ___ Common Poonwill (B)
- ___ Whip-poor-will *

SWIFTS

- ___ Black Swift
- ___ Chimney Swift *
- ___ Vaux's Swift
- ___ White-throated Swift (B)

HUMMINGBIRDS

- ___ Broad-billed Hummingbird
- ___ Xantus' Hummingbird *
- ___ Black-chinned Hummingbird (B)
- ___ Anna's Hummingbird (B)
- ___ Costa's Hummingbird (B)
- ___ Calliope Hummingbird
- ___ Broad-tailed Hummingbird *
- ___ Rufous Hummingbird
- ___ Allen's Hummingbird

KINGFISHERS

- ___ Belted Kingfisher (B)

WOODPECKERS

- ___ Lewis' Woodpecker
- ___ Acorn Woodpecker (B)
- ___ Yellow-bellied Sapsucker *
- ___ Red-naped Sapsucker
- ___ Red-breasted Sapsucker (B)
- ___ Williamson's Sapsucker
- ___ Ladder-backed Woodpecker
- ___ Nuttall's Woodpecker (B)
- ___ Downy Woodpecker (B)
- ___ Hairy Woodpecker (B)
- ___ White-headed Woodpecker
- ___ Northern Flicker (B)

TYRANT FLYCATCHERS

- ___ Olive-sided Flycatcher (B)
- ___ Greater Pewee
- ___ Western Wood-Pewee (B)
- ___ Willow Flycatcher (B)
- ___ Least Flycatcher
- ___ Hammond's Flycatcher
- ___ Dusky Flycatcher (B)
- ___ Gray Flycatcher
- ___ Pacific-slope Flycatcher (B)
- ___ Black Phoebe (B)
- ___ Eastern Phoebe
- ___ Sey's Phoebe (B)
- ___ Vermilion Flycatcher (B)
- ___ Dusky-capped Flycatcher *
- ___ Ash-throated Flycatcher (B)
- ___ Great Crested Flycatcher *
- ___ Sulphur-bellied Flycatcher *
- ___ Tropical Kingbird
- ___ Cassin's Kingbird (B)
- ___ Thick-billed Kingbird *
- ___ Western Kingbird (B)
- ___ Eastern Kingbird
- ___ Scissor-tailed Flycatcher

LARKS

- ___ Horned Lark (B)

SWALLOWS

- ___ Purple Martin (B)
- ___ Tree Swallow (B)
- ___ Violet-green Swallow (B)
- ___ N. Rough-winged Swallow (B)
- ___ Bank Swallow
- ___ Cliff Swallow (B)
- ___ Barn Swallow (B)

JAYS & CROWS

- ___ Steller's Jay (B)
- ___ Scrub Jay (B)
- ___ Pinyon Jay
- ___ Clark's Nutcracker
- ___ American Crow (B)
- ___ Common Raven (B)

TITMICE

- ___ Mountain Chickadee (B)
- ___ Plain Titmouse (B)

VERDINS

- ___ Verdin (B)

BUSHITTIS

- ___ Bushit (B)

NUTHATCHES

- ___ Red-breasted Nuthatch (B)
- ___ White-breasted Nuthatch (B)
- ___ Pygmy Nuthatch (B)

CREEPERS

- ___ Brown Creeper (B)

WRENS

- ___ Cactus Wren (B)
- ___ Rock Wren (B)
- ___ Canyon Wren (B)
- ___ Bewick's Wren (B)
- ___ House Wren (B)
- ___ Winter Wren
- ___ Marsh Wren (B)

DIPPERS

- ___ American Dipper

MUSCICAPIDS

- ___ Golden-crowned Kinglet
- ___ Ruby-crowned Kinglet
- ___ Blue-gray Gnatcatcher (B)
- ___ California Gnatcatcher (B)
- ___ Black-tailed Gnatcatcher (B)
- ___ Western Bluebird (B)
- ___ Mountain Bluebird
- ___ Townsend's Solitaire
- ___ Gray-cheeked Thrush *
- ___ Swainson's Thrush (B)
- ___ Hermit Thrush
- ___ Wood Thrush *
- ___ American Robin (B)
- ___ Varied Thrush
- ___ Wrenlet (B)

MOCKINGBIRDS & THRASHERS

- ___ Gray Catbird
- ___ Northern Mockingbird (B)
- ___ Sage Thrasher
- ___ Brown Thrasher
- ___ Bendire's Thrasher
- ___ California Thrasher (B)
- ___ Crissal Thrasher (B)
- ___ Le Conte's Thrasher (B)

PIPITS

- ___ Red-throated Pipit
- ___ American Pipit
- ___ Sprague's Pipit *

WAXWINGS

- ___ Bohemian Waxwing *
- ___ Cedar Waxwing

SILCY-FLYCATCHERS

- ___ Phainopepla (B)

SHRIKES

- ___ Loggerhead Shrike (B)

STARLINGS

- ___ European Starling (I)

VIREOS

- ___ White-eyed Vireo *
- ___ Bell's Vireo (B)
- ___ Gray Vireo (B)
- ___ Solitary Vireo (B)
- ___ Yellow-throated Vireo *
- ___ Hutton's Vireo (B)
- ___ Warbling Vireo (B)
- ___ Philadelphia Vireo
- ___ Red-eyed Vireo
- ___ Yellow-green Vireo

EMBEREZIDS

- ___ Blue-winged Warbler *
- ___ Golden-winged Warbler *
- ___ Tennessee Warbler
- ___ Orange-crowned Warbler (B)
- ___ Nashville Warbler
- ___ Virginia's Warbler
- ___ Lucy's Warbler
- ___ Northern Parula
- ___ Yellow Warbler (B)
- ___ Chestnut-sided Warbler
- ___ Magnolia Warbler
- ___ Cape May Warbler
- ___ Black-throated Blue Warbler
- ___ Yellow-rumped Warbler (B)
- ___ Black-throated Gray Warbler (B)
- ___ Townsend's Warbler
- ___ Hermit Warbler
- ___ Black-throated Green Warbler
- ___ Blackburnian Warbler
- ___ Yellow-throated Warbler
- ___ Grace's Warbler *
- ___ Pine Warbler *
- ___ Prairie Warbler
- ___ Palm Warbler
- ___ Bay-breasted Warbler
- ___ Blackpoll Warbler
- ___ Cerulean Warbler *
- ___ Black-and-white Warbler
- ___ American Redstart
- ___ Prothonotary Warbler
- ___ Worm-eating Warbler
- ___ Ovenbird
- ___ Northern Waterthrush
- ___ Louisiana Waterthrush *
- ___ Kentucky Warbler *
- ___ Connecticut Warbler *
- ___ Mourning Warbler *
- ___ MacGillivray's Warbler
- ___ Common Yellowthroat (B)
- ___ Hooded Warbler
- ___ Wilson's Warbler
- ___ Canada Warbler
- ___ Red-faced Warbler *
- ___ Painted Redstart (B)
- ___ Yellow-breasted Chat (B)
- ___ Hepatic Tanager

- ___ Summer Tanager
- ___ Scarlet Tanager
- ___ Western Tanager (B)
- ___ Pyrrhuloxia *
- ___ Rose-breasted Grosbeak
- ___ Black-headed Grosbeak (B)
- ___ Blue Grosbeak (B)
- ___ Lazuli Bunting (B)
- ___ Indigo Bunting
- ___ Painted Bunting *
- ___ Dickcissel
- ___ Green-tailed Towhee (B)
- ___ Rufous-sided Towhee (B)
- ___ California Towhee (B)
- ___ Cassin's Sparrow *
- ___ Rufous-crowned Sparrow (B)
- ___ American Tree Sparrow
- ___ Chipping Sparrow (B)
- ___ Clay-colored Sparrow
- ___ Brewer's Sparrow
- ___ Black-chinned Sparrow (B)
- ___ Vesper Sparrow
- ___ Lark Sparrow (B)
- ___ Black-throated Sparrow (B)
- ___ Sage Sparrow (B)
- ___ Lark Bunting
- ___ Savannah Sparrow (B)
- ___ Baird's Sparrow *
- ___ Grasshopper Sparrow (B)
- ___ Sharp-tailed Sparrow
- ___ Fox Sparrow (B)
- ___ Song Sparrow (B)
- ___ Lincoln's Sparrow
- ___ Swamp Sparrow
- ___ White-throated Sparrow
- ___ Golden-crowned Sparrow
- ___ White-crowned Sparrow
- ___ Harris' Sparrow
- ___ Dark-eyed Junco (B)
- ___ McCown's Longspur *
- ___ Lapland Longspur
- ___ Chestnut-collared Longspur
- ___ Bobolink
- ___ Red-winged Blackbird (B)
- ___ Tricolored Blackbird (B)
- ___ Western Meadowlark (B)
- ___ Yellow-headed Blackbird

- ___ Rusty Blackbird *
- ___ Brewer's Blackbird (B)
- ___ Great-tailed Grackle (B)
- ___ Common Grackle *
- ___ Bronzed Cowbird *
- ___ Brown-headed Cowbird (B)
- ___ Orchard Oriole
- ___ Hooded Oriole (B)
- ___ Striped-backed Oriole *
- ___ Northern Oriole (B)
- ___ Scott's Oriole (B)

FINCHES

- ___ Purple Finch (B)
- ___ Cassin's Finch
- ___ House Finch (B)
- ___ Red Crossbill
- ___ Pine Siskin
- ___ Lesser Goldfinch (B)
- ___ Lawrence's Goldfinch (B)
- ___ American Goldfinch (B)
- ___ Evening Grosbeak

OLD WORLD SPARROWS

- ___ House Sparrow (I)

**FIELD CHECKLIST
of the
BIRDS OF SAN DIEGO COUNTY**

prepared by Guy McCaskie
for the

**SAN DIEGO COUNTY
PARKS AND RECREATION DEPARTMENT**

August, 1990.

- B - species known to have bred in the county in recent times.
- * - species sighted fewer than 10 times in the last 25 years.
- E - native species now extirpated in the county.
- I - nonnative species introduced in the county.

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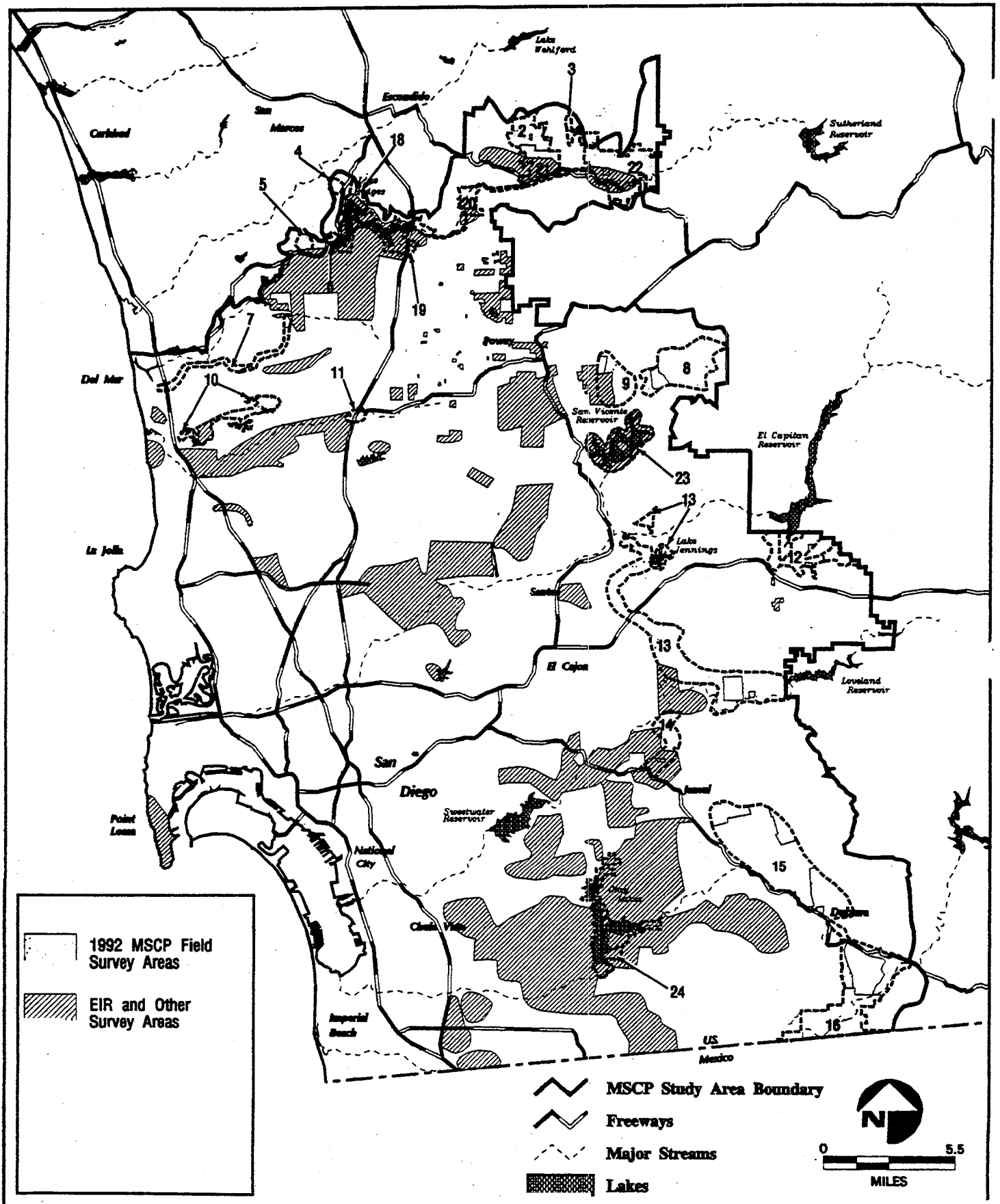
APPENDIX A-6

DESCRIPTIONS OF 1992 FIELD SURVEY AREAS

Upon completion of the regional vegetation mapping and plotting of sensitive species based on existing information, it was apparent that there were large areas of the MSCP study area for which there was little information on habitat quality, species diversity, wildlife movement, or the potential for MSCP target species. Therefore, Ogden designed a field sampling program with the objective of establishing a more complete data base on sensitive species, biodiversity, wildlife movement, and habitat quality across unstudied portions of the study area. These additional data provide a basis from which to make more informed decisions in prioritizing critical biological resource areas.

Twenty-two areas, totaling approximately 33,500 acres across the study area, were surveyed during the period April through July 1992 (Figure A-6.1). This is in addition to the public lands surveyed for California gnatcatchers and cactus wrens in the winter of 1991/1992 (Otay Lakes, San Vicente Reservoir, Lake Hodges/San Pasqual Valley, and Marron Valley). The 22 survey areas were selected using the following criteria: 1) areas which appeared to be ecologically significant portions of a potential preserve design for the MSCP area, based on existing biological resources data; 2) areas for which more information was needed to determine ecological significance; 3) areas adjacent to or with the potential to function as corridors connecting areas of existing open space and/or public lands; and 4) areas for which there is a moderate to high potential for development based on criteria including land ownership, proposed land uses, and topographic characteristics.

Two teams of botanists and two teams of wildlife biologists conducted surveys almost daily. Separate field forms for plants and wildlife and accompanying maps were completed and filed daily by each team, according to standardized field survey guidelines (see Appendices A-4 and A-5). Results of the surveys were compiled weekly, and species locality data were digitized for inclusion on the vegetation and sensitive species maps. Vegetation community data were also verified and modifications were made, where necessary, to the vegetation maps. Numbers of sensitive target and non-target species detected in each survey area are summarized in Tables A-6.1, A-6.2, and A-6.3. Total numbers of California gnatcatchers and coastal cactus wrens are provided in Table A-6.4.



1992 Field Survey Areas

FIGURE

A-6-1

Table A-6.1

MSCP SENSITIVE PLANT SURVEY RESULTS BY SURVEY AREA

| Area # | Survey Area | Acreage | # of Sensitive Plants* | # MSCP Target Species |
|--------|-----------------------|---------|------------------------|-----------------------|
| 1 | Boden Canyon | 0 | -- | -- |
| 2 | N of Wild Animal Park | 1112 | 2 | 0 |
| 3 | Rockwood Canyon | 87 | 4 | 0 |
| 4 | Del Dios Hwy N | 177 | 2 | 1 |
| 5 | Del Dios Hwy SW | 319 | 5 | 2 |
| 6 | Del Dios Hwy SE | 114 | 2 | 2 |
| 7 | San Dieguito RV | 1029 | 7 | 4 |
| 8 | Wildcat Canyon | 2854 | 8 | 1 |
| 9 | Iron Mountain | 1629 | 8 | 5 |
| 10 | Del Mar Mesa | 962 | 17 | 10 |
| 11 | Poway | 263 | 4 | 0 |
| 12 | S. El Capitan Res. | 1886 | 7 | 1 |
| 13 | Crest/Dehesa | 6274 | 14 | 6 |
| 14 | Jamul | 1310 | 14 | 5 |
| 15 | Daley Ranch | 4347 | 6 | 1 |
| 16 | Marron Valley | 2851 | 16 | 7 |
| 17 | Otay Mesa | 0 | -- | -- |
| 18/19 | Lake Hodges | 2576 | 5 | 1 |
| 20 | Santa Ysabel Creek | 862 | 1 | 1 |
| 21 | Wild Animal Park | 1414 | † | † |
| 22 | San Pasqual Valley | 3408 | 2 | 0 |

-- No access.

* Including target species.

† No rare plant surveys conducted in this survey area.

Table A-6.2

MSCP SENSITIVE WILDLIFE SURVEY RESULTS BY SURVEY AREA

| Area # | Survey Area | Amphibians and Reptiles | | Birds | | Mammals | |
|--------|-----------------------|-------------------------|----------------|------------------|----------------|-------------------|----------------|
| | | Total Sens. Spp. | # Target Spps. | Total Sens. Spp. | # Target Spps. | Total Sens. Spps. | # Target Spps. |
| 1 | Boden Canyon | -- | -- | -- | -- | -- | -- |
| 2 | N of Wild Animal Park | 4 | 2 | 5 | 3 | 2 | 2 |
| 3 | Rockwood Canyon | -- | -- | -- | -- | -- | -- |
| 4 | Del Dios Hwy N | 3 | 2 | 4 | 3 | 0 | 0 |
| 5 | Del Dios Hwy SW | 0 | 0 | 1 | 0 | 1 | 0 |
| 6 | Del Dios Hwy SE | 0 | 0 | 3 | 1 | 1 | 1 |
| 7 | San Dieguito RV | 0 | 0 | 7 | 4 | 0 | 0 |
| 8 | Wildcat Canyon | 7 | 2 | 14 | 7 | 1 | 1 |
| 9 | Iron Mountain | 7 | 2 | 12 | 6 | 2 | 2 |
| 10 | Del Mar Mesa | 2 | 2 | 10 | 4 | 2 | 1 |
| 11 | Poway | 0 | 0 | 1 | 1 | 1 | 1 |
| 12 | S. El Capitan Res. | 4 | 2 | 6 | 3 | 2 | 2 |
| 13 | Crest/Dehesa | 6 | 2 | 12 | 5 | 4 | 2 |
| 14 | Jamul | 4 | 2 | 7 | 3 | 4 | 2 |
| 15 | Daley Ranch | 8 | 2 | 12 | 4 | 2 | 1 |
| 16 | Marron Valley | 7 | 2 | 18 | 8 | 2 | 1 |
| 17 | Otay Mesa | -- | -- | -- | -- | -- | -- |
| 18/19 | Lake Hodges | 2 | 2 | 15 | 7 | 1 | 1 |
| 20 | Santa Ysabel Creek | 3 | 1 | 11 | 5 | 3 | 1 |
| 21 | Wild Animal Park | 2 | 2 | 13 | 7 | 3 | 2 |
| 22 | San Pasqual Valley | 5 | 2 | 8 | 2 | 1 | 1 |

-- No access.

One sensitive species of butterfly, Harbison's dunn skipper, has potentially been detected in areas 2, 12, 13, 14, and 15. No positive identification has been made.

Sensitive wildlife information is not available for areas 23 and 24 (San Vicente Reservoir and Otay Lakes) as field effort was focused on California gnatcatcher and cactus wren surveys and no amphibian, reptile, or mammal surveys were conducted.

Table A-6.3

WILDLIFE SPECIES DIVERSITY BY SURVEY AREA

| Area # | Survey Area | # Amphib. Species | # Reptile Species | # Bird Species | # Mammal Species | Total # of Species |
|--------|-----------------------|-------------------|-------------------|----------------|------------------|--------------------|
| 1 | Boden Canyon | -- | -- | -- | -- | -- |
| 2 | N of Wild Animal Park | 2 | 9 | 43 | 14 | 68 |
| 3 | Rockwood Canyon | -- | -- | -- | -- | -- |
| 4 | Del Dios Hwy N | 1 | 5 | 42 | 4 | 52 |
| 5 | Del Dios Hwy SW | 0 | 2 | 28 | 4 | 34 |
| 6 | Del Dios Hwy SE | 0 | 2 | 27 | 6 | 35 |
| 7 | San Dieguito RV | 3 | 2 | 44 | 5 | 54 |
| 8 | Wildcat Canyon | 5 | 13 | 77 | 11 | 106 |
| 9 | Iron Mountain | 2 | 10 | 52 | 12 | 76 |
| 10 | Del Mar Mesa | 1 | 7 | 54 | 10 | 72 |
| 11 | Poway | 0 | 0 | 12+ | 5 | 17 |
| 12 | S. El Capitan Res. | 1 | 10 | 58 | 13 | 82 |
| 13 | Crest/Dehesa | 4 | 12 | 78 | 18 | 112 |
| 14 | Jamul | 2 | 10 | 68 | 14 | 94 |
| 15 | Daley Ranch | 4 | 12 | 58 | 12 | 86 |
| 16 | Marron Valley | 6 | 14 | 107 | 15 | 142 |
| 17 | Otay Mesa | -- | -- | -- | -- | -- |
| 18/19 | Lake Hodges | 2 | 3 | 89 | 10 | 104 |
| 20 | Santa Ysabel Creek | 2 | 6 | 81 | 13 | 102 |
| 21 | Wild Animal Park | 0 | 5 | 63 | 9 | 77 |
| 22 | San Pasqual Valley | 2 | 9 | 60 | 14 | 85 |

-- No access.

In addition to the species listed above, fish species were detected in Areas 9, 13, 15, and 18-22.

Wildlife species diversity information is not available for areas 23 and 24 (San Vicente Reservoir and Otay Lakes) as field effort was focused on California gnatcatcher and cactus wren surveys and no amphibian, reptile, or mammal surveys were conducted.

Table A-6.4
CALIFORNIA GNATCATCHERS AND CACTUS WRENS

| Survey Area | California Gnatcatchers | | Cactus Wrens ¹ | |
|--------------------------|-------------------------|------------------------------|---------------------------|-----------------|
| | Pairs | Individuals (single juv.) | Pairs | Individuals |
| 2 N of Wild Animal Park | 3 | 2 | | |
| 4 Del Dios Hwy N | | 1 | | |
| 12 S. El Capitan Res. | | 1 | | |
| 13 Crest/Dehesa | 51 | 23 | 20+ | 30 |
| 14 Jamul | 2 | 3 | | |
| 15 Daley Ranch | 1 | 2 | | |
| 16 Marron Valley | 1 | 1 | | |
| 18/19 Lake Hodges | 30 | 5 | | 19 ³ |
| 20 Santa Ysabel Creek | 8 | 14 | | |
| 21 Wild Animal Park | 23 | | | 28 ³ |
| 23 San Vicente Reservoir | 2 | | | |
| 24 Otay Lakes | 32 ² | | | |

- ¹ Some of these cactus wrens probably have been mapped previously by Ken Weaver.
² Focused California gnatcatcher surveys were conducted in only a portion of the coastal sage scrub habitat adjacent to upper and lower Otay Lakes.
³ Estimates for the number of cactus wren pairs were not made for winter survey data.

In addition to these summary tables, Tables A-6.5, A-6.6, and A-6.7 include complete lists of sensitive species present in each of the survey areas.

Following is a summary assessment of each area visited. Although we received a number of calls limiting access to specific parcels, for the most part we were able to conduct surveys in most or all of our designated survey areas, with the exception of areas 1, 3, 15, and 17.

Wildlife Corridors

In addition to the 22 survey areas, Ogden studied potential corridors in portions of the MSCP study area. The corridors were surveyed for tracks and sign along the majority of the routes, with special focus on "choke" points. A total of approximately 40 choke points were identified and 15-20 were examined in detail. In addition, road kill data from the City of San Diego and Caltrans were obtained and examined to evaluate where animals are crossing roads.

Area 1 - Boden Canyon

Access to the Boden Canyon survey area was denied; however, the city-owned land at the mouth of the canyon was surveyed as part of Area 22. Boden Canyon borders the Cleveland National Forest and connects the San Pasqual Valley to the vacant land on Rancho Guejito. Steep chaparral-covered slopes rise from a sandy, oak riparian woodland-lined creek.

Area 2 - North of Wild Animal Park

Area 2 is a wide, hilly plateau bordered to the north by undeveloped, chaparral-covered hills, to the east by a series of ridges with widely spaced houses, to the south by the San Diego Wild Animal Park, and to the west by the Eagle Crest golf course and housing development along Cloverdale Creek. The vegetation in Area 2 consists of a vast expanse of coastal sage scrub with smaller amounts of chaparral and oak woodlands. No MSCP target sensitive plant species were detected, and only two non-target sensitive plant species were observed.

Table A-6.5

SENSITIVE PLANT SPECIES DETECTED DURING MSCP FIELD SURVEYS

| MSCP Target Species | Survey Area | | | | | | | |
|---|-------------|---|-----|-------|---|----|------|-------|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| <i>Acanthomintha ilicifolia</i> | | | | | | | 975 | |
| <i>Arctostaphylos glandulosa</i> var. <i>crass.</i> | | | | | | 79 | | |
| <i>Astragalus deanei</i> | | | | | | 7 | | |
| <i>Baccharis vanessae</i> | | | | | | | | X |
| <i>Brodiaea orcuttii</i> | | | | | | | | X |
| <i>Caulanthus stenocarpus</i> | | | | 2,505 | | | | |
| <i>Ceanothus cyaneus</i> | | | X | X | X | X | | |
| <i>Ceanothus verrucosus</i> | | | | | | | 452 | |
| <i>Corethrogyne filaginifolia</i> var. <i>lin.</i> | | | | | | | | |
| <i>Cupressus forbesii</i> | | | | | | | | |
| <i>Dudleya brevifolia</i> | | | | | | | | |
| <i>Dudleya variegata</i> | | | | | | | | |
| <i>Ericameria palmeri</i> var. <i>palmeri</i> | | | | | | | | |
| <i>Eryngium aristulatum</i> var. <i>parishii</i> | | | | | | | | |
| <i>Erysimum ammophilum</i> | | | | | | | | |
| <i>Ferocactus viridescens</i> | | | | | | | | |
| <i>Lepechinia cardiophylla</i> | | | | | | | | |
| <i>Monardella linoides</i> ssp. <i>viminea</i> | | | | | | | | 2000+ |
| <i>Muilla clevelandii</i> | | | | | | | | |
| <i>Nolina interrata</i> | | | | | | | | |
| <i>Pinus torreyana</i> | | | | | | 92 | | |
| <i>Solanum tenuilobatum</i> | | | | | | | | 60 |
| <i>Tetracoccus dioicus</i> | | | | | | | | |
| Non-Target Species | | | | | | | | |
| <i>Adolphia californica</i> | | | | 33 | | | | |
| <i>Artemisia palmeri</i> | | | 125 | | | | 25 | |
| <i>Calamagrostis densa</i> | | | | | | | | |
| <i>Chorizanthe procumbens</i> | X | X | | | | | X | |
| <i>Clarkia delicata</i> | | | | | | | 476 | |
| <i>Comarostaphylos diversifolia</i> | | | | | | X | | |
| <i>Coreopsis maritima</i> | | | | | | X | | |
| <i>Dichondra occidentalis</i> | | | | | | X | | |
| <i>Haplopappus junceus</i> | | X | | | | | 91+ | |
| <i>Harpagonella palmeri</i> | | | | | | | 550+ | |
| <i>Horkelia truncata</i> | | | | | | | | |
| <i>Iva hayesiana</i> | | | | | | | | |
| <i>Juncus acutus</i> var. <i>sphaerocarpus</i> | | | | | | | | X |
| <i>Lathyrus splendens</i> | | | | | | | | |
| <i>Monardella hypoleuca</i> ssp. <i>lanata</i> | | | | | | | | 300 |
| <i>Physalis greenei</i> | | | | | | | | |
| <i>Quercus engelmannii</i> | X | X | | X | | | 18 | X |
| <i>Romneya coulteri</i> | | | | | | | | |
| <i>Selaginella cinerascens</i> | | | | X | | | X | X |
| <i>Stipa diegoensis</i> | | X | | | | | | |
| <i>Viguiera laciniata</i> | | | | | | | | |

Table A-6.5 (Continued)

SENSITIVE PLANT SPECIES DETECTED DURING MSCP FIELD SURVEYS

| MSCP Target Species | Survey Area | | | | | | |
|---|-------------|----|------|------|------|-----|--------|
| | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| <i>Acanthomintha ilicifolia</i> | | | 3300 | 120 | 5000 | | |
| <i>Arctostaphylos glandulosa</i> var. <i>crass.</i> | 5 | | | | | | |
| <i>Astragalus deanei</i> | | | | | | | |
| <i>Baccharis vanessae</i> | | | | | | | |
| <i>Brodiaea orcuttii</i> | X | | | | | 50 | |
| <i>Caulanthus stenocarpus</i> | | | | | | | 6 |
| <i>Ceanothus cyaneus</i> | | | | | | | |
| <i>Ceanothus verrucosus</i> | 81 | | | | | | |
| <i>Corethrogyne filaginifolia</i> var. <i>lin.</i> | 1774 | | | | | | |
| <i>Cupressus forbesii</i> | | | | | | | 4 |
| <i>Dudleya brevifolia</i> | X | | | | | | |
| <i>Dudleya variegata</i> | | | | 202 | | | 15171 |
| <i>Ericameria palmeri</i> var. <i>palmeri</i> | | | | | 21 | | |
| <i>Eryngium aristulatum</i> var. <i>parishii</i> | 1000 | | | | | | |
| <i>Erysimum ammophilum</i> | 6 | | | | | | |
| <i>Ferocactus viridescens</i> | 162 | | | | | | 1534 |
| <i>Lepechinia cardiophylla</i> | | | | | | | |
| <i>Monardella linoides</i> ssp. <i>viminea</i> | | | | | | | 60 |
| <i>Muilla clevelandii</i> | 300 | | | 5 | | | 100025 |
| <i>Nolina interrata</i> | | | | 2158 | 375 | | |
| <i>Pinus torreyana</i> | 20 | | | | | | |
| <i>Solanum tenuilobatum</i> | | | | 11 | 75 | | 71 |
| <i>Tetracoccus dioicus</i> | | | | 74 | 100 | | |
| Non-Target Species | | | | | | | |
| <i>Adolphia californica</i> | 320 | | | | | | |
| <i>Artemisia palmeri</i> | | X | | X | X | | |
| <i>Calamagrostis densa</i> | | | | | | | |
| <i>Chorizanthe procumbens</i> | X | | X | X | | | |
| <i>Clarkia delicata</i> | | | 50 | | 505 | | 30 |
| <i>Comarostaphylos diversifolia</i> | X | | | | | | |
| <i>Coreopsis maritima</i> | X | | | | | | |
| <i>Dichondra occidentalis</i> | | | | | | | |
| <i>Haplopappus junceus</i> | | | 86 | 6 | 6 | | |
| <i>Harpagonella palmeri</i> | 30 | | X | X | 1400 | | |
| <i>Horkelia truncata</i> | | | | | | | |
| <i>Iva hayesiana</i> | | X | X | | | | X |
| <i>Juncus acutus</i> var. <i>sphaerocarpus</i> | | X | | | X | X | X |
| <i>Lathyrus splendens</i> | | | | | X | | X |
| <i>Monardella hypoleuca</i> ssp. <i>lanata</i> | | | | | | | |
| <i>Physalis greenei</i> | X | | | 25 | | | |
| <i>Quercus engelmannii</i> | | | X | | | X | 15 |
| <i>Romneya coulteri</i> | | | | | | 800 | 186 |
| <i>Selaginella cinerascens</i> | X | X | | X | X | X | X |
| <i>Stipa diegoensis</i> | | | | X | X | | X |
| <i>Viguiera laciniata</i> | | | | X | X | X | X |

Table A-6.5 (Continued)

SENSITIVE PLANT SPECIES DETECTED DURING MSCP FIELD SURVEYS

| MSCP Target Species | Survey Area | | | |
|---|-------------|-----|----|----|
| | 18/19 | 20 | 21 | 22 |
| <i>Acanthomintha ilicifolia</i> | | | | |
| <i>Arctostaphylos glandulosa</i> var. <i>crass.</i> | | | | |
| <i>Astragalus deanei</i> | | | | |
| <i>Baccharis vanessae</i> | | | | |
| <i>Brodiaea orcuttii</i> | | | | |
| <i>Caulanthus stenocarpus</i> | | | | |
| <i>Ceanothus cyaneus</i> | | | | |
| <i>Ceanothus verrucosus</i> | X | | | |
| <i>Corethrogyne filaginifolia</i> var. <i>lin.</i> | | | | |
| <i>Cupressus forbesii</i> | | | | |
| <i>Dudleya brevifolia</i> | | | | |
| <i>Dudleya variegata</i> | | | | |
| <i>Ericameria palmeri</i> var. <i>palmeri</i> | | | | |
| <i>Eryngium aristulatum</i> var. <i>parishii</i> | | | | |
| <i>Erysimum ammophilum</i> | | | | |
| <i>Ferocactus viridescens</i> | | 247 | | |
| <i>Lepechinia cardiophylla</i> | | | | |
| <i>Monardella linoides</i> ssp. <i>viminea</i> | | | | |
| <i>Muilla clevelandii</i> | | | | |
| <i>Nolina interrata</i> | | | | |
| <i>Pinus torreyana</i> | | | | |
| <i>Solanum tenuilobatum</i> | | | | |
| <i>Tetracoccus dioicus</i> | | | | |
| Non-Target Species | | | | |
| <i>Adolphia californica</i> | 30 | | | |
| <i>Artemisia palmeri</i> | 10+ | | | X |
| <i>Calamagrostis densa</i> | | | | |
| <i>Chorizanthe procumbens</i> | | | | |
| <i>Clarkia delicata</i> | | | | |
| <i>Comarostaphylos diversifolia</i> | | | | |
| <i>Coreopsis maritima</i> | | | | |
| <i>Dichondra occidentalis</i> | | | | |
| <i>Haplopappus junceus</i> | | | | |
| <i>Harregonella palmeri</i> | | | | |
| <i>Horkelia truncata</i> | | | | |
| <i>Iva hayesiana</i> | | | | |
| <i>Juncus acutus</i> var. <i>sphaerocarpus</i> | | | | |
| <i>Lathyrus splendens</i> | | | | |
| <i>Monardella hypoleuca</i> ssp. <i>lanata</i> | | | | |
| <i>Physalis greenei</i> | | | | |
| <i>Quercus engelmannii</i> | X | | | X |
| <i>Romneya coulteri</i> | | | | |
| <i>Selaginella cinerascens</i> | X | | | |
| <i>Stipa diegoensis</i> | | | | |
| <i>Viguiera laciniata</i> | | | | |

Table A-6.6

SENSITIVE BIRD SPECIES DETECTED IN MSCP SURVEY AREAS

| Survey area | 2 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18/19 | 20 | 21* | 22 |
|--------------------------------|---|---|---|---|---|---|---|----|----|----|----|----|----|----|-------|----|-----|----|
| Target bird species | | | | | | | | | | | | | | | | | | |
| White-faced ibis | | | | | | | | | | | | | | | | X | | |
| Canada goose | | | | | | | | | | | | | | | | | X | |
| Bald eagle | | | | | X | | | | | | | | | | | | | |
| Northern harrier | | | | | X | | | | | | | | | | | | | |
| Cooper's hawk | X | | | | | X | | | | X | | X | | | | | | |
| Ferruginous hawk | | | | | | | | | | | | | | | | | | |
| Golden eagle | | X | | | | | | | | | X | | | | | | | |
| Coastal cactus wren | | | | | | | | | | | X | | | | | | | |
| California gnatcatcher | X | X | | | | | | X | | X | | X | | | | | | |
| Western bluebird | | | | | | | | X | | | | | | | | | | |
| Least Bell's vireo | | | | | | | | X | | | | | | | | | | X |
| So. Ca. rufous-crowned sparrow | X | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Grasshopper sparrow | | | | | X | X | | | | | | | | | | | | |
| Tri-colored blackbird | | | | | X | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|--------------------------|---|---|---|---|---|----|----|----|---|---|----|---|----|----|----|----|----|---|---|
| Other sensitive birds | | | | | | | | | | | | | | | | | | | |
| American white pelican | | | | | | | | | | | | | | | | | | | |
| Double-crested cormorant | | | | | | | | | | | | | | | | X | X | | |
| Turkey vulture | X | X | | X | X | X | X | X | | X | | | | | | | | | X |
| Osprey | | | | | X | | | | | | | | | | | | | | |
| Black-shouldered kite | | | | | | | | | | | | | | | | | | | |
| Sharp-shinned hawk | | | | | | | | | | | | | | | | | | | |
| Red-shouldered hawk | X | | | | | | | | | | | | | | | | | | X |
| Prairie falcon | | | | | | | | | | | | | | | | | | | |
| Long-eared owl | | | | | | | | | | | | | | | | | | | |
| Downy woodpecker | | | | | | | | | | | | | | | | | | | |
| California horned lark | | | | X | | | | | | | | | | | | | | | |
| Blue-gray gnatcatcher | | | | | | | | | | | | | | | | | | | X |
| Loggerhead shrike | | | | | | | | | | | | | | | | | | | |
| Yellow warbler | | | | | | | | | | | | | | | | | | | X |
| Yellow-breasted chat | | | | | | | | | | | | | | | | | | | X |
| Blue grosbeak | | | | | | | | | | | | | | | | | | | |
| Bell's sage sparrow | | | | | | | | | | | | | | | | | | | X |
| Total sensitive birds | 5 | 4 | 1 | 3 | 7 | 14 | 12 | 10 | 1 | 6 | 12 | 7 | 12 | 18 | 15 | 11 | 15 | 8 | 8 |
| Total target birds | 3 | 3 | 0 | 1 | 4 | 7 | 6 | 4 | 1 | 3 | 5 | 3 | 4 | 8 | 7 | 5 | 8 | 2 | 2 |

* Area 21 was surveyed during the winter, all other areas were surveyed in the spring.

Table A-6.7

SENSITIVE AMPHIBIANS, REPTILES, AND MAMMALS DETECTED DURING MSCFP FIELD SURVEYS

| Survey area | 2 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18/19 | 20 | 21 | 22 |
|-----------------------------------|---|---|---|---|---|---|---|----|----|----|----|----|----|----|-------|----|----|----|
| Amphibians & Reptiles | | | | | | | | | | | | | | | | | | |
| W. spadefoot toad | | | | | | X | X | | | | | | X | X | | | | |
| San Diego horned lizard * | X | X | | | | X | X | X | | X | X | X | X | X | | | X | X |
| Granite night lizard | | | | | | X | | | | | X | X | | | | | | |
| Coronado skink | | | | | | | | | | | | | X | | | | | |
| Orange-throated whiptail * | X | X | | | | X | X | X | | X | X | X | X | X | X | X | X | X |
| Coastal western whiptail | X | | | | | X | X | | | X | X | | X | X | | X | | X |
| Coastal rosy boa | X | | | | | | X | | | X | X | | X | X | | | | X |
| San Diego ring-necked snake | | | | | | | X | | | X | | | | | | | | |
| Coast vach-nosed snake | | | | | | X | X | | | | | | X | X | | X | | X |
| Two-striped garter snake | | X | | | | | | | | | | X | X | X | | | | X |
| No. red diamond rattlesnake | 4 | 3 | 0 | 0 | 0 | 7 | 7 | 2 | 0 | 4 | 6 | 4 | 8 | 7 | 2 | 3 | 2 | 5 |
| Total sensitive herpetiles | 2 | 2 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 |
| Total target herpetiles | | | | | | | | | | | | | | | | | | |

| Mammals | 2 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18/19 | 20 | 21 | 22 |
|--------------------------------|---|---|---|---|---|---|---|----|----|----|----|----|----|----|-------|----|----|----|
| SD black-tailed jackrabbit | | | X | | | | | X | | | X | X | X | X | | X | X | |
| San Diego desert woodrat | | | | | | | | | | | X | X | | | | X | X | |
| Mountain lion * | X | | | | | | X | X | | X | X | X | X | X | X | X | X | X |
| Mule deer * | X | | | X | | | X | X | X | X | X | X | X | X | X | X | X | X |
| Total sensitive mammals | 2 | 0 | 1 | 1 | 0 | 1 | 2 | 2 | 1 | 2 | 4 | 4 | 2 | 2 | 1 | 3 | 3 | 1 |
| Total target mammals | 2 | 0 | 0 | 1 | 0 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 |

* Target species

Most of the plateau drains into a valley in the west-central portion of the survey area. A wide swath of coast live oak woodland borders the creek that flows through the valley. Some Engelmann (*Quercus engelmannii*) oaks also occur in the valley. The creek had a small flow of water in late June. The valley floor outside the woodland is mostly hayfields and pasture land with a few scattered sheds and stables. Cooper's and red-shouldered hawks, two species of owl, mule deer, mountain lion, and bobcat were among the species identified in the valley.

Hills along the northern border of the survey area rise nearly 1000 feet to a mesa above the site. The steep slopes are covered with dense stands of chamise chaparral and southern mixed chaparral between rock outcrops and granite boulders. Similar steep chaparral-covered slopes are located along the northeast border of the survey area.

A deep canyon lies at the southeast end of the survey area. The main upland habitat found in the canyon is a patchwork of coastal sage scrub and non-native grassland. The creek through the canyon is lined with riparian scrub at the top of the canyon, transitioning into a closed canopy oak woodland at the lower end. Old nests, pellets, and whitewash indicate that the oak woodland is utilized by raptors as a roosting and breeding area. Several abandoned buildings at the lower end of the canyon are collapsed and are probably of little significance to wildlife.

Most of the remainder of the area is covered by California sagebrush-dominated coastal sage scrub. This scrub supports a diversity of wildlife including orange-throated whiptails, San Diego horned lizards, and California gnatcatchers. The lizards were found at scattered locations throughout the area. At least two pairs of California gnatcatchers and one individual were found at the west end of the survey area, one pair was found at the east end, north of the canyon, and one individual was found at the northwest corner of the survey area. Adjacent habitat west of this survey area also supports gnatcatchers.

Most of the sensitive wildlife species expected in the habitats in this area were observed. It is possible that the plateau is used for foraging by bats which could live in the crevices and rock caves to the north of the area. Cactus patches at the east end of the survey area, though somewhat small, could potentially serve as habitat for dispersing cactus wrens.

Wildlife movement in the area is restricted to the south by the 10-foot fencing of the Wild Animal Park. The golf course and development underway to the west will effectively

constrain wildlife movement along the Cloverdale Creek drainage. The network of dirt roads and habitat along the western ridge of the survey area may become an important corridor link between the San Pasqual Valley and open land to the north as the lower section of the creek becomes constrained.

Area 3 - Rockwood Canyon

One day of botanical survey was completed before access was denied to the Rockwood Canyon area. Wildlife surveys were not conducted. Excellent quality oak riparian forest occurs along Guejito Creek, with pools, large rock outcrops and freshwater marsh. Four non-target sensitive plant species were detected during the visit, including Engelmann oak, San Diego County stipa (*Stipa diegoensis*) rush-like bristleweed (*Haplopappus junceus*), and spineflower (*Chorizanthe procumbens*). Based on the habitats and data from the surrounding area, a number of sensitive wildlife species would be expected in the canyon. The oak forest has the potential to support Cooper's hawks and red shouldered hawks, and the surrounding sage scrub at the south end of the canyon is potential habitat for California gnatcatchers, orange-throated whiptails, and San Diego horned lizards.

Areas 4, 5, and 6 - Del Dios Highway N, SW, and SE

These areas comprise a sample of the habitat along the northern border of the MSCP study area, north of Lake Hodges. The habitats in this area consist of chaparral and coastal sage scrub on steep slopes rising from the San Dieguito River valley. Beyond the slopes to the northwest of the MSCP study boundary are the vacant natural lands of Harmony Grove, San Marcos, and Carlsbad. Along the ridgetops and in the drainages the soil has washed away, exposing large sheets of rock. An extensive area above Del Dios, including survey areas 5 and 6, has recently burned (mostly in 1989). The post-fire vegetation, including both coastal sage scrub and chaparral, is a sparse, low shrubland, almost obscured by a cover of wild oat (*Avena barbata*), narrow-leaf bindweed (*Calystegia macrostegia*), and black mustard (*Brassica nigra*). Historic golden eagle nesting sites are located in these areas.

Area 4 is the least disturbed of the three areas. The slopes are covered with dense southern mixed chaparral and support smaller patches of coastal sage scrub. The coastal sage scrub onsite is dense and mostly dominated by black sage (*Salvia munzii*) and California sagebrush (*Artemisia californica*). One California gnatcatcher was observed in this area.

The deep drainage north of the site contains California sagebrush-dominated coastal sage scrub and leads to the vacant lands around Harmony Grove. Overall, a relatively low diversity of wildlife species inhabits the survey area. A shallow stock pond located in the center of the site provides a water source. A dirt road from Del Dios Highway to the top of the slope showed use by coyotes and would be a potential route for other large mammals through the tall chaparral cover. Orange-throated whiptails and San Diego horned lizards were found along the road.

One MSCP target plant species, wart-stemmed ceanothus (*Ceanothus verrucosus*), and one additional non-target sensitive plant, San Diego sagewort (*Artemisia palmeri*) were found in Area 4. Wart-stemmed ceanothus is a dominant species making up 25 to 40 percent cover throughout the site. Patches of San Diego sagewort are present on the canyon slopes draining toward Lake Hodges.

Area 5 is located on the slopes above the San Dieguito River, north of Santa Fe Valley. The scrub vegetation in this area has recently been burned and consists of equal amounts of chaparral and coastal sage scrub; the latter community occurs at the lower elevations and on south-facing slopes. The wildlife diversity in the area is low. Two sensitive animal species, San Diego black-tailed jackrabbit and coastal horned lark, were detected in the grasslands at the top of the ridge.

The abandoned flumes and siphons of the San Dieguito aqueduct that run mid-slope above the Del Dios Highway have some value to wildlife. The flumes consist of cement-capped steel troughs approximately 6 feet wide and 4 feet deep. The sections of flume on trestles over the deeper drainages along the slope are open. Additionally, holes have been punched in the roof of the flumes every 50 feet or so. Numerous bird species were observed drinking from the trickle of water that still flows down the aqueduct. The flumes are known to be roosting sites for bats (Westec 1977), and scat and tracks on the roof of the flumes indicate that they are used by a number of large mammals, including bobcats, mule deer, and coyotes, as a route to traverse the steep slopes above the river. Two MSCP target plant species, slender pod caulanthus (*Caulanthus stenocarpus*) and wart-stemmed ceanothus, as well as three other sensitive plant species were found in Area 5.

Area 6 is a burned area above the Lake Hodges dam, with post-burn chaparral and coastal sage scrub vegetation similar to that in Area 5. The topography ranges from a gentle slope at the base of the hill to an extremely steep rocky slope below the ridgeline. Few animal

species were observed. Three sensitive bird species, a pair of rufous-crowned sparrows, a very young black shouldered kite, and a turkey vulture, were detected in the area. Mule deer tracks, scat, and faint paths were observed on even the steepest sections of the slope, indicating that the deer were traversing the higher areas of the slope. Encinitas baccharis (*Baccharis vanessae*), an MSCP target plant and state-listed species, was found in this area. Wart-stemmed ceanothus was common in the southeastern portion of Area 6.

Area 7 - San Dieguito River Valley

Area 7 was investigated as a potential corridor link between the San Dieguito River mouth and the upper sections of the river in the Santa Fe Valley. The area surveyed stretches from San Dieguito peak above Del Mar Lagoon, along the south bank of the San Dieguito River, up La Zanja Canyon, and north to Lusardi Creek along the eastern edge of Fairbanks Ranch. The area is rapidly being developed, and potential for use as a wildlife corridor is somewhat limited. Islands of remaining native habitat in the San Dieguito River floodplain, Gonzales Canyon, and La Zanja Canyon form the potential link between the coast and the Black Mountain area to the east. Because of access problems, only limited time was spent surveying the area.

West End

The west end of Area 7, both east and west of Interstate 5, consists of north-facing coastal bluffs overlooking the San Dieguito Lagoon. The predominant vegetation type is southern maritime chaparral. Smaller amounts of coastal sage scrub, grassland, disturbed habitat and Torrey pine forest are present.

Habitat around the San Dieguito Lagoon consists of coastal salt marsh with disturbed salt marsh, coastal sage scrub and the ruins of a ranch and sewage treatment facility at the upper elevations of the marsh. California gnatcatchers are known from the upland areas surrounding the marsh, and the wetlands are rich in bird diversity, especially in the winter season. The I-5 bridge allows passage underneath to the area east of the freeway, which is an area of heavily disturbed salt marsh, grassland habitat, and agricultural fields. The river valley east of these fields is blocked by golf courses, farms, and development east to Lusardi Creek.

Four MSCP target species were found in the southern maritime chaparral community; these include Del Mar manzanita (*Arctostaphylos glandulosa* var. *crassifolia*), Torrey pine (*Pinus torreyana*), Del Mar sand-aster (*Corethrogyne filaginifolia* var. *linifolia*), and wart-stemmed ceanothus. Additional sensitive plant species detected on this bluff include summer-holly (*Comarostaphylos diversifolia* ssp. *diversifolia*), San Diego sea-dahlia (*Coreopsis maritima*), and western dichondra (*Dichondra occidentalis*).

La Zanja Canyon

La Zanja Canyon is blocked at its confluence with the San Dieguito River by a golf course and high density housing which extends about 1 mile up the canyon floor. Islands of good quality riparian woodland near the east end of the golf course are intact and may harbor a number of riparian bird species. The vegetation, mostly southern maritime chaparral, is intact along the steep south wall of the canyon. The south wall is linked to the upper end of Gonzales Canyon across a strip of agricultural land. Rancho Santa Fe Farms Road crosses the canyon at its midpoint, above the Gonzales Canyon link. This is probably the most constrained point of the canyon, as houses block both banks and a community park and tennis courts occupy the canyon floor. A willow woodland remains in the park. In the culvert under the road, which would likely be used by any large mammals moving along the canyon, there were raccoon, opossum, coyote, and domestic dogs tracks. East of the park is an area of floodplain vegetation and chamise chaparral with two ponds. In more recent surveys of the area, a juvenile California gnatcatcher was observed near the Santa Fe Farms golf course in a remaining patch of chamise chaparral adjacent to the canyon, suggesting that there is dispersal through the region (Ogden unpubl. data). A cleared horse ranch area covers the canyon floor above the upper pond, but chaparral habitat is intact on the south canyon wall. Three MSCP target plant species were found along the remaining strip of chaparral and grassland habitat including wart-stemmed ceanothus, Del Mar sand-aster, and San Diego barrel cactus (*Ferocactus viridescens*).

The upper end of the canyon consists of finger-like sage scrub filled ravines penetrating an extensive grassland grazing area. Black-shouldered kites and rufous-crowned sparrows were found in the scrub, and grasshopper sparrows inhabit the surrounding grassland. The drainages leading into the head of the canyon have been reduced to shallow swales with thin lines of tamarisk and mulefat scrub. Some of these drainages are continuous with a disturbed sage scrub-covered hill that connects to the natural vegetation of Black Mountain. California gnatcatchers are known from the area around the hill. McGonigle

Canyon, which connects to the Carmel Valley/Los Peñasquitos Canyon areas to the south, is separated from La Zanja Canyon by about 500 feet of grassland at two points.

Lusardi Creek, which flows from east of Black Mountain to the San Dieguito River, is separated from La Zanja Canyon by a wide agricultural area with no north-south topographic features to guide wildlife movement. Lusardi Creek and a strip of disturbed coastal sage scrub habitat along the east side of Black Mountain road, south of Artesian Road, are the only links between the remaining habitat in the Black Mountain area and the currently vacant lands to the north and east.

Area 8 - Wildcat Canyon Area

This is a rugged area in the foothills characterized by steep rocky slopes above wide, flat valleys of agricultural land and woodland drainages. The most abundant habitats include coastal sage scrub, chaparral, and oak riparian forest. The area is drained by two main creeks: San Vicente Creek, which flows through the northern part of the survey area, and Long's Gulch in the southern part of the survey area, which converges with San Vicente Creek at Kimball Valley. Daney Canyon and Daly Creek are also important features in the area. This area has a diverse assemblage of habitats as well as numerous microhabitat features. Species richness was quite high, with a total of 108 wildlife species (5 amphibians, 13 reptiles, 77 birds, 11 mammals, and 2 fish) identified from the area. Several sensitive plant species were mapped, including a large population of San Diego thorn-mint (*Acanthomintha ilicifolia*), which is an MSCP target plant and state-listed species.

Due to access restrictions, Ogden field surveys were conducted mostly on the Monte Vista Ranch which occupies most of the eastern three-quarters of the survey area and includes Daney Canyon, San Vicente Creek, Long's Gulch, and East Mesa del Padre Barona. The western quarter, which includes the Kimball Valley, was surveyed from the hills above but was not entered. Surveys of the Monte Vista Ranch area were very complete and included day and night surveys in moderate temperatures.

Kimball Valley

The floor of the valley is relatively flat and contains agricultural fields and pastures as well as scattered farms and houses. This section of San Vicente Creek has extensive high

quality riparian habitat which could support a variety of riparian species, possibly including least Bell's vireos. The walls of the canyon are steep and brush-covered, with coastal sage scrub on the lower slopes and chaparral on the upper slopes. These hillsides are very rocky with boulder piles and granite outcroppings, especially near the ridges. To the northwest is a flat mesa with dense chaparral and extensive sheets of exfoliating granite which supports a number of reptile species including granite night lizards. The disturbances in the valley are scattered enough at this time to allow the mostly unconstrained passage of wildlife.

Daney Canyon

This steep-sided canyon is formed by a tributary of San Vicente Creek. The floor of the valley is weedy pasture land, and the creek is cut deep into the soft soil. Within the channel is a sandy streambed with a patchwork of willows and freshwater marsh habitat. Extensive stands of coast live oaks line the banks at the southern end of the creek. This large, shady canopy was observed to provide roosts for three owl species and nesting habitat for several other raptor species. The east-facing slopes are covered with thick mixed chaparral, and the west-facing slopes have a very dense cover of California sagebrush-dominated coastal sage scrub. The sage scrub appeared to be marginally suitable habitat for California gnatcatchers; no gnatcatchers were detected. Two low open wells, fed by a pipe from a spring, probably provide a year-round water source. Several non-target sensitive plant species were detected in the canyon. San Diego sagewort, Engelmann oak (*Quercus engelmannii*), and Campo clarkia (*Clarkia delicata*) were found within the oak woodland along the west side of the canyon.

San Vicente Creek

The habitat along San Vicente Creek within Area 8 is intact except for some minor grazing damage. Upland habitats consist of chaparral, coastal sage scrub, and previously farmed disturbed habitat. The creekside habitat ranges from sections of sandy streambed and mulefat scrub to dense, well developed riparian woodland. At the time of the surveys in May, the creek had a good volume of flowing water. Dense stands of coast live oak occur along the creek and in patches on the valley floor. The remainder of the valley, including an abandoned landing strip and a wide flat floodplain, supports coastal sage scrub and disturbed habitat. California gnatcatchers were not detected in the sage scrub, although it appeared to be suitable habitat for the species. The scrub did support populations of

orange-throated whiptails and San Diego horned lizards as well as a number of other sensitive reptiles and amphibians. A high diversity of bird species, including yellow warbler, yellow breasted chat, and a least Bell's vireo, was identified along the creek. The slow-flowing sections and pools provide breeding habitat for a number of amphibian species including two toad species and three frog species as well as two-striped garter snakes and a variety of aquatic life. The ranch house, with a cleared yard and some dogs, is located by the creek at the northeast end of the site but is easily avoided by wildlife. In the narrows below Goat Ranch, the creek passes through an extensive talus cave formed by a huge collapsed rock sheet. The cave could potentially provide habitat for subterranean dwelling creatures such as bats, ringtails, and owls. It was not surveyed extensively due to the high water level. Two sensitive plant species were observed along San Vicente Creek and a tributary; both species, Engelmann oak and Campo clarkia, are scattered within the oak riparian forest.

Long's Gulch

The creekside habitat and wildlife diversity of Long's Gulch are similar to that at San Vicente Creek, though the oak riparian habitat is somewhat less extensive and there is less water flow. Daly Creek, which is a shallow oak-filled drainage, flows into Long's Gulch at the east end of the survey area. Near the middle of the gulch, several earthen dams form cattle ponds in the creek. Campo clarkia and rush-like bristleweed occur in the oak riparian forest and shrublands bordering Long's Gulch.

East Mesa del Padre Barona

This is a wide flat valley which has been converted to a variety of agricultural uses such as a vineyard, an avocado grove, hay fields, and pastures. Low slopes of coastal sage scrub and chaparral surround the valley to form a large bowl. The floor of the valley provides habitat for large populations of small mammal species, including California ground squirrel, Botta's pocket gopher, agile kangaroo rat, desert cottontail, and meadow vole, which make this a potentially important raptor foraging area. Several raptor species were observed in the area, including three adult golden eagles. On the ridge northeast of the mesa is the Daley mine which consists of three main shafts with a number of entrances. A deep horizontal shaft with groundwater flowing from it is located low on the slope, and two very deep vertical shafts linked by horizontal shafts are located at the peak of the hill. These mines were not surveyed extensively. The upper mine contained an active raven nest

and a barn owl roost, and both mines were somewhat inaccessible and undisturbed and probably support populations of bats. Bats were heard over the mesa soon after dark. A knob on the valley floor near the groves supports a large population of San Diego thorn-mint and two non-target sensitive plant species, rush-like bristleweed and Palmer's grappling-hook (*Harpagonella palmeri*). A large vernal seep was discovered at the eastern end of the study area along with several plant species indicative of vernal pools and seeps.

The survey area is bordered on all sides by large tracts of vacant natural lands. Mule deer movement was detected along San Vicente Creek and Long's Gulch, and mule deer and bobcat sign were found throughout most of the site. The area may be part of an important link between the San Vicente Lake/Iron Mountain areas and the Cleveland National Forest as well as being a large area of intact wildlife habitat.

Area 9 - Iron Mountain Area

Area 9 is located north of the San Vicente Reservoir, west of and including the Mussey Grade Road area. Elevations in this area range from about 1000 feet in the creekbed to about 1700 feet on the hills. Area 9 includes Boulder Oaks, Wildwood Ranch, and the Fernbrook/Shady Dell areas. The west portion of the area is a broad, hilly plateau bordered to the west and south by high, rocky ridges; the east side encompasses the West Branch of San Vicente Creek. The study area is part of the link between the Poway and Iron Mountain areas and the Cleveland National Forest. It borders the Kimball Valley and Area 8 to the east.

Fred Sproul, a local biologist who has surveyed large portions of this and the surrounding area, supplied Ogden with sensitive species sightings within and around the Iron Mountain and Boulder Oaks area. Ogden biologists surveyed only those areas not previously covered. The area has a rich assemblage of plant and animal species and serves as a north-south and east-west connection between surrounding vacant lands. Eight sensitive plant species, including five MSCP target species, were identified from the area. Seven sensitive amphibians and reptiles, eleven sensitive birds, and two sensitive mammals also inhabit the area.

Wildwood Ranch/ Rancho Cielo Area

Located at the north end of the Area 9, this region includes flat, grassy valleys divided by a narrow, chaparral-covered ridge. It is bordered to the west by steep chaparral-covered slopes and to the east by the West Branch of San Vicente Creek. Access was denied to Wildwood Ranch, so the area west of the central ridge was not surveyed. The primary habitats of this area include grassland and sparse phase oak woodland in the flat valleys, chaparral on the slopes, and oak riparian forest and dense phase oak woodland in the tributary drainages. Two large ponds are located near the ranchhouse at Wildwood Ranch, and two more occur in the drainage above Shady Dell. Rancho Cielo, a youth camp in the northeastern portion of Area 9, consists of a central staging area with weedy fields, scattered oaks, and clustered cabins and buildings, surrounded by cow pastures. The camp is used mainly on weekends. The valley floor in and around the camp is heavily grazed and trampled grassland with scattered patches of chaparral, sage scrub, and oak woodland. Sensitive wildlife found in the area included spadefoot toads in the lower pond above Shady Dell, San Diego horned lizard, and western whiptails in the chaparral, western bluebirds around the campground, and rosy boa reported by camp staff. Mule deer sign was found throughout the area, especially along the creek that flows along the east side of the central ridge. Mountain lion sightings are reported from the north tip of the site and from the south end of the camp where one was observed walking past the cabins and down the dirt road toward Boulder Oaks. Sensitive plant species observed in the Wildwood/Rancho Cielo area include narrow-leaved nightshade (*Solanum tenuilobatum*), felt-leaved monardella (*Monardella hypoleuca* ssp. *lanata*), Engelmann oak, and ashy spike-moss (*Selaginella cinerascens*).

West Branch of San Vicente Creek

This section of the survey area has a well developed riparian woodland bordered by stands of coast live oak. Chaparral-covered slopes rise above the shady woodland both to the east and west. Mussey Grade Road, a narrow, two-lane paved street with only light traffic, closely follows the creekbed all the way to San Vicente Lake. The last mile or so is gated and has no traffic. Some trailer parks, farms, and rural houses are scattered along the road, but not in the creek itself. The creek had a good flow rate in late June and probably flows most of the year. The east bank of the drainage at the south end of the survey area rises steeply to a chaparral-covered ridge that separates the creek from the East Branch in the Kimball Valley. A dirt road through the chaparral south of Fernbrook connects the valleys.

Species found along the creek included a diversity of summer riparian birds as well as several reptile and mammal species. Sensitive species detected include blue-gray gnatcatcher, Cooper's hawk, western bluebird, and western whiptail. The creek provides a connection between San Vicente Lake and the Ramona Valley. A large population of Cleveland's golden stars (*Muilla clevelandii*) was detected among large boulders just south of Fernbrook. Non-target sensitive plant species observed in this area include Engelmann oak, ashy spike-moss, and spiny rush (*Juncus acutus* var. *sphaerocarpus*).

Boulder Oaks Area

The southern half of Area 9 includes a large plateau bordered to the west and south by steep hills and to the east by the deep San Vicente Creek drainage. The plateau consists of Engelmann oak woodland with intervening grassland and vernal pools and smaller patches of coastal sage scrub. Several ponds and wetland areas are located along oak-lined creeks that traverse the plateau and its borders. Highland chaparral on substrate of metasedimentary origin lies to the west of the survey area on the flanks of Iron Mountain. This type of chaparral supports a diversity of sensitive and unusual plant species. Sensitive animal species reported from the area include: prairie falcon, ferruginous hawk, Cooper's hawk, red-shouldered hawk, turkey vulture, long-eared owl (F. Sproul pers. comm.), golden and bald eagles, osprey, California gnatcatcher, blue-gray gnatcatcher, western bluebird, rufous-crowned sparrow, San Diego horned lizard, orange-throated whiptail, western whiptail, coastal rosy boa, San Diego ring-necked snake, two-striped garter snake and western spadefoot toad. Mule deer and mountain lion sign have been observed repeatedly in the area (F. Sproul pers. comm.).

Target sensitive plant species reported on and adjacent to the Boulder Oaks plateau include Orcutt's brodiaea (*Brodiaea orcuttii*), a common component of the grassland and vernal pools, Cleveland's golden stars, and Lakeside ceanothus (*Ceanothus cyaneus*). Engelmann oak is a dominant of the plateau's woodland; ashy spike-moss dominates in the thin soils that have collected on flat surfaces of massive boulders.

Area 10 - Del Mar Mesa

Area 10 is located on the northern edge of a large, mostly undeveloped mesa which extends between Carmel Valley and Los Peñasquitos Canyon from Interstate 5 east to the Rancho Peñasquitos development. This area includes Carmel Mountain and Del Mar Mesa. The

top of the mesa is very flat and the slopes drop steeply into the valleys below. Undeveloped habitat and agricultural open space link Area 10 to Los Peñasquitos Canyon Reserve to the south. Seventeen sensitive plant species, ten of which are MSCP target species, are found in the area. Many of these are species restricted to the coastal strip in southern maritime chaparral and coastal sage scrub communities. The mesa is heavily used as habitat and as a corridor by mule deer, bobcats, and coyotes.

Carmel Valley

The bluffs above Carmel Valley at the western edge of Area 10 are steep and covered with sparse, open stands of southern maritime chaparral. Coastal sage scrub grows at the foot of the bluffs on the floodplain in areas where it has not been cleared. Deep, narrow ravines have been eroded out of the soft sandy soils. Some are 150 feet high, 2-4 feet wide, and extend 100 yards or more into the bluff. Cavities and overhangs have formed in the walls which may serve as denning or nesting sites. A dead barn owl chick in one of the canyons suggests a nesting site in the area for this species. At the far west tip of Area 10 is an abandoned nursery which has become an extensive freshwater marsh between the bluff and Carmel Creek. This area shows very heavy use by mule deer. Much of the valley floor from this point east to Santa Monica Ridge is developed into high and low density housing and horse stables. The target sensitive plant species found in this area include Del Mar manzanita, coast wallflower (*Erysimum ammophilum*), San Diego barrel cactus, wart-stemmed ceanothus, Del Mar sand aster, and Torrey pine.

The east end of the site is divided by a number of deep chaparral-covered drainages with scrub oak in the channels. A pond is located near the mouth of Deer Canyon. Sensitive species found in this area include orange-throated whiptail and a yellow warbler near the Deer Canyon creek. Large populations of California adolphia and scattered coast barrel cactus grow in the area.

Mesa Tops

Carmel Mountain is flat-topped and supports a diverse chaparral plant community and a series of vernal pools/swales. The chaparral is open, and a network of dirt roads and trails winds through the area. Mule deer and bobcats are common and travel the trails. An access road to the top of the mesa at the west end is lined with houses. One of the only remaining populations of the endangered species, short-leaved dudley (*Dudleya brevifolia*),

occupies the mesa top. Other target plant species include Orcutt's brodiaea and Cleveland's golden stars.

Del Mar Mesa is separated from Carmel Mountain by Shaw Valley. The eastern region of the mesa is vegetated with chaparral and coastal sage scrub and supports large vernal pool areas including a Caltrans vernal pool preserve area. Sensitive wildlife species found in this area include the loggerhead shrike, rufous-crowned sparrow, horned lark, and orange-throated whiptail. Low density housing and dirt roads occupy the central mesa, and the western portion of the mesa is mostly agricultural and hay fields. Black-shouldered kites and northern harriers were observed foraging in the grassy fields. In addition to Cleveland's golden stars, San Diego button-celery (*Eryngium aristulatum* var. *parishii*), a sensitive vernal pool plant, occurs on Del Mar Mesa.

Area 11 - Los Peñasquitos Creek Bridge at Poway

Area 11 was selected as a study site because of its potential as a wildlife movement corridor. It includes the area under and around the Interstate 15 bridge over Los Peñasquitos Creek. The bridge is a chokepoint in the corridor between the Torrey Pines State Reserve and Los Peñasquitos Reserve to the west and vacant lands to the east, including Beeler Canyon and Miramar NAS. The bridge is the only passage under I-15 in the area. The I-15 bridge is very high and wide (100 feet high, 200 feet wide, 450 foot span), and the noise level under the bridge is relatively low. A smaller bridge (50 feet high, 30 feet wide, 200 foot span), now used as a bike path, is located just east of the freeway bridge. Los Peñasquitos Creek flows year-round and supports a freshwater marsh habitat under the bridges; a riparian woodland lines the creek on both sides of the bridges. The I-15 bridge itself provides nesting habitat for a number of bird species including northern rough-winged swallow, cliff swallow, and white-throated swift. The habitat under the bridge is used as a movement corridor by mule deer, raccoons, Virginia opossums, coyotes, and probably bobcats (scat found at east end). The creek also provides a dispersion corridor for aquatic life, including tadpoles. Four sensitive plant species (all non-target species) were found, including San Diego sagewort, San Diego marsh-elder (*Iva hayesiana*), spiny rush, and ashy spike-moss.

Area 12 - South El Capitan Reservoir

Area 12 is located north of Alpine along Peutz Valley. To the north is El Capitan Reservoir and to the east is Viejas Mountain. The area is bordered by the Cleveland National Forest to the north and east, rural residential and chicken ranches to the west, and the Victoria area of Alpine to the south. The area includes riparian habitat, coastal sage scrub, chaparral, and oak woodland. The slopes in the area are generally rocky with large boulder piles and outcrops of exfoliating granite. Elevations in the area range from 1000-2400 feet. Seven sensitive plant species, including San Diego thorn-mint, were found on the site. Eighty-two vertebrate species were identified of which 12 are considered sensitive and 7 are MSCP target species. The high diversity in animal species is probably due to the variety of habitats and abundance of microhabitats in the survey area.

Peutz Valley

The Peutz Valley drainage extends from Viejas Mountain to the El Capitan Reservoir. The portion within the survey area has a well developed oak-sycamore riparian woodland with an understory of mugwort (*Artemisia douglasiana*) and wild grape (*Vitis girdiana*). Peutz Valley Road is a two-lane paved road with light traffic. It closely follows the creekbed for about 2 miles. The western end of the valley has a number of scattered houses with guard dogs in and around the riparian habitat.

The riparian habitat along the slow flowing creek is well developed and supports a diversity of bird species including yellow-breasted chat and great horned owl. Deer and coyote tracks in the creekbed east of the houses indicate use as a wildlife movement corridor. San Diego sedge (*Carex spissa*), the larval host plant of Harbison's dun skipper, was detected in the creek. Several small dark skipper butterflies were observed on the slopes above the creek, but were not positively identified as Harbison's dun skipper.

The area east of Murphy Ranch was not surveyed extensively for wildlife due to access restrictions. Scattered houses are in and along a section of the creekbed. San Diego horned lizards and western whiptails were found in this area. The habitats were similar to those in the rest of Peutz Valley; however gabbro derived chaparral covers the eastern-most slopes in the foothills of Viejas Mountain. A large population of San Diego thorn-mint occurs in this area at the head of Peutz Valley. Approximately 3,300 plants were detected.

The southern bank of the canyon is mostly steep, chaparral-covered slopes divided by several deep drainages. The most extensive of these drainages, near the middle of the survey area, has a shallow flowing creek lined by a closed canopy oak woodland. Some of the ravines in the sides of this drainage are filled with boulders, forming moderate-sized talus caves with rock pools. The plateau above the south bank is characterized by tall, dense stands of southern mixed chaparral.

The riparian areas could potentially support other sensitive species such as the downy woodpecker and two-striped garter snake.

Chocolate Canyon

This deep drainage extends from I-8 to the El Capitan Reservoir. The freeway crosses a saddle at the south end of the canyon. Peutz Valley Road cuts through this underpass. The north end of the canyon is inundated by the reservoir. The creek in the central portion of the canyon supports a narrow riparian woodland bordered by oaks. The banks are covered in coastal sage scrub. A dirt road on one of the banks connects the reservoir to I-8. Scat and tracks on the road indicate that it is heavily used by bobcats, mule deer, and mountain lions. Large populations of San Diego horned lizards, western whiptails, and orange-throated whiptails were observed basking and foraging on the road and in the surrounding scrub. Across the freeway are vacant lands in the Galloway Valley and Harbison Canyon. Although Chocolate Canyon is used by wildlife as a movement corridor, it is unknown if the animals cross the freeway, walk along Peutz Valley Road under the bridge, or turn back at the freeway.

West of Chocolate Canyon

This part of the survey area is on the edge of a mesa occupied by residential development and chicken ranches. The vegetation consists of California sagebrush-dominated coastal sage scrub and chamise chaparral at the higher elevations. Much of the sage scrub adjacent to the chicken ranch has recently burned and has a high wild oat and black mustard content, yet still supports San Diego horned lizards and mule deer as well as typical sage scrub bird species.

East of Chocolate Canyon

A large, chamise-covered plateau borders the national forest. The chamise is low and open and supports orange-throated whiptails, San Diego horned lizards, and sage sparrows. A cone-shaped peak and gentle slope southwest of the plateau is covered in California sagebrush-dominated coastal sage scrub. Western and orange-throated whiptails and San Diego horned lizards occur in especially high concentrations in this scrub. Rufous-crowned and sage sparrows are also abundant. A single female gnatcatcher was observed defending a territory at the base of the peak. A red-eared slider turtle was observed dispersing across the slope, far from a water source.

Area 13 - Crest-Dehesa

This 6200-acre study area forms an almost continuous band of natural open space that stretches from Loveland Reservoir on the Sweetwater River to Lake Jennings on the San Diego River. It represents the only habitat linkage between the rivers west of the Cleveland National Forest. Area 13 had the largest populations of California gnatcatchers (51 pairs) and San Diego cactus wrens (>20 pairs), as well as one of the highest number of sensitive plant species (14, of which 6 are MSCP target species) of any of the survey areas visited.

Sweetwater River

The Sweetwater River valley from Loveland Reservoir to the Sloan sand mine, near Willow Glen Road, was surveyed. Below the dam, the river has a good flow of water. The riverbed is rocky with an open riparian woodland. At one point, the river flows across an extensive sheet of granite. A number of potholes and rock pools have formed in this area, along with a large pond. Turtles, which were never positively identified, were observed in the pools along with bass and sunfish. The caves and crevices in the rock are used as nesting habitat by species such as cliff swallow, northern rough-winged swallow, black phoebe, and canyon wren. The area would also be suitable for a number of bat species, with its rock caves and the river and ponds for foraging. Below the pond, the riverbed is sandier and the riparian canopy is denser. Yellow-breasted chats and numerous other birds inhabit the woodland. Orange-throated whiptails and mule deer are fairly common on the floodplain and on the banks. Near the west end of the site, the riverbed is in various stages of regrowth from historical and recent sand mining operations. Active

sand mining is taking place below the confluence with Sycuan Creek. Sycuan Creek has a dense oak canopy above the confluence, although the vegetation appears somewhat degraded through the residential part of the Sycuan reservation.

Several sensitive species would be expected in the area. The sandy floodplains are potential habitat for the legless lizard and arroyo toad; the two-striped garter snake would be expected in aquatic habitat along the river and in Sycuan Creek; the Coronado skink could occur in the woodland areas; and some potential least Bell's vireo occurs along this section of the river.

Ridge between Sweetwater River and Sycuan Creek

This area was surveyed for wildlife with the exception of the Sycuan Indian Reservation. Plant surveys were focused only within the Sweetwater River Valley. No MSCP target plant species were detected in this area. The sage scrub-covered ridge is sharp and steep-sided. The habitat is mostly undisturbed west of a cluster of houses and trailers at the edge of the survey area. Patches of chamise chaparral occur on several of the slopes, and a clump of eucalyptus trees has been planted around the ruins of an old ranch near the middle of the ridge. Elevation ranges from 600 feet at the river to over 1600 feet. Dirt roads that run the length of the ridgetop are heavily used by mule deer, bobcats, coyotes, mountain lions, and other large mammals. No water is available on the ridge, but water sources surround the base of the ridge. Sensitive wildlife species in the area include sage sparrow, rufous-crowned sparrow, San Diego horned lizard, and western and orange-throated whiptails. The area was surveyed intensively for California gnatcatchers. Five territories were identified along the ridgetop and above the east end of the river.

Dehesa Peak Area

This section of the survey area connects the Sweetwater River valley to Forester Creek to the north. A ridge extends from the junction of Harbison Canyon and the Sweetwater River between El Cajon and Crest to the eastern side of Lakeside. The area has only a few scattered houses on large lots and is mostly vacant land. The major constraint between this area and natural areas to the south is the development along the Sweetwater River. The Singing Hills golf course, Sloan sand mine, and residential development on the Sycuan Indian Reservation and Harbison Canyon constrain wildlife movement. The least constrained route seems to be from the end of the ridge north of the Sweetwater River-

Sycuan Creek confluence, up Harbison Creek to the north-facing slope of the ridge south of Dehesa Peak. A dirt trail leads up this canyon through dense mixed chaparral to the south end of Crest.

The south-facing slope north of the Sweetwater River supports a repeatedly burned, grassy sage scrub habitat. Little wildlife was observed on these slopes, although sage scrub species such as the California gnatcatcher and orange-throated whiptail inhabit some of the remnant mature patches of the coastal sage scrub community. This slope is dominated by the sensitive San Diego sunflower (*Viguiera laciniata*) and supports scattered patches of Dehesa bear-grass (*Nolina interrata*), a target sensitive species.

Farther north is a wide valley and Dehesa Peak. The valley has extensive coastal sage scrub and patches of clay and gabbro-derived soils which support most of the sensitive plants found in the survey area. Target plant species located here include San Diego thornmint, variegated dudleya (*Dudleya variegata*), narrow-leaved nightshade, Parry's tetraococcus (*Tetraococcus dioicus*), and a large population of Dehesa bear-grass with over 2,000 plants. Four California gnatcatcher territories were identified in the valley. Several small patches of prickly pear and cholla cactus contain nests of San Diego desert woodrats. One of the patches is large enough to support cactus wrens, but none was located. An oak-filled drainage above Singing Hills golf course had springs and intermittent water, but a low diversity of wildlife. The crest of Dehesa Peak is covered with patches of open chamise chaparral and sage scrub, and the east side has tall, dense stands of southern mixed chaparral. Golden eagles were observed on the east slope and in the oak-lined drainage north of the peak, but no nest was detected. Massive rock outcrops on the peak are habitat for a number of lizard and bird species, but the chaparral has limited wildlife diversity.

South of the Forester Creek drainage is a valley with a large patch of coastal sage scrub habitat. The floor of the valley shows extensive off-highway vehicle damage. Local residents say that the damage is recent and report a decrease in the bobcat and deer populations in the last ten years. San Diego black-tailed jackrabbits, orange-throated and western whiptails, and San Diego horned lizards are common in this area. The habitat appears suitable for California gnatcatchers, but none was detected.

Forester Creek drains out of Crest and into El Cajon. The drainage is deep, and the steep walls are covered with dense southern mixed chaparral to the south and chamise chaparral

to the north. A dense stand of riparian woodland grows along the flowing creek, and rural houses dot the streamside. La Cresta Road, a two-lane paved road, follows the creek.

Forester Creek to Lake Jennings Road

North of the creek, sage scrub-covered foothills rise to rugged chaparral-covered hills. Wildlife in the good quality sage scrub between the creek and Interstate 8 is abundant and diverse. Sensitive species in the sage scrub include rufous-crowned and sage sparrows, orange-throated and western whiptails, and San Diego black-tailed jackrabbit. The sage scrub itself in this area is diverse, with dominants ranging from flat-topped buckwheat, California sagebrush, and laurel sumac to monkey flower, lemonadeberry, and white sage. Nine California gnatcatcher territories were detected in this section, concentrated at the west end.

Interstate 8 crosses this area where it narrows to a 500-foot wide gap. West of the freeway this area is bounded on both sides by development. This section of the freeway is four lanes wide and has a 50-foot wide divider vegetated in sage scrub. The freeway is at the bottom of a 50-75 foot deep cut with sparse sage scrub on the steep walls at the point where it divides the habitat linkage. A cleared field with remnant patches of sage scrub links the sage scrub adjacent to the freeway with sage scrub west of Business Loop 8. Little wildlife was observed in the field, but an active California gnatcatcher nest was observed in a patch of scrub the size of a bus in the middle of the field. North of Business Loop 8, an archipelago of sage scrub habitat islands winds between trailer parks and residential and commercial development for approximately 3 miles to vacant natural areas around Lake Jennings. One of the most constrained sections of coastal sage scrub is about 1500 feet from the road. A patch of sage scrub habitat less than 200 feet wide links habitat in a north-south direction between residential development and a trailer park and equipment storage yard. California gnatcatchers (18 territories) were found in the sage scrub between Business Loop 8 and Los Coches Road. At the equipment yard, a pair of gnatcatchers was observed moving through the scattered broom baccharis growing among the equipment, suggesting that the yard may act as a buffer to a potential gnatcatcher dispersal corridor. Bobcat, mountain lion, and coyote sign was observed along the ridge roads, indicating large mammal movement along the corridor. No deer sign was observed. San Diego black-tailed jackrabbits and orange-throated whiptails were common in this area, but overall wildlife diversity was low. This patch is separated by a short section of channelized creek and some graded lots from habitat on a natural ridge across Los Coches Road. The

disturbed area is about 300 feet wide, and habitat is visible to wildlife on the other side when crossing in either direction. The sage scrub habitat between here and Lake Jennings Park Road is mostly in good condition with the exception of a degraded area along Lakeview Road. A total of 8 California gnatcatcher territories were identified in the western portion of this area, along with San Diego cactus wrens and San Diego desert woodrats in a patch of cactus just south of the study area along Lake Jennings Park Road. No MSCP target sensitive plant species were detected in this area, although Greene's ground cherry (*Physalis greenei*), San Diego sunflower, and ashy spike-moss were observed.

Lake Jennings-Cactus County Park Area

The ridge between Lake Jennings and the San Diego River is bordered by Lakeside to the south and sand mines along the river to the north. Wildcat Canyon borders the river on the north. The coastal sage scrub and large stands of prickly pear in this area support relatively large and dense populations of California gnatcatchers and cactus wrens. At least 20 pairs and over 30 individual cactus wrens and over 16 pairs of gnatcatchers were found in this region. The west-facing slope and mesa above Lake Jennings Park Road has dense stands of cholla and prickly pear, 1-2 meters tall, separated by patches of good quality coastal sage scrub. Grading is underway in the middle of the cactus patch in the canyon west of the Lake Jennings Park campground. The ridge west of El Monte Road is mostly good quality coastal sage scrub with patches of cactus at the east end. The wildlife diversity is similar to that on the habitat islands to the south. No target sensitive plant species were detected in this area, although San Diego sunflower and Palmer's grappling-hook were present.

Area 14 - Jamul

Area 14 spans the open space on the west foot of McGinty Mountain between Steele Canyon and the Sweetwater River valley south of Singing Hills. Coastal sage scrub is the major habitat in the area; chaparral, oak woodland, and riparian habitats occur in lesser amounts. Elevations range from 400 feet in the riverbed to 1200 feet on the slopes of McGinty Mountain. A total of 94 vertebrate species were detected in this survey area. Fifteen of these are considered sensitive and 7 are MSCP target species. Fourteen sensitive plant species including 5 MSCP target species were also detected in the area. The area appears to be an important link between the San Miguel Mountain and Otay areas and the McGinty Mountain and Dehesa areas to the north.

North End

The northern three-quarters of the survey area is in the foothills of McGinty Mountain. At the north end, a steep, sage scrub-covered slope rises about 400 feet above the Sweetwater River. At the base of the slope, in the floodplain, are a number of human disturbances including sand mines, horse stables, houses, and cleared areas. The least disturbed section of the river, which may serve as a wildlife crossing point, is located just south of the Singing Hills golf course.

South of the river is a relatively undisturbed expanse of coastal sage scrub-covered ridges and valleys. The area is strewn with large exfoliating granite boulders as well as some rock outcrops along the ridges and in the creekbeds. The deeper drainages support narrow stands of coast live oak woodland and had some pooled water at the time of the April surveys. Several large patches of gabbro-derived soil occur on the higher slopes of McGinty Mountain and adjacent to the survey area. A number of MSCP target sensitive plant species including Dehesa bear-grass, San Diego thorn-mint, and Parry's tetracoccus were found in this sparsely vegetated soil. Most of the gabbro soil area is heavily grazed by cattle. About 20 individuals of Palmer's ericameria (*Ericameria palmeri* ssp. *palmeri*) occupy the upper slopes of a small tributary drainage.

The vegetation and topography of the survey area are very similar to that in the Amber Ridge area across the river to the north and to the hills above the Cottonwood golf course to the west. Both of the other areas, as well as The Mesa to the east, have high California gnatcatcher population densities. However, only a few pairs of gnatcatchers were detected at the northeast corner of the survey area. San Diego horned lizards and orange-throated whiptails were very abundant in the scrub and along the dirt roads. Red-diamond rattlesnakes were detected as well as large numbers of rufous-crowned sparrows and sage sparrows.

Mexican Canyon

Mexican Canyon originates in North Jamul and ends in the Steele Canyon golf course. This area was not thoroughly surveyed because most of it is in residential back yards. Jamul Road, a lightly traveled two-lane paved street, closely follows the creek. A number of rural houses are clustered in and around the creekbed, and many of them have guard

dogs. A riparian woodland and oaks line the creek. A small section of the canyon outside the study area, just west of North Jamul, has not been built in and may be an important corridor area, as tracks of mule deer and bobcat were common on both sides of the canyon. No MSCP target plant species were detected in this area.

South End

A steep, sage scrub-covered ridge separates Mexican Canyon and Steele Canyon. The top of the ridge has been graded for a future development, effectively blocking the north-south connection except at the extreme east and west ends, outside the survey area. High numbers of San Diego horned lizards, orange-throated whiptails, red-diamond rattlesnakes, and rufous-crowned sparrows were detected on the ridge. This section of Steele Canyon supports a good quality riparian woodland. One target sensitive plant species, narrow-leaved nightshade, occurred in several locations on steep slopes just below the ridge-top.

Area 15 - Daley Ranch Area

This survey area includes Dulzura Creek and the foothills to the north from Jamul Butte to Barrett Junction as well as a section of Cottonwood Creek and Bee Canyon south to Area 16. Within this area, we sampled Dulzura and Cottonwood creeks, Bee Canyon, and an area between Honey Springs Road and Dutchman Canyon. Elevations in the area range from 800 to over 2400 feet. One target sensitive plant species, Orcutt's brodiaea, and several less sensitive plant species were detected in the survey area.

Northwest of Honey Springs Road

Highway 94 forms the southern border of the survey area. The land to either side of Highway 94 is used for farming, cattle grazing, and other agricultural purposes. The habitat consists of grassland and fields with remnant patches of coastal sage on knolls and around rocky outcrops. The habitat farther back from the road is more intact and transitions from low coastal sage scrub-covered hills to steep, rocky chaparral-covered foothills. Two major drainages divide this area. Jamul Creek and Hollenbeck Valley both drain Lee Valley and flow into Dulzura Creek. The upstream section of Jamul Creek supports riparian woodland, but the southern section within the agricultural lands has been reduced to a weedy channel with scattered sycamores along the 5 miles above the junction

with Dulzura Creek. Hollenbeck Canyon has water most of the year and supports a high quality riparian woodland along most of its length.

Pringle Canyon

Pringle Canyon connects the Bratton Valley, south of Lyons Peak, with Dulzura Creek. West of this (beyond an avocado grove) is a sage scrub and chaparral-covered ridge. Orange-throated whiptails, San Diego horned lizards, and sage sparrows were found in the sparse scrub on top of the ridge, and the only California gnatcatchers detected in the study area were located on the western slope.

East of Pringle Canyon, there is a wet meadow supporting freshwater marsh and *Stipa* grassland habitats among sheets of bedrock. Orcutt's brodiaea was found in fissures in the bedrock. Water flows out of a pond near a house and down a steep, sage scrub-covered slope to a ranch on the plateau 600 feet below.

The lower section of Pringle Canyon supports an aquatic habitat lined by high quality riparian and oak woodlands. Large-mouth bass, bluegills, mosquitofish, and African clawed frogs have been introduced into the creek, and a diversity of native wildlife inhabits the canyon bottom. Sensitive species in the drainage include: two-striped garter snake, Coronado skink, and orange-throated and western whiptails. Southeast of the canyon, across the highway from Dulzura, is a large hay farm and ranch surrounded by low sage scrub-covered hills. The hay farm may be a foraging area for wintering raptors such as prairie falcon and northern harrier. No California gnatcatchers were detected in this area, although the California sagebrush-dominated sage scrub habitat appeared suitable to support a population.

Dutchman Canyon

Dutchman Canyon originates at the base of Mother Grundy Peak and flows into Dulzura Creek. Riparian and oak woodland line the creek in a portion of the canyon. The banks of the canyon are covered with coastal sage scrub and chaparral. The upper and lower sections of the canyon are steep-sided, but the central part opens into a small valley. At the upper end of the valley is a spring surrounded by a freshwater marsh and a pond with bullfrogs. Tracks around the pond indicate use by mule deer, bobcats, and skunks. A number of abandoned cabins at the lower end of the valley and in the drainage below

provide habitat for small mammals. A Coronado skink was observed in the oak woodland below the cabins near an open, water-filled well.

Bee Canyon

This canyon connects the rest of the Daley Ranch area to Area 16 in the Marron Valley where it joins Cottonwood Creek. A wooded creek flows through the canyon. South of Highway 94 the creek passes through a patchwork of scattered agricultural fields, houses, chaparral, and coastal sage scrub. Two other creeks converge at the southernmost agricultural field and flow through undisturbed habitat to a grove of eucalyptus and oaks at the junction with Cottonwood Creek. The diverse wildlife in the riparian habitat includes sensitive species such as yellow-breasted chat, black-shouldered kite, yellow warbler, and downy woodpecker. Sensitive plant species surveys were not conducted in Bee Canyon.

Cottonwood Creek

Cottonwood Creek is a major drainage in the region which extends from Barrett Lake to the Tijuana River. The portion in the study area includes the confluence with several other creeks at Barrett Junction and flows around Little Tecate Peak to Marron Valley.

At Barrett Junction is an extensive patch of riparian woodland and riparian scrub bordered by grassy fields. The numerous channels and backwaters in this sandy floodplain are an important breeding area for amphibians. Tadpoles of bullfrog, Pacific treefrog, California treefrog, western toad, and western spadefoot toad were found in almost all available surface water in this area. The creek then flows through a horse ranch. This section of the creek is somewhat disturbed as it passes through pastureland but supports another extensive riparian woodland just downstream. The habitat along the remainder of the creek consists of braided stream channels with riparian vegetation bordered by shelves with oak woodland and sage scrub-covered canyon walls. As the canyon narrows along the foot of Little Tecate Peak, the canopy opens up and the creek bed becomes bedrock with scattered boulders and rock pools.

The wildlife along this creek is abundant and diverse. Yellow-breasted chats and yellow warblers were found in the riparian woodlands; two-striped garter snakes were observed in the rock pools at the south end near a clump of willows with two male least Bell's vireos; San Diego black-tailed jackrabbits and orange-throated whiptails were observed in the

upland habitats; and mule deer and other large mammals were detected along the length of the creek.

The sandy floodplain along the creek is potential habitat for the arroyo toad and legless lizard. The two-striped garter snake was detected only at the southern end of the creek, but the population likely extends to the pools upstream. Southwestern pond turtles are known from the area and may inhabit the more ponded areas. Several small patches of potential habitat for least Bell's vireos occur between the stands of sycamore and oak riparian woodlands. Three-spined unarmored sticklebacks have been reported from Pine Valley Creek, north of Barrett Lake but were not detected in Cottonwood Creek. The rocky crags above the creek on Little Tecate Peak are suitable for golden eagle nesting, and the chaparral may support rufous-crowned sparrows and red diamond rattlesnakes.

Dulzura Creek

Dulzura Creek originates east of Dulzura and flows west along Highway 94. It turns south and runs along Otay Lakes Road to Lower Otay Reservoir. The high quality riparian woodland and oak woodland bordering the creek is mostly intact and uninterrupted except for a degraded section south of the Highway 94-Otay Lakes Road junction. Most of the creek is not on accessible land, but the portion that was surveyed had high wildlife diversity.

Area 16 - Marron Valley

The Marron Valley is situated along the Mexican border at the confluence of Tecate Creek and Cottonwood Creek. The waters below this confluence become the Tijuana River which flows into Mexico at the south end of the study area. The valley is uninhabited, and no surrounding development is visible from the valley. Access is restricted by a series of gates on the entrance road which is used by the City of San Diego Department of Water Utilities and by cattle ranchers who lease the land from the city for grazing and maintain a barn and hayfield in the valley. The site is bordered by the San Ysidro Mountains to the west and the mountains surrounding Tecate Peak to the east. To the south, hills and mountains broken only by scattered cattle ranches and the new Tecate-Tijuana toll road extend for miles into Baja California. To the north, Cottonwood Creek, Mine Canyon, and Bee Canyon flow into the valley from the Barrett Junction and Dulzura Peak areas.

This survey area supports a variety of habitats including coastal sage scrub, chaparral, riparian and oak woodlands, riparian scrub and freshwater marsh, native and non-native grasslands, vernal pools, floodplain, and agricultural fields. Some of the species found in the area such as Mormon tea, desert fragrance, and speckled rattlesnake are associated with more inland or desert habitats. Microhabitats were equally diverse and abundant and included massive rock outcrops, boulders and cliffs as well as sandy washes, leaf litter, logs, snags, and debris in the woodlands and nearby mines and old buildings. This area is also at the northern distributional boundary of a number of species endemic to Baja California, resulting in a great diversity of plants and wildlife in the area. This area had the highest vertebrate species diversity of any of the areas studied, with 142 species. Ogden biologists recorded 107 birds, 20 reptile and amphibian species, and 15 species of mammals. Twenty-seven of these species are considered sensitive and 11 are MSCP target species. Sixteen sensitive plants including seven target species were also detected.

Tecate Creek-Tijuana River Area

Tecate Creek enters the United States at the east end of the survey area and joins with Cottonwood Creek near the center of the site to form the Tijuana River. Large quantities of untreated sewage from Tecate, Mexico are released into Tecate Creek upstream. At this time the waters of the creek and the Tijuana River are a stinking, black sludge. According to the ranchers, this sludge inundates much of the floodplain during storm events. Despite the contamination, the creek supports extensive high quality riparian woodland and riparian scrub communities and a high diversity of wildlife. The Tijuana River supports an even more extensive riparian habitat bordered by a wide, sandy floodplain vegetated with desert fragrance (*Hymenoclea monogyra*) scrub. A tall, closed canopy oak woodland borders the confluence of the river and Mine Canyon Creek. A least Bell's vireo was found in the riparian scrub in this section of the river. At the west end of the site, oaks border the riparian habitat, and the slopes above the river support a band of open coastal sage scrub which transitions into chamise chaparral higher on the mountain. Populations of coast barrel cactus and variegated dudleya are found in the rocky, clay-lined drainages on the slope.

Between Tecate Creek and Cottonwood Creek is a low area with mima mound topography. The habitat in this area is a low flat-topped buckwheat-dominated coastal sage scrub. Five high quality vernal pools were recorded along with western spadefoot toad. During the winter surveys, several unusual migrants, including a sage thrasher and a group of vesper

sparrows, were observed in this area. The clay soils south of Cottonwood Creek support large populations of variegated dudleya and Cleveland's golden-stars.

Ranch Area

A cluster of barns and sheds are located in the west-central portion of the survey area near the junction of Mine Canyon Creek and the Tijuana River. To the east of the buildings, on the valley floor, is a small hay field. An adjacent fallow field has regrown into a *Stipa* grassland. A narrow strip of good quality coastal sage scrub in a drainage divides the fields. The fields are used by California horned larks and as a foraging area for red-shouldered and red-tailed hawks.

Mine Canyon and San Ysidro Foothills

Mine Canyon is a deep drainage with a spring-fed intermittent creek which originates near Sycamore Canyon. The creekbed is cobbled, and coastal sage scrub grows on the banks and slopes. To the east of the canyon, steep slopes and deep drainages rise 900 feet from the valley floor to a mesa. The sage scrub habitat on the slopes has burned and exhibits moderate to heavy grazing damage. The scrub is open and grassy on the slopes and almost barren at the base of the hills above the agricultural fields. No California gnatcatchers were detected on these slopes, though marginally suitable habitat is available. Horned larks, orange-throated and western whiptails, and San Diego horned lizards are relatively common in this area, and substantial populations were observed on the dirt roads and flatter areas. This area supports a few individuals of San Diego barrel cactus, narrow-leaved nightshade, and one Tecate cypress tree (*Cupressus forbesii*).

Entrance Road Area

The Donohoe mine and several other mines occur just north of this area. The Donohoe mine has two horizontal shafts extending deep into the rock slope. Large bats were observed emerging from the tunnel but were not positively identified. These bats may use the valley as a foraging area. Marron Valley Road descends alongside a deep, sage scrub-covered drainage into the valley. A coastal rosy boa was observed crossing the road, and a red diamond rattlesnake along with horned larks, rufous-crowned sparrows, and sage sparrows were found in the drainage. During the winter surveys, a pair of California gnatcatchers was detected near the mouth of the drainage. Coastal sage scrub similar to that

inhabited by the gnatcatcher pair extends along the slopes and into most of the valley. San Diego barrel cactus and variegated dudleya were detected along the slopes.

Cottonwood Creek

The upper end of the creek in the survey area has a rocky bed and a string of deep rock pools which contained water even during the dry period during the winter surveys. The lower section of the creek flows along a wide sandy floodplain and is bordered by mulefat, desert fragrance, and desert arrowweed scrub. The surrounding valley floor is sandy and supports an open, sandy sage scrub habitat. Some of the plant species, such as Mormon tea, suggest a more inland phase of scrub. Sage sparrows, red-diamond rattlesnakes, and San Diego horned lizards were observed in the scrub. A male California gnatcatcher was detected on the sage scrub-covered ridge south of the creek. This area supports San Diego barrel cactus, narrow-leaved nightshade, Cleveland's golden-stars, and slender-pad caulanthus.

Eastern Border

The east end of the valley rises nearly 1000 feet into chaparral-covered mountains. A jeep trail used by mule deer and bobcats follows a sharp ridgeline just north of the Mexican border. A recent burn has left a nearly barren area that extends along this ridge from Tecate Creek into the mountains to the east. Few wildlife species were observed in the burned habitat, but typical sage scrub and chaparral-dwelling species, including the San Diego horned lizard, were observed in the remaining intact habitat. The steep rock faces in this area contain numerous deep crevices and caves. An active golden eagle nest was observed and eagles were observed foraging over the valley.

Potential habitat exists in the area for a number of wildlife species which were not detected during the surveys. The sandy valley and floodplain along Cottonwood Creek is potential habitat for the arroyo toad and legless lizard. The aquatic habitats, especially the upper portions of Cottonwood Creek and the Mine Canyon Creek area, are potential habitat for the two-striped garter snake. This species was observed in Cottonwood Creek in Area 15. Much of the riparian scrub habitat along the river appears to be potential least Bell's vireo nesting habitat. Single vireos were found near the ranch house and in Cottonwood Creek just north of the site, but no pairs were observed during the late April surveys. The coastal sage scrub habitat, except for the most degraded area around the ranch, appears to be

suitable for California gnatcatchers, although only two sightings were recorded after extensive search effort. Several sensitive bat species may roost in the mines and crevices in and around the site. A leaf-nosed bat was reported from Mine Canyon, and the western mastiff bat was known from the area in the late 1970s (Westec 1977). Several target sensitive plant species occur in the steep canyon tributary to Cottonwood Creek. State endangered willow monardella (*Monardella linoides* ssp. *viminea*) and Tecate cypress grow within the channel bottom, while San Diego barrel cactus, narrow-leaved nightshade, and slender-pod caulanthus occupy the steep slopes.

Area 17 - Otay Mesa

Access to the majority of this survey area was denied; therefore, the area was not surveyed. Although the 457-acre area is relatively isolated, it was originally selected for survey primarily because of its potential to support rare plants.

Area 18/19 - Lake Hodges

This area includes the City-owned land around Lake Hodges. California gnatcatcher surveys were conducted over a large area of the lakeshore in the winter, while wildlife and botanical surveys were conducted in the spring in areas 18 and 19. Tables A-6.3 and A-6.6 present information on species diversity and sensitive species detected for spring surveys only to be comparable with data from other areas which were surveyed in the spring only, Lake Hodges winter survey results are not included in these tables. Winter surveys were conducted along the northern shore of Lake Hodges from the Del Dios Community Park east to Interstate 15. The southwestern edge of the lake from the southern edge of the community of Del Dios south to the dam was also surveyed. The area sampled in the spring included the habitat from the south end of Del Dios to the dam and a strip of habitat parallel to the east side of Lake Drive and extending north from the Del Dios Community Park north of the lake to Via Rancho Parkway.

The shoreline of the lake is lined by a narrow strip of cattails, bulrushes, and willow scrub. The shores of the lake are used for hiking, fishing, and picnicking on weekends and are lined with paths and dirt roads. The north shores of the lake rise gently to the steep hills and support coastal sage scrub with dense stands of prickly pear cactus. Within the last few years a wildfire has burned a large portion of Bernardo Mountain north of city owned lands. At the west end of the lake near the dam the slopes are very steep and rocky.

Coastal sage scrub grows above the sparsely vegetated beach, and dense stands of southern mixed chaparral occur on the steeper slopes. One of the components of the chaparral is the sensitive warty-stemmed ceanothus. Several of the drainages support stands of coast live oak.

A diversity of avian species were detected at Lake Hodges during the winter California gnatcatcher surveys. Of the 76 bird species observed, 15 species are considered to be sensitive and 7 are classified as MSCP target species. Along the northern edge of the lake between the Park and Interstate 15, there were 25 documented gnatcatcher pairs with the potential for an additional four pairs based on birds that were heard but not seen. Privately owned lands to the east and the north of the city lands were not surveyed and are known to support additional gnatcatcher pairs (Ogden unpubl. data). A pair of California gnatcatchers and an individual potentially representing a second pair were observed along the southwestern edge of the lake south of the community of Del Dios. Nineteen coastal cactus wren individuals were detected along the narrow strip of habitat north of the lake and on the knoll south of the boat docks. The number of cactus wren pairs was not determined.

Waterbird species observed at Lake Hodges during winter surveys include American white pelican, double-crested cormorant, great-blue heron, great egret, western and Clark's grebes, Canada goose, cinnamon teal, lesser scaup, bufflehead, and ruddy duck. Raptor species were common in the area and sightings included turkey vulture, osprey, black-shouldered kite, northern harrier, Cooper's hawk, and golden eagle. American peregrine falcon have also been documented using the lake in the winter (Preston pers. comm.).

During spring surveys of area 18, a pair of San Diego cactus wrens was observed nesting in a small patch of cactus near the lake shore. A San Diego horned lizard was observed at the south end of the lake. A single pair of California gnatcatchers was detected in the area, although suitable habitat is present, and large populations are found at either end of the lake. Coyote and bobcat tracks were observed along the dirt roads. Yuma myotis bats were observed roosting in the access tunnels of the dam.

Area 19 was surveyed in the spring and includes Del Dios Community Park and the tip of the ridge that separates south Escondido from the north end of Del Dios. This area may be an important link for wildlife moving from the Lake Hodges area to the natural areas to the west.

An unnamed creek flows from the north end of the site to the north tip of the lake alongside Lake Road. The creek supports a dense, mature sycamore-oak riparian woodland reaching heights of 15 meters in some areas. Numerous fishing paths weave through the understory among the backwaters of the lake. Raccoons, coyotes, mule deer, and roosting waterfowl utilize this area.

Stands of riparian scrub and tall cattails and bulrushes line the south shore of the lake. A border of riparian woodland and oaks mostly conceals the houses and yards of Del Dios which border the woodland. The area is heavily used by fishermen, and dogs bark from the yards above. It was not determined that the shoreline is a route used by large mammals. Some waterfowl and shorebirds were observed along the edges of the lake, but the spring species list does not reflect the waterfowl diversity that would be found during the migration or wintering seasons.

The ridge east of the creek is steep and vegetated primarily in black sage-dominated coastal sage scrub. A band of flat, California sagebrush-dominated sage scrub borders the foot of the ridge. Orange-throated whiptails and San Diego horned lizards as well as several pairs of California gnatcatchers inhabit the ridge. The slopes and ridgeline in the northern portion of the survey area are covered with chaparral including dense stands of the target species, warty-stemmed ceanothus.

Area 20 - Santa Ysabel Creek

This area encompasses the drawdown area of Lake Hodges, east of the I-15 bridge, and the Santa Ysabel Creek through the San Pasqual Valley. A high diversity of wildlife inhabits the area, especially the wetlands surrounding the lake and river. Only the northern end of the area was surveyed for sensitive plants. A single sensitive plant species, coast barrel cactus, was found in large numbers.

Drawdown Area

The passageway under the I-15 bridge represents the only east-west wildlife movement corridor in the area. At times of inundation, any animal movement is restricted to dirt paths along the top of the rip-rap at the edges of the lake under the bridge. Animal movement was not detected along the paths, probably because any tracks would have been obliterated

by fishermen and migrant workers moving along the path. A colony of several thousand cliff swallows nests on the bridge. West of the bridge, fishing paths ring the lake. Fire rings and trash imply that the area is used for night fishing. The lake itself is deep and is populated by a number of large exotic fish including large-mouth bass, bluegill, carp, and catfish. East of the bridge, the lake is lined by willow woodland, freshwater marsh, and coastal sage scrub. This area supports a very rich species diversity, and a number of bird species considered rare in the county breed here. A plant nursery extends from the edge of the riparian habitat on the south shore of the lake to Pomerado Road to the south. East of the nursery is an extensive riparian woodland. Yellow-breasted chats, least Bell's vireos, and a breeding colony of yellow warblers were found in this area. Yellow-billed cuckoos, believed to be dispersing young, were sighted in the area in summer 1992 (Ogden unpubl. data). A willow flycatcher feeding fledglings was also observed in this area during the summer of 1992 (Ogden unpubl. data). The woodland exhibits signs of cattle grazing and trampling damage in the understory and encompasses numerous pools of standing water. North of the lake, another extensive riparian woodland remains above water level. This woodland and the freshwater marsh along its north border extend north up the San Bernardo Valley to the North County Fair shopping center which separates it from the rest of the woodland in Kit Carson Park. Numerous bird species were detected in the riparian area including downy woodpecker, white-faced ibis, yellow warbler, yellow-breasted chat, Cooper's hawk, and least Bell's vireo. A sewage disposal plant is located in the floodplain near the freeway, and a nearby abandoned adobe house (the Sykes adobe) offers potential habitat for bats and barn owls. A narrow (<100 feet) strip of coastal sage scrub borders the freeway from the north end of the bridge to the sewer plant. Two pairs of California gnatcatchers were found in this habitat, suggesting that it may be an important link between the populations west of the freeway and those to the east. Across the wetland area from this strip is a ridge with coastal sage scrub bordered by a mostly bare floodplain area to the west and south. The coastal sage scrub supports at least four California gnatcatcher territories as well as the San Diego desert woodrat and San Diego black-tailed jackrabbit. The floodplain area has been repeatedly inundated, and what vegetation has regrown has been heavily grazed by cattle. Breeding spotted sandpiper were found in the floodplain east of the lakeshore. The lack of deer in the area may be partially attributed to hunters observed in the area.

Upper River Area

Between the drawdown area and the San Pasqual Valley is a wide floodplain bordered by coastal sage scrub, plant nurseries, and residential developments. The river channel narrows and supports riparian woodland and riparian scrub communities. This area adjacent to the river is used primarily for cattle grazing.

The hillsides south of the river, just west of the San Pasqual Valley are covered with large tracts of coastal sage scrub and chaparral. Some of the north facing slopes and drainages support dense stands of coast live oak forest. Numerous shacks and shelters built by transients and piles of trash are on the slopes in the oak forests. The riverbed is sandy and has floodplain vegetation with riparian woodland along the channel. Four California gnatcatcher territories were identified in the coastal sage scrub above the river. A two-striped garter snake was found along the river, and San Diego black-tailed jackrabbits, orange-throated and western whiptails, loggerhead shrikes, and mule deer inhabit the floodplain and adjacent coastal sage scrub.

Tracks indicate that large mammals move along the dirt roads on the valley floor. The north-facing slopes and some of the deeper drainages support dense coast live oak forest. Among the giant boulders under the canopy are numerous shacks and shelters built by transients and piles of trash. Across the river are low, coastal sage scrub covered hills and houses. California gnatcatchers were not detected in the sage scrub.

Area 21 - Wild Animal Park

The San Diego Wild Animal Park is located north of the San Pasqual Valley and Highway 78, east of Rockwood Canyon (Area 3), west of the valley containing Cloverdale Creek, and south of Area 2. The Wild Animal Park was surveyed in the winter for California gnatcatchers. There are large expanses of vacant land along the northern half and in the southeastern portions of the park. Much of the remainder of the park is developed. A village with numerous animal enclosures, visitor facilities, and other park buildings is located near the southwest corner of the parcel. To the north and east are gardens and very large enclosures used to house, breed, and display large mammal species. Around the perimeter of the large enclosures is a monorail from which visitors may view the animals. Those areas surveyed were to the north and east of the monorail and village, as well as a

strip of habitat along the western edge of the parcel adjacent to the service entrance to the Wild Animal Park.

There are several types of natural habitats at the Wild Animal Park including coastal sage scrub, chaparral, and oak woodland. Coastal sage scrub occurs on the south facing slopes throughout much of the undeveloped portions of the site. A large proportion of the coastal sage scrub is disturbed from fire and the introduction of exotic species (e.g., black mustard, wild oat, eucalyptus species, and Acacia species). Southern mixed chaparral and chamise chaparral are found on north facing slopes along the northern portion of the site. There are small stands of coast live oak and Englemann oak along the larger drainages and on some of the north facing slopes along the northern half of the property.

There were 64 different avian species detected during the winter at the Wild Animal Park in the coastal sage scrub and chaparral habitats and in ponds in the large field enclosures adjacent to undeveloped habitats. Fifteen bird species detected are considered sensitive and eight of these are MSCP target species. Large populations of coastal cactus wren and California gnatcatchers occur on undeveloped lands at the San Diego Wild Animal Park.

The southeastern portion of the property including the large knoll west of the San Pasqual Battlefield monument supported the majority of the gnatcatcher sightings and all of the coastal cactus wren sightings. The coastal sage scrub in this area is dominated by California sagebrush, flat-topped buckwheat, and prickly pear cactus. Large portions of the habitat have been disturbed by recent fires and the invasion of non-native annual plants. Twenty-three pairs of gnatcatchers were detected onsite, with 18 of these pairs occurring along the southeastern portion of the property. There were 28 individual cactus wrens observed, although the number of pairs was not determined.

Some of the bird species observed in field enclosure ponds at the Wild Animal Park include American white pelican, double-crested cormorant, Canada goose, Great egret, great-blue heron, snowy egret, and black-crowned night heron. Large rock outcrops, small oak woodlands, and open foraging habitats supported a number of sensitive raptor species including turkey vulture, northern harrier, Cooper's hawk, sharp-shinned hawk, red-shouldered hawk, ferruginous hawk, and golden eagle. Coastal sage scrub and chaparral habitats support a variety of avian species including Costa's hummingbird, rock wren, canyon wren, blue-gray gnatcatcher, southern California rufous-crowned sparrow, and Bell's sage sparrow. A rather unusual species in western San Diego County, the common

ground dove, was observed at several locations at the Wild Animal Park, often in ruderal or open habitats near cultivated plantings.

Area 22 - San Pasqual Valley

This area is undeveloped and is surrounded by vacant land, with the exception of Highway 78 which is carved into the slope, high above Santa Ysabel Creek. A series of city-maintained hiking trails lead up the steep slopes on either side of the creek to the tall peaks above. The habitat on both slopes above the creek is recovering from a recent series of brush fires. There are several scattered houses and groves to the south of the site, along the ridge. The majority of this area was surveyed for plants and wildlife; however, no target sensitive plant species were detected.

Santa Ysabel Creek

The section of the creek in the survey area and to the east is at the bottom of a narrow, steep-sided gorge. The creek supports a diverse riparian woodland of sycamore, willow, alder, and oak. Open areas support freshwater marsh habitat. The creek had some flowing water during surveys in late June and several deep sand and rock pools that probably hold water year-round. Introduced aquatic species including bullfrog, bass, catfish, bluegill, and mosquitofish inhabit the deeper pools. The creek and surrounding habitat are in excellent condition and support a diversity of wildlife species. The creek could potentially support two-striped garter snakes.

Tims Canyon

Tims Canyon is the largest of a series of a very steep drainages that lead from the flat mesa top to Santa Ysabel Creek. This drainage has cut through the topsoil, exposing piles of talus and boulders below. Tims Canyon is lined with dense coast live oak forests with a poison oak and wild grape understory. The talus is potential habitat for the San Diego banded gecko. These drainages may be too steep and rugged to act as wildlife corridors. Deer trails were found zig-zagging through the surrounding habitat. The surrounding habitat is a burned mosaic of coastal sage scrub and chaparral which at the time of the surveys had a large wild oat and black mustard component.

South Slope

The slope south of the creek is covered with coastal sage scrub at the lower elevations and burned and intact southern mixed chaparral higher on the slope. The area has a relatively low wildlife diversity and abundance with the exception of an oak riparian woodland along Santa Ysabel Creek. The surrounding southern mixed chaparral supports blue-gray gnatcatchers, orange-throated whiptails, and San Diego horned lizards.

Boden Canyon/Clevenger Canyon Area

High quality riparian woodland lines the creeks in the canyons and at the confluences with Santa Ysabel Creek. Least Bell's vireos and warbling vireos were observed at the mouth of Clevenger Canyon. The habitats in both canyons are similar to those in Santa Ysabel Creek, although the tree species diversity decreases as the riparian habitat transitions to oak woodland higher in the canyons. Boden Canyon has a sandy creekbed with a low understory.

Boden Canyon leads up to the open spaces of the Rancho Guejito area and the Cleveland National Forest. Santa Ysabel Creek continues unconstrained into the National Forest. Clevenger Canyon links the upper San Pasqual Valley to the Santa Maria and Ramona valleys. The creek itself becomes constrained for wildlife movement as Highway 78 drops into the oak canopy upstream and is lined by rural housing. A narrow gap between the development of the Santa Maria Valley along the north side of the creek and development underway at the top of the south bank may still allow passage of animals.

Area 23 - San Vicente Reservoir

During the winter, suitable habitat along the San Vicente Reservoir was surveyed for California gnatcatchers. Areas surveyed included an island in the lake, large expanses of coastal sage scrub south of the dam, and patches of sage scrub on the steep slopes along the western and northern shores of the reservoir. The northeastern edge of the reservoir was also briefly surveyed. Most of the habitat to the north and west of the reservoir consists of steep boulder strewn slopes with fingers of coastal sage scrub habitat on south facing slopes interspersed among large expanses of charrise chaparral and occasional small stands of oak trees. Some areas show signs of having been burned by wildfire.

Sixty avian species were detected during the gnatcatcher surveys: 12 of these species are considered sensitive and 6 are classified as MSCP target species. Two pairs of gnatcatchers were detected in coastal sage scrub to the west and northwest of the boat launch facilities along the western edge of the reservoir. Mews from an unseen gnatcatcher south of the dam indicate the potential for additional pairs in this area.

Large granite boulders, outcrops, and cliff faces provide nesting and roosting sites for raptors while the reservoir and surrounding open space provide foraging opportunities. Sensitive raptors observed at San Vicente Reservoir include turkey vulture, osprey, bald eagle, golden eagle, and peregrine falcon. Some of the avian species observed utilizing the reservoir include common loon, western and Clark's grebes, American white pelican, double-crested cormorant, great-blue heron, snowy egret, gadwall, greater and lesser scaup, common merganser, and belted kingfisher. Coastal sage scrub and chaparral habitats supported species such as Anna's hummingbird, Say's phoebe, bushtit, canyon wren, Bewick's wren, California thrasher, southern California rufous-crowned sparrow, and Bell's sage sparrow.

Area 24 - Otay Lakes

California gnatcatcher surveys were conducted in the winter in coastal sage scrub along the shorelines of portions of Upper and Lower Otay Lakes. Areas surveyed included city owned property around Upper Otay Lake, the shoreline around the northwestern arm of Lower Otay Lake, and the eastern edge of Lower Otay Lake, from the dam north to the vernal pool peninsula south of the lakeshore and north of Buschalaugh Cove. Coastal sage scrub in these areas is dominated by California sagebrush and flat-topped buckwheat. In the vernal pool area north of Buschalaugh Cove, the scrub is sparse with shrubs clumped on mima mounds and with a high abundance of annual herbaceous cover between the mima mounds. South and east of this area chamise chaparral is interspersed with patches of coastal sage scrub. The shoreline around the northwest arm of the lake supports coastal sage scrub with an abundant herbaceous cover between the shrubs. Along the southeast side of Upper Otay Lake is a large patch of Munz's sage, and the slopes to the northeast are open and grassy from an old burn. Freshwater marsh is found in a narrow fringe, broadening at the coves, along much of the lakeshore.

Upper and Lower Otay Lakes support an extremely rich and diverse avian assemblage, with 92 species detected during the winter gnatcatcher surveys. Fourteen sensitive bird

species were observed, 8 of which are target MSCP species. There is a very high density of California gnatcatchers around the Upper and Lower Otay Lakes, with thirty-two pairs documented during the winter surveys. City-lands along the eastern arm of the lake and the southwestern edge were not surveyed but are known to support additional pairs (Ogden 1992). Privately owned lands adjacent to the city owned lands next to the lakes also support a significant number of gnatcatchers.

Open scrub, chaparral, and grassland habitats in the vicinity of Upper and Lower Otay Lakes support a high number of foraging raptors. Nesting and roosting sites are found in the San Miguel, San Ysidro, and Jamul mountains, as well as in larger trees west of Upper Otay Lake and at Dulzura Creek at the east end of Lower Otay Lake. Sensitive raptor species observed include osprey, northern harrier, sharp-shinned hawk, Cooper's hawk, red-shouldered hawk, and golden eagle. Some of the bird species observed using the lakes include pied-billed, eared, and western grebes, double-crested cormorant, great-blue heron, great egret, green-backed heron, northern pintail, canvasback, ring-necked duck, common moorhen, American coot, greater yellowlegs, least sandpiper, common snipe, Bonaparte's gull, and Forester's tern. Coastal sage scrub and chaparral habitats supported a number of avian species including California quail, common raven, bushtit, rock wren, Bewick's wren, blue-gray gnatcatcher, California thrasher, rufous-crowned sparrow, and sage sparrow. Virginia rail, sora, common yellowthroat, Savannah sparrow, song sparrow, red-winged blackbird were among those species found in freshwater marsh areas.

APPENDIX A-7

Population Viability Analysis for the California Gnatcatcher within the MSCP Study Area

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1.0 INTRODUCTION

Two types of ecological analyses, denoted by the acronyms PVA and MVP, have become central to sensitive species evaluations in recent years. The objective of a PVA, or population viability analysis, is to identify all threats, natural and human-caused, to a population and determine if these threats endanger the continued existence of the population. An MVP, or minimum viable population, is the smallest population that has a specified probability of remaining extant (not going extinct) within a specified period of time. For example, one might wish to determine the population size necessary to maintain a population with 95% probability over 200 years. The term viability refers to the ability of a population to persist, and is the converse of vulnerability, or the propensity of a population to go extinct. Virtually all aspects of the biology of a species must be considered in determining the actual viability of a real population. It is widely appreciated by biologists that larger populations are more viable than smaller populations, but actually predicting the viability of a given population is a difficult and uncertain undertaking. The following sections discuss the status, biology, and threats to the California gnatcatcher within the Multiple Species Conservation Program (MSCP) study area and present a computer simulation model to evaluate alternative reserve designs for this metapopulation.

2.0 BACKGROUND

2.1 DECLINE IN POPULATION OF THE CALIFORNIA GNATCATCHER

The California gnatcatcher (*Polioptila californica californica*) is one of three recognized subspecies within the species *Polioptila californica* (Atwood 1991). This small songbird was previously a widespread resident of coastal sage scrub (CSS) habitats in much of southern California and northern Baja California. The subspecies was recorded from coastal areas of southern Ventura County to approximately 30° N latitude in Baja California. Eastern limits of the species' United States distribution historically were the most western portions of San Bernardino and Riverside counties. The interior distributional limits of *P.c. californica* in northern Baja California are not accurately known, but it is believed to be limited primarily to a relatively narrow band of suitable habitat along the coast below elevations of 250 meters (Atwood 1991, Atwood and Bolsinger 1992).

The distribution and relative abundance of California gnatcatchers appear to have been patchy and highly localized even prior to the extensive changes in land use during the past ninety years. Grinnell (1898) found gnatcatchers to be "numerous" in the San Fernando Valley and about Pomona and Claremont, but gnatcatchers were not detected between these two localities (i.e., near Pasadena), although suitable habitat apparently was present. This patchy distributional pattern has been accentuated by the agricultural and urban development of southern California. By 1944, Grinnell and Miller noted that suitable habitat for *P.c. californica* had been "somewhat reduced." Pyle and Small (1961) and McCaskie and Pugh (1964) considered the species rare and attributed the lack of recent sightings in historically occupied areas to loss of habitat. Atwood (1980) conducted an extensive, although not exhaustive, survey of the species' status and reported to the California Department of Fish and Game (CDFG) that continued loss of already limited habitat warranted an immediate concern for the subspecies within the United States.

Population declines have been most evident in the three northern counties of the species' historical distribution. Gnatcatchers apparently have been extirpated from Ventura and San Bernardino counties, and a single remnant population is known on the Palos Verdes Peninsula in Los Angeles County. Other small remnant populations may still exist near Azusa, Tujunga, and Claremont, where relatively recent sightings (1960-1984) were documented (Atwood 1990). The most substantial U.S. populations of California gnatcatchers currently occur in Orange, Riverside, and San Diego counties.

No population estimate of the total number of breeding pairs extant in the early twentieth century is available. Atwood (1980) estimated between 1000 and 2000 breeding pairs remained in the United States. In a more detailed population assessment, Atwood (1990) made a "best-case" estimate of 1200 to 2000 breeding pairs based on a rough analysis of areas with moderate habitat potential. The U.S. Fish and Wildlife Service (USFWS) population estimate is 1800 to 2300 pairs, with 770 to 960 pairs in San Diego County (USFWS 1991). Nearly 1,700 geographically distinct gnatcatcher localities are recorded within the MSCP study area in Ogden's regional database. Based on the distribution of habitat and recent gnatcatcher sightings, Ogden estimates the gnatcatcher population within the MSCP study area likely exceeds 900 pairs. This is a conservative estimate since a substantial portion of the MSCP study area has not yet been adequately surveyed for gnatcatchers.

The decline of the California gnatcatcher is primarily attributed to the reduction of CSS habitat throughout the range of the subspecies. Loss, degradation, and fragmentation of CSS habitat have occurred as the result of agricultural and urban development in southern California and northern Baja California (O'Leary 1990). The USFWS has estimated that CSS habitat has been reduced by 70 to 90 percent of its historical extent (USFWS 1991). In addition to habitat loss and degradation, potential adverse effects of brown-headed cowbird brood parasitism and human-subsidized predators (e.g., domestic cats) on the reproductive output of breeding pairs may also contribute to a reduction in the long-term viability of California gnatcatcher populations adjacent to development.

2.2 CURRENT STATE AND FEDERAL STATUS OF THE CALIFORNIA GNATCATCHER

To date, the California gnatcatcher is not listed by federal or state resource agencies. It is presently a federal Candidate 2 species and a state Species of Special Concern. On September 18, 1990, the San Diego Biodiversity Project and Palomar Audubon Society filed a petition with the Portland Regional Office of the USFWS to list the California gnatcatcher as endangered under the federal Endangered Species Act of 1973. On December 15, 1990, the Natural Resources Defense Council (NRDC) and the Manomet Bird Observatory filed a separate petition with the USFWS to list the California gnatcatcher as an endangered species. This petition sought a listing on an emergency basis, or in the alternative, to list through the normal process under the Act. On September 5, 1991, the USFWS made the finding that listing of the California gnatcatcher is warranted and initiated preparation of a draft listing regulation to be circulated for public review. A final determination of whether to list the gnatcatcher will be made before March 17, 1993 by the USFWS. An emergency listing can be implemented by the USFWS at any time during this review process.

The NRDC petition was also filed with the CDFG on February 28, 1991. The Fish and Game Commission denied State Candidate Species status for the gnatcatcher on August 30, 1991. The NRDC has subsequently filed suit against the Fish and Game Commission to reverse their decision. A State Candidate Species is protected under the "taking" provisions of the State Endangered Species Act during the one-year public review process. Any proposed taking of a State Candidate Species during this time period must be done after a permit is granted by the CDFG.

2.3 CALIFORNIA GNATCATCHER BIOLOGY

The gnatcatcher genus *Polioptila* is a distinctive group of small (5-7 grams), long-tailed, insectivorous songbirds. The genus consists of 12 species, primarily distributed throughout the tropical and sub-tropical New World. Three species occur in the United States. The plumage characteristics of *Polioptila* are relatively constant, being predominantly gray with varying amounts of black on the head of the adult male during the breeding season and varying amounts of white on the outer tail feathers. Based on a recent taxonomic study (Atwood 1988), the American Ornithologists' Union recognized the coastally distributed California gnatcatcher (*P. californica*) to be a taxonomically distinct species that is reproductively isolated from the black-tailed gnatcatcher (*P. melanura*) of the North American desert regions (AOU 1989). The California gnatcatcher historically was distributed from southern Ventura County eastward to western San Bernardino and Riverside counties and southward to the Cape region of Baja California.

There are three described subspecies of California gnatcatcher (Atwood 1991). *P. c. californica* is the only subspecies found in the United States, with its southern distributional limits at 30° N latitude. This latitude coincides with the southern distributional limits of the CSS plant community in which *P. c. californica* is typically found. *P. c. margaritae* occurs in Baja California from 30° N south to 24° N latitude and *P. c. abbreviata* occurs in the Cape region of Baja California, south of 24° N latitude.

The California gnatcatcher is a year-round resident of sage scrub habitats on the coastal slope of southern California and northwestern Baja California. Individuals are rarely seen outside areas of regular residency. The most striking plumage characteristic of *P. californica* is the fairly dark sooty-gray color of the underparts (Dunn and Garrett 1987). The underparts of the other two U.S. gnatcatcher species, the black-tailed gnatcatcher and the blue-gray gnatcatcher (*P. caerulea*), are much lighter in color. The blue-gray gnatcatcher is a "white-tailed" gnatcatcher due to its almost completely white outer tail feathers. The different color of the outer tail feathers is the diagnostic field character that distinguishes the California gnatcatcher from the blue-gray gnatcatcher during the winter months when these two species co-occur in the same area. The distributions of black-tailed and California gnatcatchers are geographically distinct within the U.S., but they co-occur in a small area of Baja California.

In addition to differences in plumage characters, the three U.S. gnatcatcher species also have distinct vocalizations. The blue-gray gnatcatcher's call is a soft *speeee*, which is unlike either of the two "black-tailed" species. The song of the black-tailed gnatcatcher includes a distinctive quick series of staccato *chee-chee-chee* notes on one pitch along with a descending, raspy wren-like call. The California gnatcatcher produces a variety of calls, but the most common call is a cat-like mew *zeeer*.

The California gnatcatcher resides in CSS habitats that typically are dominated by California sagebrush (*Artemisia californica*) and flat-top buckwheat (*Eriogonum fasciculatum*). In San Diego County, California gnatcatchers show a strong positive association for California sagebrush, flat-top buckwheat, broom baccharis (*Baccharis sarothroides*), and laurel sumac (*Malosma laurina*; RECON 1987, ERCE 1991, Mock et al. 1990). California sagebrush and flat-top buckwheat are the dominant plant species used by gnatcatchers when foraging for insects. Laurel sumac is used primarily as a high perch for territorial vocalization (ERCE 1991, Ogden 1992, unpublished data).

A strong negative preference has been documented for sage scrub dominated by black sage during drought conditions (*Salvia mellifera*; Mock et al. 1990, Atwood 1990, Bontrager 1991). Several black sage-dominated areas not occupied by gnatcatchers during drought years (i.e., 1988-1990) have become occupied during 1991 and 1992 (Ogden unpublished data, B. Jones pers. comm.). Under stressful environmental conditions, black sage may produce secondary plant compounds (e.g., terpenes; Tyson et al. 1974) that have insecticidal properties. The production of these compounds may make black sage less suitable for foraging gnatcatchers. Where black sage patches occur within a mosaic with patches dominated by California sagebrush, gnatcatchers show a preference for the sagebrush areas (Mock 1992).

A wide variety of sage scrub plant species are used for nesting by gnatcatchers. The choice of a host plant appears to be dependent on the relative availability of the plant species and its structural capability to support a nest (Atwood 1990; Ogden 1992, unpublished data). The nest typically is constructed of grasses, bark, small leaves, and other materials. Nests are usually placed less than 1 m from the ground in a shrub located on a flat to gentle slope (less than 40% slope; Ogden 1992). Vegetation structure around the nest site is typically composed of shrubs about 1 meter in height with a semi-open canopy. Gnatcatchers begin nest-building in late February and the first set of eggs is laid after March 20 (Unitt 1984). Nests at the incubation stage can be found in early August. Most nestlings leave the nest

between early May and early July. Fledglings usually remain within their parents' breeding territory for 3-5 weeks. Nest predation is a common event, but breeding gnatcatchers are persistent, usually making several nesting attempts in a season.

Producing more than one successful nest within a season is dependent upon seasonal climatic conditions, food availability, and predation pressure during the breeding season. The incidence of multiple brooding appears to be highly variable between years and location (Bontrager 1991, Braden 1992, ERCE 1991, Ogden 1992, Ogden unpublished data). Both sexes participate in territory defense, nest construction, incubation, and parental activities. Nest building requires 4 to 13 days prior to laying of the first egg of a clutch of 3 or 4 (rarely 5) eggs. The mean productivity of the gnatcatcher population in the Rancho San Diego area was 2.7 fledglings per pair for the three-year period of 1989-1991, with a coefficient of variation between years of 54% (ERCE 1991; Ogden 1992, unpublished data). Fledging success was lowest in 1990 (1.6 fledglings/pair) and highest in 1991 (4.3 fledglings/pair).

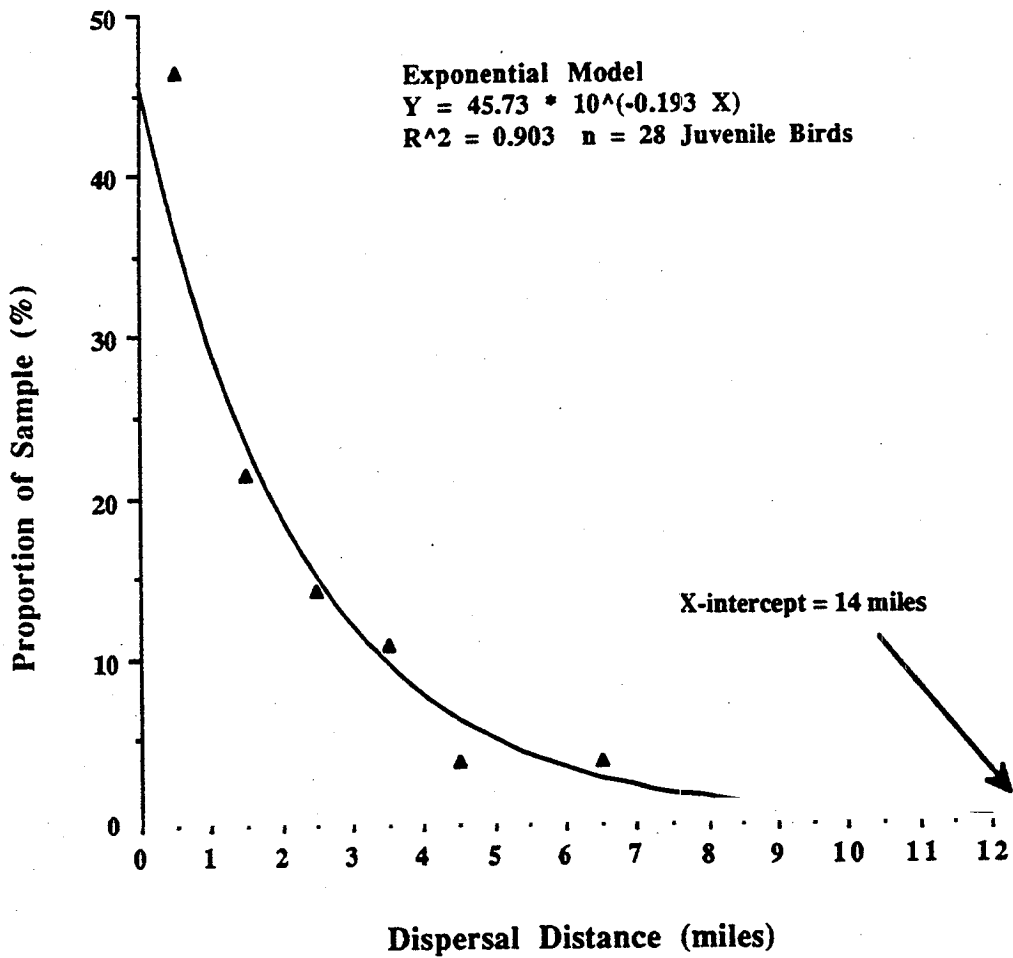
California gnatcatchers maintain year-round territories. The boundaries of the defended territory are usually sharply defined during the breeding season (late February to early August; Ogden 1992, Ogden unpublished data). During fall and winter, the home range of an established pair expands to include areas not used or defended during the breeding season. These winter expansion areas are not actively defended, but are neutral areas often used simultaneously by neighboring pairs. Breeding territory boundaries are defended throughout the year, although the intensity of aggressive behavior fluctuates seasonally. The most intense periods of territorial behavior is during the beginning of the breeding season and during the late summer and early fall when dispersing juveniles pass through established territories. Territory boundaries usually follow natural physical features such as ridges, roadways/trails, or where there is an abrupt change in vegetation composition (e.g., sage scrub-chaparral interface).

The California gnatcatcher appears to have highly variable and relatively large home range requirements for a small songbird. In San Diego County, documented gnatcatcher breeding home ranges have varied from 6 to 45 acres (SEB 1986, RECON 1987, ERCE 1991, Ogden 1992, Ogden unpublished data). The winter home range of a gnatcatcher pair is typically about 70% larger than their breeding season territory and, to a limited extent, occasionally includes habitats other than sage scrub (e.g., riparian scrub, chaparral; ERCE 1991, Atwood 1990; Ogden 1992, unpublished data). Ogden (1992) compiled home range

size estimates for over 50 breeding territories. The overall mean is about 17 acres. Territories less than 7 miles from the coast, all of which are constrained by development, averaged slightly less than 10 acres and more inland territories averaged slightly less than 19 acres. Inland territories constrained by development averaged less than 11 acres. These data suggest that gnatcatchers may need 6 to 15 acres to meet their energetic requirements for breeding, but they are able to defend much larger areas, at least when population densities are relatively low. Gnatcatchers have enlarged their territories to encompass much of a neighboring territory when the neighboring pair died and was not replaced by dispersing juveniles (Ogden 1992).

Adult gnatcatchers appear to be site tenacious, remaining in the same territory for their entire adult life. The exception to this generality is when an experienced adult loses its mate between breeding seasons and is unable to acquire a new mate prior to the next breeding season. Ogden (1992, unpublished data) has documented several instances in which a widowed female abandoned her established territory and paired with a widower male in an adjacent territory. There has been one observation of an established male abandoning his territory. This was a male in a peripheral territory who lost his mate and was unable to acquire a new mate prior to the next breeding season. The majority of movements by established adults were less than 0.5 mile, with a maximum distance less than 2 miles ($n < 10$ birds).

To date, Ogden (1992) has documented the dispersal of 28 juvenile gnatcatchers banded in their natal territories. Assuming gnatcatchers prefer to follow corridors of natural topography and natural habitats relative to landscaped or graded areas, these juveniles dispersed from 0.5 to 6.1 miles from their banding site (Figure 1). Mean dispersal distance was 1.75 miles (± 0.26 SE), with a median of 1.37 miles. The maximum dispersal distance of juvenile gnatcatchers is likely to be larger than the maximum distance documented by Ogden's studies. Dispersal studies are limited by the size of the search area and the level of effort expended to detect banded individuals within the search area (Cunningham 1986). Average dispersal distance was nearly identical between sexes. In Riverside County, one banded juvenile gnatcatcher was resighted nearly 9 miles from the natal territory. The two other juveniles were both resighted 6.3 miles from their natal



territories (Braden 1992). The Rancho San Diego data predict a maximal dispersal distance of about 14 miles using an exponential model (Figure 1).

Juveniles become independent of their parents 3-5 weeks after leaving the nest. Parents actively exclude independent fledglings from their territory by scolding and chasing them outside of their territory boundaries. Juveniles roam widely, sometimes briefly joining a neighboring family group until they are forced out by the established pair. Eventually juveniles find undefended areas between or at the edge of occupied territories to maintain themselves. Juveniles may mate with other first-year birds, or with established residents that have lost their mate. Pairing may occur within a few weeks after leaving the natal territory if a potential mate is encountered early, or the juveniles continue their dispersal further away. Most juveniles are established territorial residents by early October. A majority of juveniles likely die before they are able to acquire a mate and establish a territory (e.g., Sullivan 1989).

Information on annual adult survival is limited to Ogden's population studies in the Rancho San Diego area (Ogden 1992, unpublished data) and a one-year study conducted in southern Orange County (Bontrager 1991). Average annual adult survival in the Rancho San Diego area was 39.2% for the three-year period of 1989-1992 (Ogden 1992, unpublished data). Survival was low during cold, wet winters of 1989-1990 and 1991-1992, resulting in adult survival of 25.6% and 32.6%, respectively. The gnatcatcher population survived better during the milder 1990-1991 winter, with 59.5% of the adults surviving to breed in 1991. The 1990-1991 gnatcatcher study in Orange County had an annual adult survival of 60.9% (D. Bontrager pers. comm.). This range of variation in annual adult survival is consistent with that of other songbirds (Karr et al. 1990, Martin and Li 1992).

3.0 POPULATION VIABILITY ANALYSIS

3.1 THREATS TO THE VIABILITY OF THE GNATCATCHER POPULATION

a. Direct Human Impacts

In general, the greatest threats to wildlife populations come as a direct consequence of human activities that cause habitat loss, degradation, and fragmentation. The first two directly reduce population size while the impact of fragmentation may be more subtle

(Wilcox and Murphy 1985, Rolstad 1991, Sanders et al. 1991). The fragmenting of habitat has been shown to lead to increased mortality in animal populations through a number of mechanisms. The interface between different types of natural habitats (i.e., ecotone) can be beneficial to some species. For instance, least Bell's vireos often nest at the interface between riparian and upland habitats. However, the interface between natural habitat and human-modified habitat (i.e., edge) is often associated with negative impacts that are generally detrimental to the value of the habitat to wildlife (e.g., Bolger et al. 1991, Harris 1988, Laurence and Yensen 1991).

The physical conditions along the edge of a patch of vegetation are different from those in the center. For this and other reasons, the composition of the vegetation is usually different at the edge than at the core of the patch (e.g., Alberts et al. *in press*). Human impacts also penetrate across the edge. Trampling of vegetation and path creation is usually greater near the edge of a patch. Alien plants and animals invade the native habitat at edges. Introduced predators, such as cats and dogs, and enhanced predators (natural predators whose densities are enhanced by the presence of humans), including skunks, raccoons and opossums, penetrate the native vegetation along edges (Churcher and Lawton 1987, Soulé et al. 1988). Because more of the area of a small patch is close to an edge than the area of a large patch, the usefulness of small patches as wildlife habitat is reduced. Excessive road traffic noise may also indirectly impact breeding gnatcatchers, but the available data are conflicting on this issue (Ogden 1992, RECON 1992). Brown-headed cowbird nest parasitism of gnatcatchers has been reported as being a potentially significant factor (Bontrager 1991, Braden 1992) to highly incidental (Ogden 1992, unpublished data). Direct and indirect impacts associated with development can be controlled through proper preserve design, habitat preservation, buffer zones, and appropriate habitat management (Kelly and Rotenberry *in press*).

b. Demographic Variability

Demographic variability is simply chance events that independently affect the survival and reproduction of individuals within a population. These are most important in very small populations. For instance, in a very small population (e.g., ten individuals), it is possible all individuals would die in a single year, independent of any climatic effects; or, all offspring born during a given period would be the same sex and if all the adults died, the population would be doomed because it would consist solely of the same sex. These types

of demographic anomalies are a serious threat to only very small populations (e.g., < 20 individuals; Soulé 1983, Pimm et al. 1988, Tracy and George 1992).

c. Environmental Variability

Environmental variability is simply the natural vagaries of climate. Year to year variation in temperature, precipitation, and food supply affect the survival and reproduction of organisms. The viability of most populations decreases with greater environmental variation. A long series of bad years (i.e., years in which survival and/or birth rate are low) may threaten the existence of a population. In the absence of human-caused threats, environmental variation is probably the greatest threat to population viability (Dennis et al. 1991, Stacey and Taper 1992, Virkkala 1991). Annual fluctuations in birth rate and survival are the expression of environmental variability. Long-term population data, which would allow us to directly estimate year to year variation in survival, fecundity, and population density, do not exist for the gnatcatcher. Instead, we have considered the information that is available in the literature on annual variation of songbird population dynamics.

The traditional view is that annual variation in reproductive rate in arid region songbirds is driven by variation in precipitation. It has been amply demonstrated that primary productivity in arid zone vegetation is tightly correlated with precipitation. The density of plant-feeding insects upon which insectivorous birds feed also varies with precipitation. Thus, the level of precipitation determines the amount of food resources available to the birds. This should affect not only birth rate, but survival as well when precipitation coincides with cold temperatures (Gessaman and Worthen 1982, Lustick and Adams 1977, Ogden 1992, Ogden unpublished data). Empirical work has shown a linkage between variation in weather, food resources, and songbird demographic parameters (e.g, Holmes et al. 1991, Marr and Raitt 1983, Martin 1987, Rodenhouse and Holmes 1992, Simons and Martin 1992, Ogden 1992, Ogden unpublished data).

Other studies have shown a complex interaction of weather, nest predator density, and avian reproductive success. Rotenberry and Wiens (1989) found weak and often insignificant correlations between precipitation and reproductive parameters in three species of arid zone birds. They found nest predation rates to be the most important factor determining the number of offspring successfully fledged. The density of nest predators, primarily snakes and ground squirrels, did not respond directly to annual precipitation, but

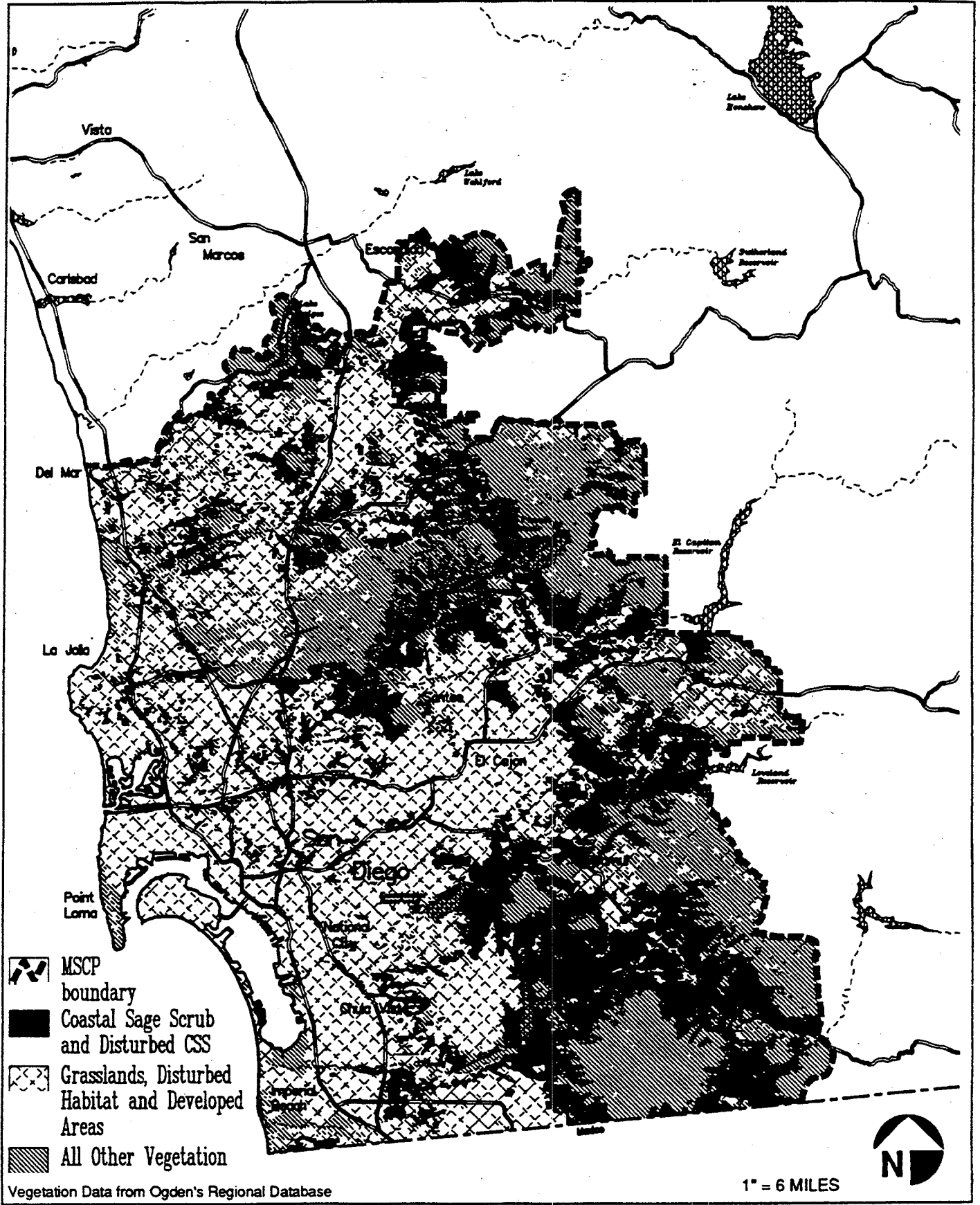
rather the response was lagged in time. Nest predation has been shown to be important in a number of songbird species. Nest failure due to predation is common in the gnatcatcher population, accounting for nearly 80% of unsuccessful nests with the predation event most often occurring during the egg stage (Bontrager 1991, Braden 1992, ERCE 1991, Ogden 1992, unpublished data). It is likely that gnatcatcher densities do respond to variation in weather; however, the relationship is likely to be a complex interaction with variation in predation pressure (Lima 1987, Martin 1992, Reitsma et al. 1990, Rotenberry and Wiens 1989, Ogden 1992, unpublished data).

3.2 SPATIAL ARRANGEMENT OF COASTAL SAGE SCRUB AND CALIFORNIA GNATCATCHER POPULATIONS IN THE MSCP STUDY AREA

The vegetation communities within the MSCP study area were mapped by Ogden using color infrared aerial photographs (1:24,000), verified by helicopter overflights, existing detailed vegetation maps, and limited ground-truthing. The vegetation map was incorporated into a geographic information system (GIS) with Spot and Thematic Mapper satellite images for geographical reference. The CSS within the MSCP study area is located in a roughly north-south band that can be considered approximately continuous within a landscape mosaic (Figure 2). The somewhat patchy distribution of coastal sage scrub within the landscape has been further fragmented by intervening agriculture and urban development (O'Leary 1990).

Substantial populations of gnatcatchers (greater than 20 pairs) are located throughout much of this band of sage scrub (Figure 3). Significant areas of sage scrub, particularly in the more inland portions of the study area, have not been adequately surveyed. Hence, the known gnatcatcher distribution is biased toward coastal areas which are more likely to have had biological surveys conducted as part of the environmental review of proposed development. However, inland areas that have had focused gnatcatcher surveys generally support substantially lower gnatcatcher densities than coastal areas (Mock et al. 1990, Mock 1992, Ogden 1992, Ogden unpublished data).

The fragmented distribution of the CSS and the known concentrations of gnatcatchers suggest a metapopulation model is an appropriate representation of the California



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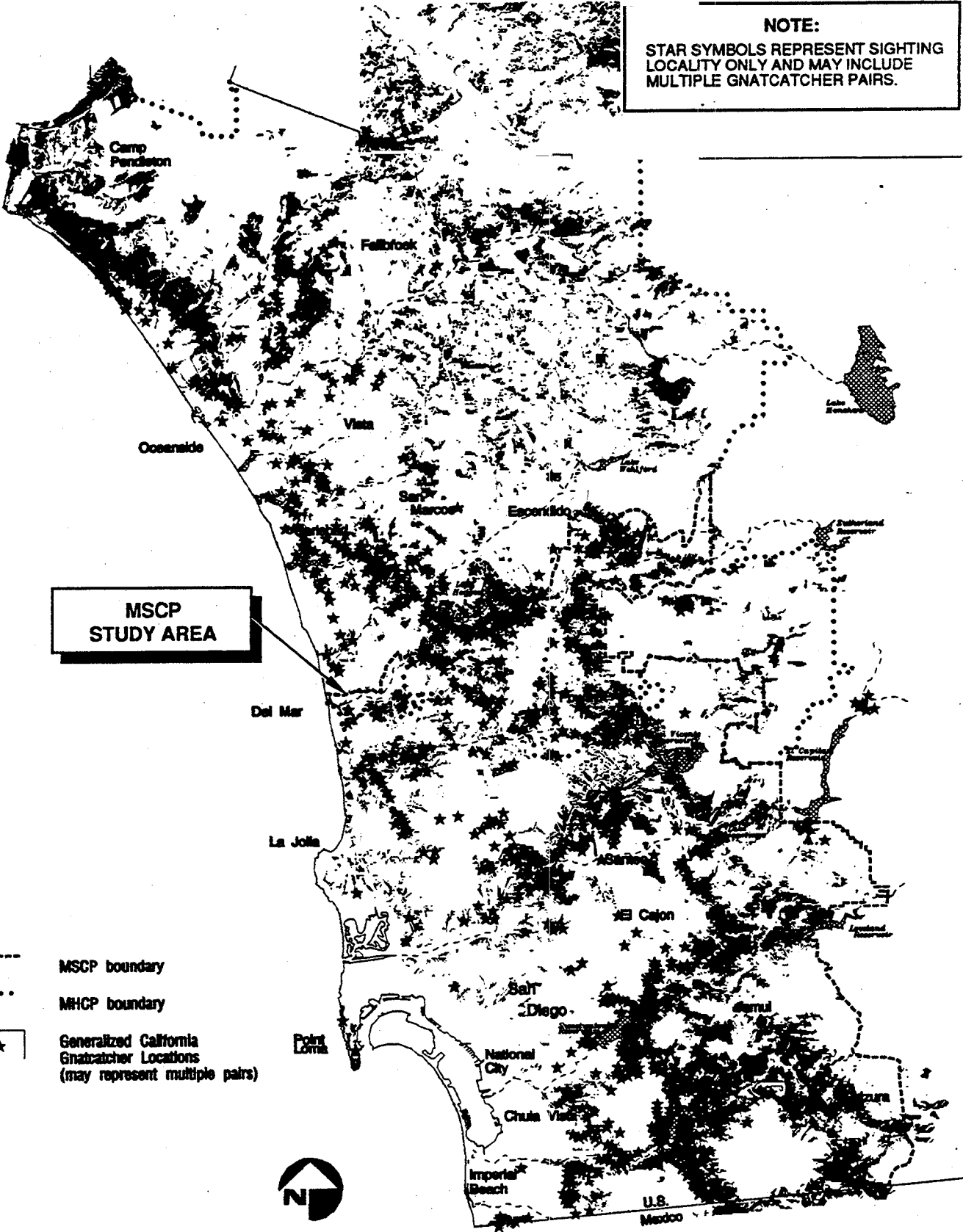
Distribution of Coastal Sage Scrub in the MSCP Study Area

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FIGURE

2

NOTE:
 STAR SYMBOLS REPRESENT SIGHTING
 LOCALITY ONLY AND MAY INCLUDE
 MULTIPLE GNATCATCHER PAIRS.



**MSCP
 STUDY AREA**

- MSCP boundary
- MHCP boundary
- ★ Generalized California Gnatcatcher Locations (may represent multiple pairs)



1" = 8 miles

DATA SOURCES: Vegetation and Sightings from OGDEN's Regional Database



California Gnatcatcher Sightings (1985 - 1992)
 in Western San Diego

FIGURE

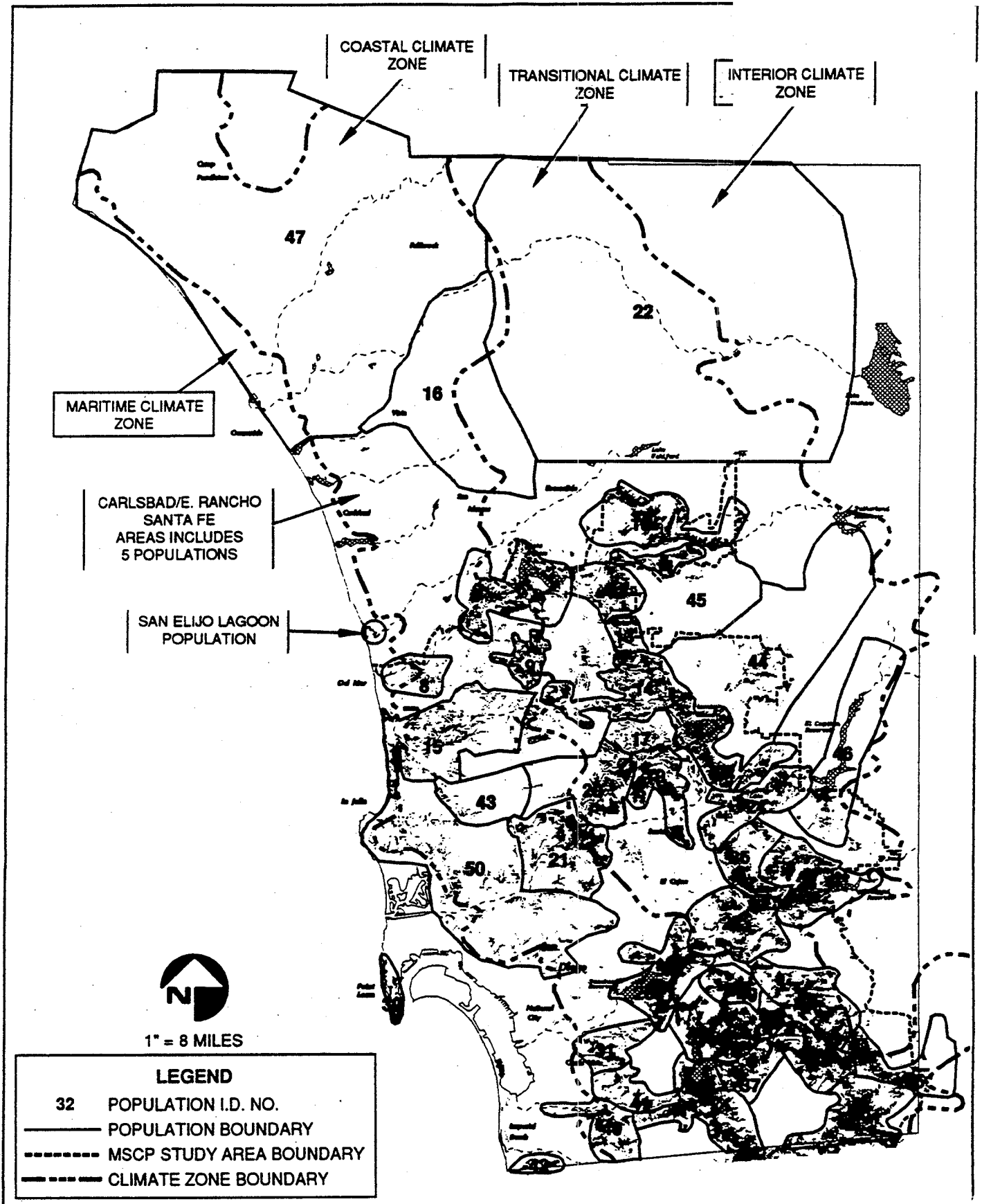
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gnatcatcher population within the MSCP study area (Figure 4). Large areas of CSS and higher concentrations of gnatcatchers form the populations of the metapopulation. Smaller patches and linear strips of CSS and other intervening shrubland habitats serve as corridors between the populations. The eventual development of much of the land outside of the implemented reserve system will further accentuate the metapopulation characteristics of the gnatcatcher population in the study area.

The spatial arrangement of populations is very important to the dynamics of a metapopulation relative to a simple isolated population. Due to the distribution of CSS within the study area, the spatial arrangement of gnatcatcher populations is approximately linear from the Otay Mesa area to the Carlsbad area. The most direct connection to Camp Pendleton is assumed to be via the San Luis Rey River drainage system to Escondido since the developed portions of Oceanside and Vista most likely act as a barrier to gnatcatcher dispersal. Important east-west connections occur primarily along major drainages. For example, several populations (Del Mar, Lake Hodges, South Escondido/San Pasqual Valley) occur along the San Dieguito River, which likely functions as a dispersal corridor between these populations. Figure 4 depicts the segregation of potential gnatcatcher habitat into populations within the MSCP study area and the remainder of western San Diego County. This configuration was used in the metapopulation simulation model described below.

For the gnatcatcher simulation model, we assumed that the gnatcatcher metapopulation functioned at the landscape level as a network of populations with source-sink dynamics (Pulliam 1988, Pulliam and Danielson 1991, Dunning et al. 1992). Landscape refers to the mosaic of habitat patches in which a particular patch (or population) is embedded. The landscape level occupies the range of spatial scales between an organism's normal home range (<100 acres for the gnatcatcher) and its regional distribution (the four counties that currently support gnatcatchers in the United States). Source-sink dynamics is the process of differential exchange of migrants between populations due to differences in productivity between source (highly productive) and sink (less productive) populations. Sink populations eventually go extinct without immigration from a source population (i.e., the rescue effect; Brown and Kodric-Brown 1977, Stacey and Taper 1992).

Source and sink gnatcatcher populations were defined by climate zones, as delineated by the University of California Agricultural Extension Service (1970), in which each population resided (Figure 4). We assumed populations in areas with relatively mild



FIGURE

Segregation of California Gnatcatcher Habitat into Populations
For Input into the Metapopulation Simulation Model

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4

weather patterns (maritime climate zone) are more stable, resilient, and productive than areas with more variable and cooler weather patterns (transitional climate zone). Populations within the coastal climate zone were assumed to have intermediate population parameters in the continuum of source-sink dynamics.

3.3 GIS HABITAT EVALUATION FOR CALIFORNIA GNATCATCHERS WITHIN THE MSCP STUDY AREA

We evaluated the potential for coastal sage scrub within the MSCP study area to support California gnatcatchers by relying on three factors: CSS patch size, elevation, and slope gradient. Details of this evaluation model are provided in Appendix A. Table 1 presents the results of this three-factor model that delineates potential gnatcatcher habitat. Over 70% of the gnatcatcher sighting localities within coastal sage scrub (as mapped by the MSCP database) occur in areas that met all three factors. CSS that met all three factors was the highest potential to support California gnatcatchers and was placed in the High Value category in the MSCP Composite Habitat Evaluation

Handwritten notes: an arrow points to the text above; "Handbook" is written vertically; "HCP" and "Sheel" are written next to it.

ON SIMULATION MODEL - RAMAS/SPACE

We used an existing metapopulation simulation program, RAMAS/space (Exeter Software, Setauket, New York) to explore the effects of spatial arrangement of populations in potential reserve designs. Lamberson (1992) recently reviewed the three versions of RAMAS available. RAMAS/space has recently been used to model populations of several vertebrates, including California spotted owl, light-footed clapper rail, seabirds, and amphibians (R. Akçakaya pers. comm.). RAMAS/space models metapopulations consisting of multiple, discrete populations such as our representation of the gnatcatcher metapopulation in Figure 4. The areas between the populations function only as movement corridors between populations.

RAMAS/space includes within-population dynamics (birth and death) and between-population dynamics (immigration and emigration). These population dynamics are modeled as randomization (stochastic) functions so that within-population growth is based on randomly drawn values from a predetermined lognormal probability distribution of the

TABLE 1
RESULTS OF CALIFORNIA GNATCATCHER GIS HABITAT EVALUATION MODEL FOR THE MSCP STUDY AREA

| Category | CSS Habitat (acres) | Total No. Gnatcatchers in CSS within Category† | Percent of Gnatcatchers in CSS within Category† | Percent of All Gnatcatchers within Category† |
|-------------------------------------|---------------------|--|---|--|
| All CSS within MSCP Study Area | 117,602 | 1,429 | 100% | 84% |
| BASIC FACTORS | | | | |
| Large CSS Habitat Patches* | 97,070 | 1,225 | 86% | 72% |
| CSS Below 950-foot Elevation | 72,689 | 1,280 | 90% | 76% |
| CSS on Slopes less than 40% | 95,793 | 1,313 | 92% | 78% |
| COMBINATION OF BASIC FACTORS | | | | |
| Large Patch Size & Elevation | 57,664 | 1,095 | 77% | 65% |
| Large Patch Size & Slope | 77,576 | 1,124 | 79% | 66% |
| Elevation & Slope | 63,691 | 1,193 | 83% | 70% |
| All Three Factors | 49,643 | 1,015 | 71% | 60% |

† Total number of gnatcatcher localities in MSCP GIS database is 1694; a minority of sightings (265) occur in baccharis scrub and other types of scrub that were classified as habitats other than CSS.

* CSS Patches ≥ 25 acres in maritime and coastal climate zones and ≥ 50 acres in transitional climate zone.

average population growth rate (R). Demographic and environmental stochasticity, environmental correlation between populations, and density-dependent growth are other features included in the model. Between-population migration is a two-way, density- and distance- dependent process based on a user-specified migration function with stochastic sampling from a binomial distribution.

The following model parameters can be specified by the user for each population:

1. **Maximum Population Growth Rate (R_{max}).** A discrete-time, density-dependent logistic growth function was employed:

$$N_{t+1} = N_t \cdot \exp\left[r \cdot (K - N_t / K)\right],$$

where r is the instantaneous rate of increase at low population densities. r is defined as the natural logarithm of the finite rate of population increase (R): $r = \ln(R)$. R_{max} is the slope of the growth curve as the population size at time t (N_t) approaches zero. The input value of R_{max} is a value appropriate when the population size is low and well below the population carrying capacity (K). Population growth was assumed to be density independent at low population sizes (i.e., Allee effects were not included in our simulations; however, RAMAS/space does include an option for Allee effects).

2. **Standard Deviation of R.** This parameter makes the simulation stochastic and is used to model the fluctuations in the population growth rate (R). This parameter defines the lognormal statistical distribution of R for each population. We assumed a coefficient of variation (CV) of 30% or 40% of R_{max} , based on population parameters from long-term population studies of songbirds (Table 2).
3. **Carrying Capacity (K).** The logistic growth function includes a parameter for the carrying capacity of each population. An estimate of carrying capacity was made for each population dependent upon available habitat, climate zone (Figure 4), and conservative estimates of population density for each climate zone. For populations with documented gnatcatcher populations that exceeded the estimated K, the value of K was calculated as 1.2 times the known population size. The majority of the available population data was collected during years of relatively poor environmental conditions (e.g., drought, harsh winters); thus most of the population estimates are expected to be below carrying capacity. This is supported

TABLE 2
 VARIATION IN ANNUAL SURVIVAL AND PRODUCTIVITY IN SMALL SONGBIRDS

| Species | Location | Coefficient of Variation (%) | | Sample Size (years) | Source |
|-----------------------------|-------------------|------------------------------|---------------------|---------------------|--|
| | | Annual Adult Survival | Annual Productivity | | |
| Blue Tit | Belgium | 12.6 | 7.9 | 10 | Dhondt et al. 1990 |
| | France | 8.2 | | 10 | Blondel and Pradel 1990 |
| | Corsica | 7.9 | | 10 | Blondel and Pradel 1990 |
| Great Tit | United Kingdom | 41.8 | 8.5 | 17, 13 | Colbert et al. 1988, Perrins and Moss 1975 |
| | Netherlands | 9.0 | | 8 | Drent 1984 |
| | Finland | | 32.5 | 12 | Orell 1983 |
| Pied Flycatcher | Finland | | 38.0 | 22 | Järvinen 1989 |
| | Finland | | 43.9 | 7 | Järvinen and Väsänen 1984 |
| | England | | 11.7 | 17 | Stemming et al. 1988 |
| | Sweden | 26.9 | | 3 | Alatalo et al. 1990 |
| Willow Tit | Finland | | 30.9 | 7 | Orell and Ojanen 1983 |
| | Sweden | | 23.5 | 7 | Ekman 1984 |
| White-crowned Sparrow | San Francisco Co. | | 24.2 | 6 | Petrinovich and Patterson 1983 |
| Cassin's Finch | Washington | 25.4 | | 5 | Mewaldt and King 1985 |
| Mountain Chickadee | New Mexico | 17.1 | 8.8 | 5 | McCallum 1990 |
| Rock Pipit | Sweden | | 14.9 | 6 | Askenmo and Neergaard 1990 |
| Yellow-eyed Junco | Arizona | 32.8 | 51.2 | 5, 6 | K. Sullivan pers. comm. |
| Sage Sparrow | Oregon | | 37.3 | 5 | Rotenberry and Wiens 1989 |
| Brewer's Sparrow | Oregon | | 23.2 | 5 | Rotenberry and Wiens 1989 |
| Sage Thrasher | Oregon | | 36.6 | 5 | Rotenberry and Wiens 1989 |
| Wrentit | Marin Co. | 18.8 | 26.2 | 10 | N. Nur pers. comm. |
| Song Sparrow | Marin Co. | 17.5 | 47.1 | 10 | N. Nur pers. comm. |
| Prairie Warbler | Indiana | 33.1 | 26.6 | 8, 9 | Nolan 1978 |
| Least Bell's Vireo | Riverside Co. | | 32.3 | 7 | L. Hayes pers. comm. |
| | Santa Barbara Co. | | 30.3 | 7 | J. Greaves pers. comm. |
| Black-throated Blue Warbler | New Hampshire | | 20.5 | 5 | Holmes et al. 1992 |
| American Redstart | New Hampshire | | 33.4 | 9 | Sherry and Holmes 1992 |
| Cactus Wren | Arizona | 42.7 | 26.5 | 4, 6 | Anderson and Anderson 1973 |
| European Dipper | England | 20.1 | | 5 | Lebreton et al. 1992 |
| Barn Swallow | Sweden | | 10.8 | 18 | Møller 1989 |
| Sand Martin | Sweden | 25.0 | 30.0 | 20, 18 | Persson 1987a, 1987b, Svensson 1986 |
| | Hungary | 26.2 | | 4 | Szép 1991 |
| Collared Flycatcher | Hungary | | 19.9 | 4 | Török and Tóth 1987 |
| Pygmy Nuthatch | Arizona | | 8.1 | 4 | Sydeman et al. 1988 |
| California Gnatcatcher | San Diego Co. | 46.9 | 53.9 | 3 | Ogden 1992, unpubl. data |
| all studies | Mean ± SD (n) | 24.2 ± 12.2 (17) | 27.1 ± 13.1 (28) | | |
| | Median | 25.0 | 26.6 | | |
| studies ≥ 5 years | Mean ± SD (n) | 20.7 ± 10.6 (13) | 27.1 ± 12.1 (25) | | |
| | Median | 18.8 | 26.6 | | |

by recent increases in local populations during 1991 and 1992. For example, the Rancho San Diego population increased 76%, from 17 pairs in 1991 to 30 pairs in 1992 (Ogden 1992). Substantial population increases have been reported elsewhere in San Diego County, as well as in Orange and Riverside counties (N. Gilbert, H. Wier, B. Jones, K. Merkel, R. Ericson, B. Wagner, pers. comms.), suggesting that a normal to above-normal rainy season followed by a relatively mild winter allows for substantial population increases when populations are well below carrying capacity.

4. **Initial Population Size.** This parameter was set at the number of gnatcatcher pairs documented within the population or at $K/1.2$, whichever was larger.
5. **Survivorship (S).** This parameter is the average annual adult survival rate and is used to incorporate demographic stochasticity into the model (Brillinger 1986, Akçakaya 1991). R , the population growth rate, can be expressed as: $R = S \cdot (1 + F)$, where F is fecundity (number of fledglings per pair per year). Given R (sampled from a lognormal distribution) and S , RAMAS/space first calculates F from the above equation. The number of adult survivors (A) is drawn from a binomial distribution with S as the probability and N_t as the sample size. The number of young produced (Y) is then drawn from a Poisson distribution with a mean of $A \cdot F$, resulting in the population size for the next year: $N_{t+1} = A + Y$. An annual survival estimate of 0.55, the typical annual adult survival rate for songbirds (Karr et al. 1990, Martin and Li 1992), was assigned to coastal populations (populations within maritime and coastal climate zones). A more conservative value of 0.40 (Ogden 1992) was assigned to populations residing in the transitional climate zone.
6. **Migration.** The migration function in RAMAS/space defines the proportion of individuals that successfully migrate between populations. A migration matrix is made by the model where each element of the matrix gives the proportion of one population migrating to another population. In the gnatcatcher metapopulation model, only migration between populations connected primarily by native vegetation, especially CSS, was allowed. No migration was allowed between populations with substantial intervening development (e.g., no migration between Point Loma, population 30, and West Otay Mesa, population 40; Figure 4).

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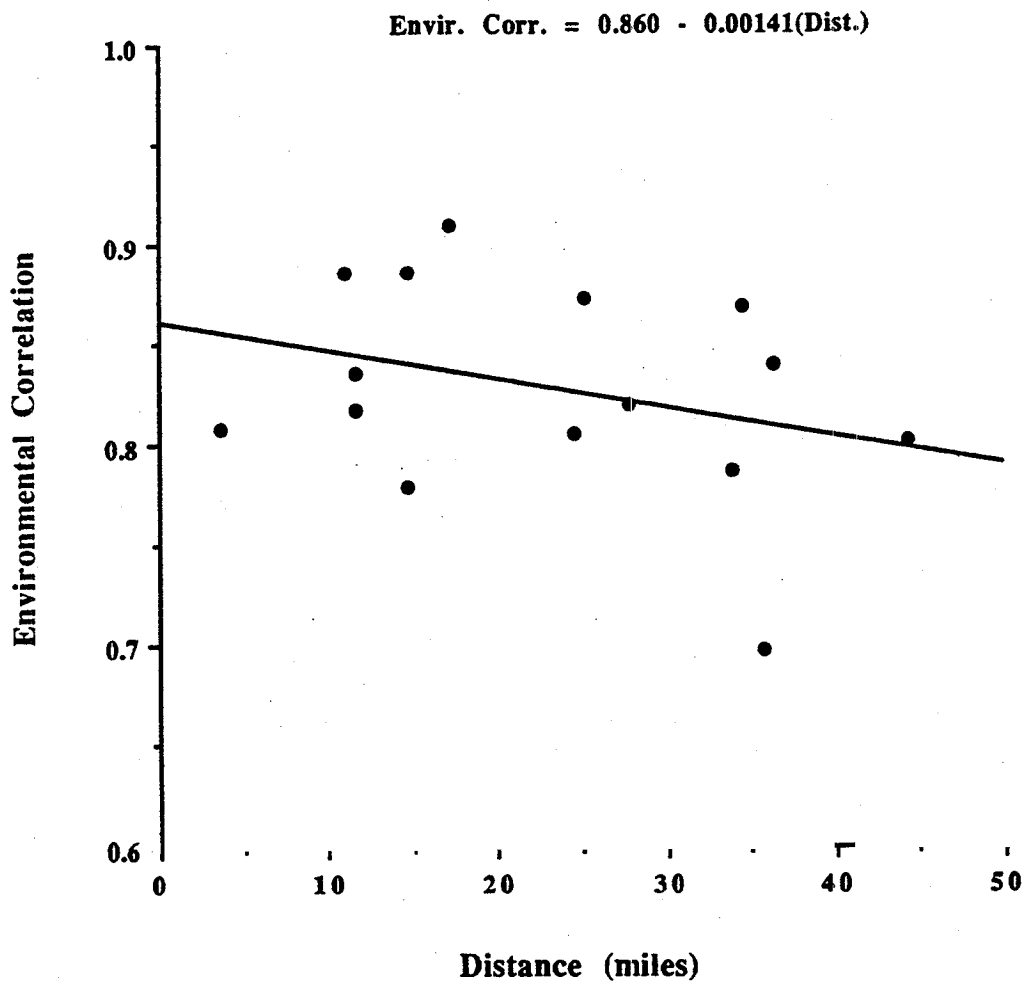
Migration proportions (M) can be input into the migration matrix as either a constant rate (e.g., 0, 0.1, 1.0, or 10 percent) or as a decreasing function of the distance between patches. The distance between populations was calculated from the center of each population habitat patch. The migration-distance function that approximates the relationship shown in Figure 1 is:

$$M_{ij} = 0.46 \exp[-d_{ij}/1.75],$$

where d_{ij} is the distance (miles) between populations i and j . The migration function contributes to demographic stochasticity by sampling the number of migrants at each time step from a binomial probability distribution.

RAMAS/space includes a density-dependent migration option that was included in our gnatcatcher model. This assumes that dispersing gnatcatchers are more likely to remain within their natal population if there is unoccupied habitat available. The relatively steep dispersal curve (Figure 1) supports this assumption. The rate of migration (and consequently the probability of recolonization of the population receiving immigrants) is an increasing function of population density of the source population. We assumed that a dispersing individual can only perceive the population density of the source population and not the density of the population to which it is dispersing. We chose the intermediate slope value of +0.5 for the relationship between migration rate and population size.

- 7. Spatially-dependent Environmental Correlation.** Although R for any population can be modeled as a random variable between years, the R experienced by populations within the same year should be environmentally correlated relative to their spatial distribution. The environmental correlation between two patches should increase the closer the patches are to each other. We estimated this correlation-distance function by using correlations of climate (i.e., average monthly minimum temperature during winter) between six weather stations (Oceanside, San Diego, Chula Vista, Escondido, La Mesa, and El Cajon) within San Diego County (Figure 5). RAMAS/space allows a correlation matrix between populations to be specified, and the R value of each population at each time step is assigned with this correlational constraint. For our gnatcatcher model, environmental correlation between populations ranged from 0.78 to 0.86.



FIGURE



Effect of Distance on Environmental Correlation of Winter Monthly Minimum Temperature between Six Locations in San Diego County 7895

5

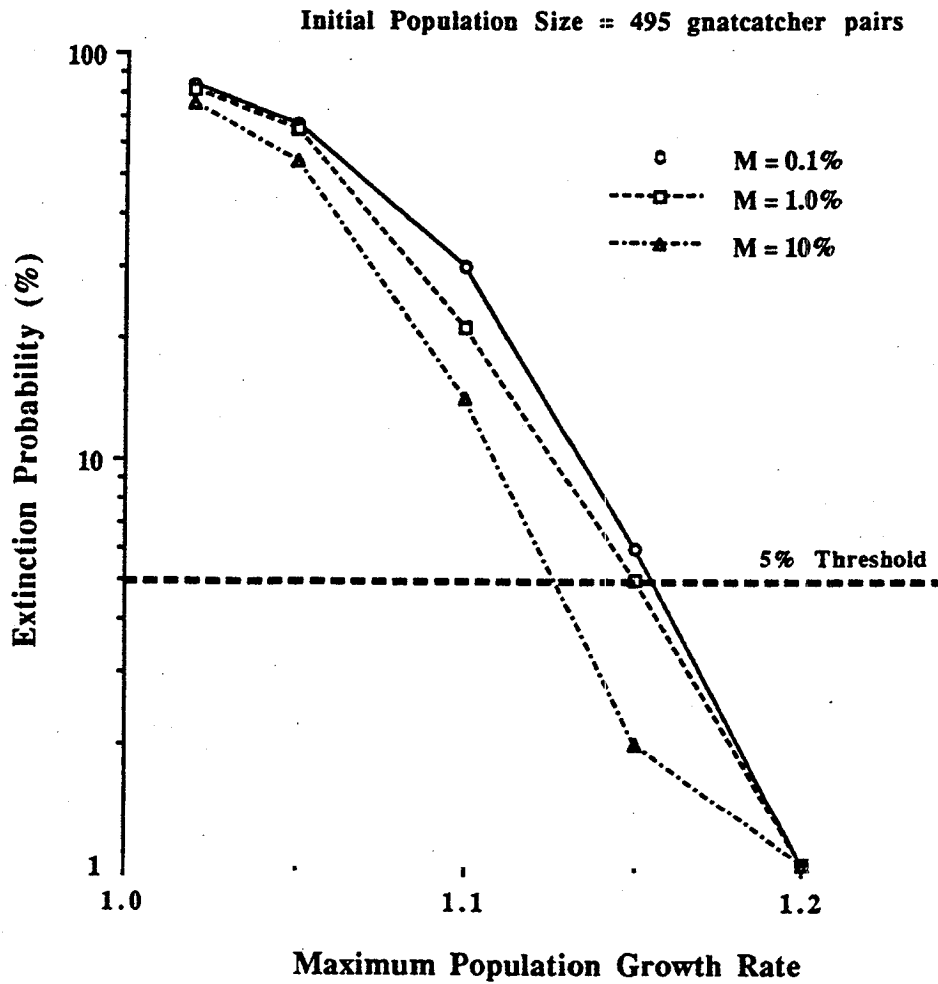
3.5 APPROPRIATE USES OF RAMAS/SPACE

RAMAS/space is a generalized model that is best used in a comparative fashion to explore the relative merits of alternative reserve designs. The uncertainty of the model's input parameter values (i.e., long-term population averages and variances) and the degree of approximation required to realistically represent gnatcatcher population dynamics make this relatively simple population model primarily a heuristic tool. Population modeling provides an objective method of estimating the relative viability of alternative reserve designs and can be used in a comparative manner to determine minimum reserve patch size, the relative importance of a given patch within a metapopulation network of habitat patches, or which potential addition to the reserve system would increase the viability of the network the most.

3.6 SENSITIVITY ANALYSIS OF RAMAS/SPACE

Preliminary simulations of the RAMAS/space model using a metapopulation of 495 pairs distributed into 13 populations indicate that the model is highly sensitive to variation in the value of R_{max} , the maximum population growth rate (Figure 6). Since R_{max} is defined as the population growth rate when the population size is well below the population carrying capacity (K), the value of R_{max} is greater than 1.0, the value of R of a population stabilized at K . Long-term population studies of small, short-lived bird species have recorded one-year population increases ranging from 1.18 to 2.66 (e.g., Hildén 1990, Dhondt et al. 1990, McCallum 1990, Dennis et al. 1991, Holmes et al. 1992, Sherry and Holmes 1992, Stacey and Taper 1992). Therefore, values of R_{max} greater than 1.1 appear to be reasonable for the gnatcatcher, which appears to have typical songbird life history traits. For scenarios with source-sink dynamics, sink populations within the transitional climate zone were modeled with a R_{max} of 1.05.

The model appears to be moderately sensitive to variation in M , the migration rate between populations (Figure 6). The migration-distance function described above produced a sensitivity curve similar to the curve with $M = 1.0\%$. A relatively low level of exchange between immediately adjacent populations appears to be sufficient to effectively rescue a sink population that is close and adequately connected to a productive source population (e.g., Stacey and Taper 1992). Many gnatcatcher populations within San Diego County



are currently interconnected by extensive widths of coastal sage scrub, much of which is known to be occupied by gnatcatchers (Figure 3).

The RAMAS/space model also appears to be highly sensitive to the variance of R . We initially assumed a coefficient of variation (CV) of R was a constant 30% of R_{max} . Two preliminary model simulations with 13 populations were performed where all parameters remained constant except for the CV of R , which was input as either 30% or 25% of R_{max} . The extinction probability for the metapopulation with a 30% standard deviation of R was 7 times larger (21% vs. 3%) than the simulation with a 25% standard deviation of R . For long-term studies (≥ 5 years) of songbird populations, the median CV of annual adult survival is about 19%, while the median CV of productivity is approximately 27% (Table 2). This suggests an appropriate range for the CV of R_{max} is between 30 and 40%.

Based on this preliminary sensitivity analysis of RAMAS/space, a more extensive evaluation was conducted with respect to R_{max} , CV of R , and Survival (S) (Table 3). For this set of simulations, we used a metapopulation of 45 San Diego County populations (Figure 4) and the migration-distance function defined above. The initial county metapopulation size was estimated at 2,200 pairs (Appendix B). All populations were assigned the same set of population parameters. Table 3 demonstrates that RAMAS/space has high to moderate sensitivity to all three parameters evaluated. As would be expected for a species with life history traits of the gnatcatcher, simulations with R_{max} less than 1.10 resulted in high extinction probabilities regardless of CV of R and S . The outcome of simulations with $R_{max} = 1.10$ were dependent upon the values of CV of R and S , with CV of R being more sensitive than S . A relatively large metapopulation with $R_{max} = 1.2$ has a low extinction probability.

Long-term studies of songbird populations suggest that R_{max} typically exceeds 1.10, CV of R is approximately 30-40%, and S averages 0.55. However, most of these population studies were conducted at single locations and usually within optimal habitat for the species examined. We expect that a gnatcatcher metapopulation with source-sink dynamics would have sink populations within suboptimal habitat maintained by immigration from highly productive source populations. Therefore, population parameters of R_{max} , CV of R , and S are likely to vary across the landscape, as suggested by the variation in gnatcatcher population densities relative to the distance from the coast (Mock et al. 1990, Ogden 1992).

Table 3

**SENSITIVITY ANALYSIS OF
R_{MAX}, COEFFICIENT OF VARIATION OF R, AND SURVIVAL
WITH A METAPOPULATION OF 2,200 GNATCATCHER PAIRS
DISTRIBUTED AMONG 45 SAN DIEGO POPULATIONS**

| Simulation ID | R _{max} | Coefficient of Variation | Survival | Extinction Probability (%) |
|---------------------|------------------|--------------------------|----------|----------------------------|
| Worst Case 1 | 1.05 | 40 | 0.40 | 71 |
| Worst Case 2 | 1.05 | 30 | 0.40 | 32 |
| Worst Case 3 | 1.05 | 30 | 0.55 | 26 |
| Intermediate Case 1 | 1.10 | 40 | 0.40 | 38 |
| Intermediate Case 2 | 1.10 | 40 | 0.55 | 20 |
| Intermediate Case 3 | 1.10 | 30 | 0.40 | 3 |
| Intermediate Case 4 | 1.20 | 30 | 0.55 | 1 |
| Best Case 1 | 1.20 | 40 | 0.40 | 3 |
| Best Case 2 | 1.20 | 40 | 0.55 | 1 |
| Best Case 3 | 1.20 | 30 | 0.55 | <<1 |

Simulations run with a 200-year horizon, 100 replications, active demographic stochasticity function, distance-dependent migration and environmental correlation. Initial population sizes and K estimates based on habitat acreage above/below 40% slope and edge effects (Appendix B).

4.0 RESULTS

4.1 VIABILITY OF THE CALIFORNIA GNATCATCHER METAPOPULATION IN SAN DIEGO COUNTY AND THE MSCP STUDY AREA

The current California gnatcatcher metapopulation within the MSCP study area likely exceeds 900 pairs based on the Ogden gnatcatcher database and the extent of potential CSS habitat. We simulated metapopulation scenarios based on our current perception of the existing San Diego County configuration (Figure 4) and various reserve designs formulated from the results of the MSCP Composite Habitat Evaluation Model (Figure 7; Appendices A-C). The results presented in Table 4 suggest that the current county-wide and MSCP metapopulations are probably viable, assuming $R_{max} \geq 1.1$ for productive source populations. The viability of the MSCP metapopulation is likely due to the existence of five major concentrations (Otay, Sweetwater, Mission Trails/Santee, Poway, and Lake Hodges) which act as source populations to the relatively smaller interconnecting populations (Figure 4). During periods of low population levels, these source populations

TABLE 4

SOURCE-SINK SCENARIOS OF CURRENT COUNTY AND MSCP METAPOPULATIONS AND SELECTED RESERVE DESIGNS

| Simulation Scenario* | No. Populations | Initial Metapopulation Size (pairs) | Proportion (%) of Metapopulation in Transitional Climate Zone | Extinction Probability (%) | Probability of Reduced Metapopulation † (%) |
|---|-----------------|-------------------------------------|---|----------------------------|---|
| Existing Condition, Entire San Diego County - One Metapopulation | 47 | 2,373 | 42 | 3 | 58 |
| Existing Condition SDC - Two functionally independent Metapopulations, Barrier @ I-8 Lakeside | 47 | 2,373 | 42 | 2 | 33 |
| Existing Condition, only MSCP Study Area | 35 | 1917 | 45 | <<1 | 5 |
| Only MSCP core populations - all CSS conserved (see Appendix C) | 21 | 1545 | 43 | 10.5 | 39 |
| MSCP Composite Model - Only Very High Value CSS in core populations conserved | 21 | 1230 | 38 | 11.5 | 43 |
| MSCP Composite Model - all Very High Value CSS conserved in all MSCP populations | 35 | 1419 | 40 | 13.5 | 46 |
| MSCP Composite Model - all Very High Value CSS plus 3 north county coastal populations† | 38 | 1701 | 31 | <<1 | 3 |
| MSCP Study Area - Reduce K of core populations by 30%, all other populations by 50% | 35 | 1268 | 45 | <<1 | 4 |

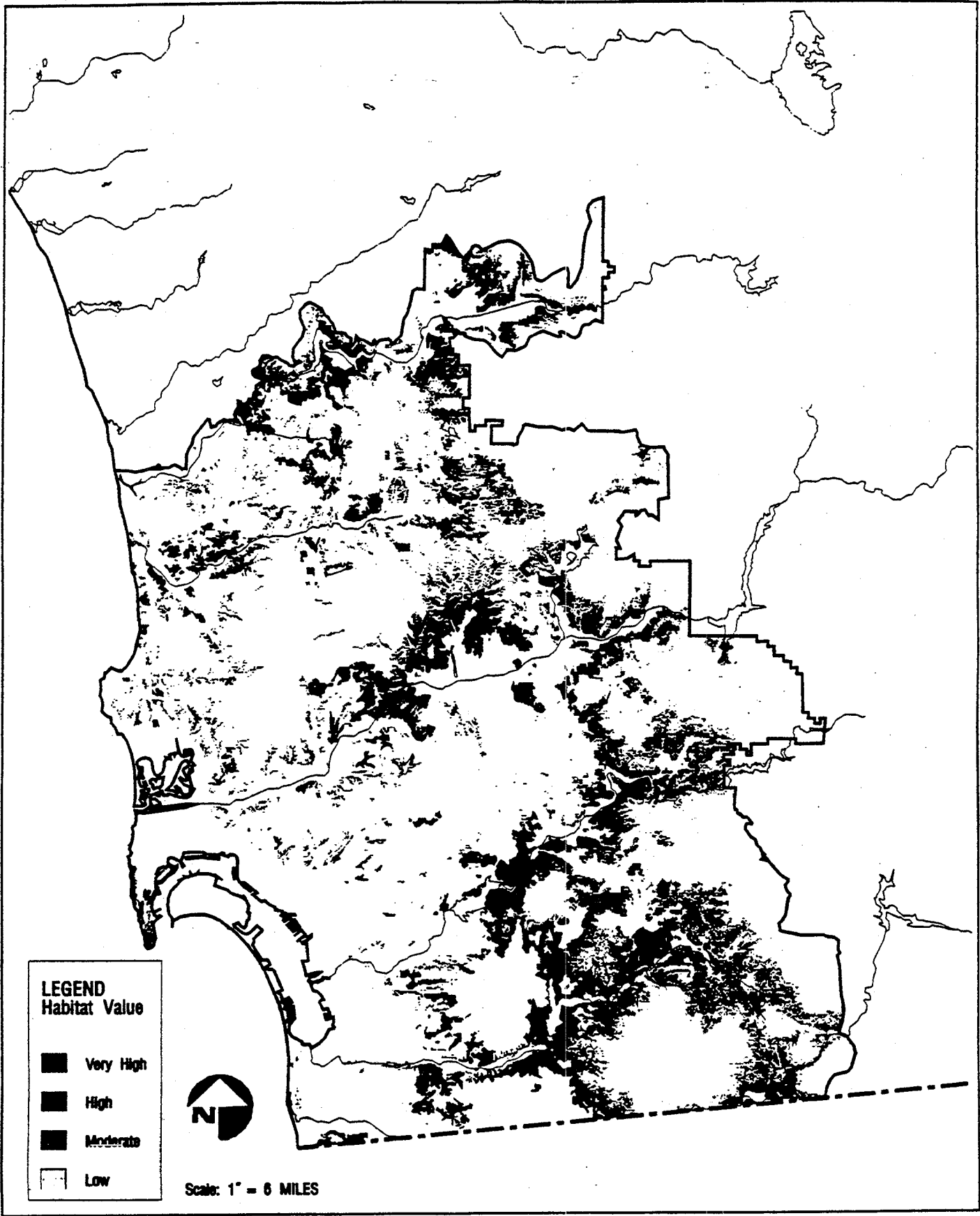
* see Appendices B and C for distribution of metapopulation

† Probability of metapopulation being reduced to 20% of initial population size after 200 years.

‡ North County populations: Camp Pendleton (175 pairs), SB Carlsbad/B Rancho Santa Fe (100 pairs), San Elijo Lagoon (7 pairs).

ASSUMPTIONS AND INPUT PARAMETERS USED IN SOURCE-SINK SCENARIOS

- 1) Model set for 200 year horizon, 300 replicate simulations, density-dependent migration = 0.5, demographic stochasticity function active.
- 2) Percent Migration = $0.46 \exp(-d/1.75)$; this approximates Ogden's exponential dispersal model.
- 3) Environmental Correlation = $0.86 \exp(-d/500)$; r-values range from 0.86 to 0.78 for San Diego County which is consistent with correlations of weather data.
- 4) Initial population size assumed = $K/1.2$ unless known pop. size was greater, then $K = 1.2 \cdot$ known population size.
- 5) K estimate determined from conservative population densities assumed for each climate zone, habitat available above and below 40% slope, and amount of habitat influenced by development edge effects.
- 6) For Source-Sink model input parameters varied by climate zone (R, CV of R, S):
 Maritime = 1.2, 30%, 0.55; Maritime/Coastal = 1.2, 40%, 0.55; Coastal = 1.1, 30%, 0.55; Coastal/Transitional = 1.1, 40%, 0.55; Transitional = 1.05, 40%, 0.40.
- 7) For Very High CSS, K estimated by Climate Zone and habitat acreage:
 Maritime Very High CSS K = 20 ac/pr; Coastal Very High CSS K = 35 ac/pr; Transitional Very High CSS K = 50 ac/pr.



OGDEN
■■■■■

MSCP Composite Habitat Evaluation
of Coastal Sage Scrub

07901

FIGURE
7

likely rescue smaller or less productive habitat patches that may become temporarily unoccupied (Pulliman 1988, Gilpin 1990). Many of the smaller populations positioned between source populations likely act as steppingstone patches, enhancing inter-population connectivity and contributing to the size and viability of the metapopulation.

Various hypothetical reserve network configurations simulated produced varying results (Table 4). Conserving only CSS habitat (all CSS or only high value CSS) in the designated MSCP core populations results in extinction probabilities of 10-12%. These relatively high extinction probabilities are likely due to excessive distance between source and sink populations. Excessive distance between populations inhibits effective migration and probably prevents the rescue of sink populations that often go extinct. Conserving all high value CSS throughout the MSCP study area also resulted in a relatively high extinction probability of 13.5%. This may be due to an uneven distribution of the metapopulation between source and sink populations. The addition of three coastal north county source populations to the high value CSS model reduces the extinction probability to well below the designated 5% threshold criteria for population viability. Reducing K of MSCP core populations and the remainder of the MSCP populations by 30% and 50%, respectively, results in an extinction probability of less than 1%. The probability that the metapopulation may be reduced to 20% of the initial population after 200 years is high for many of the scenarios presented in Table 4. This is probably due to the gnatcatcher's high annual variation in reproductive and survival rates which leads to large fluctuations in population size/density.

4.2 MINIMUM PATCH SIZE FOR GNATCATCHER RESERVES

Individual reserves should be of sufficient size to minimize local population extinction due to isolation by an extreme environmental catastrophe (e.g., large-scale fire). Thus, each conserved population should be able to withstand short intervals (i.e., 50 years) of isolation from the remainder of the metapopulation network. The RAMAS/space model was configured for a single population with varying population sizes to assist in determining the minimum patch size for the proposed reserve design. The results of this series of simulations are presented in Table 5. Depending on the population size and value of R_{max} , we may expect an isolated population to have an extinction probability of 1 to 79 percent over a 50-year planning horizon. A realistic prediction of extinction probability is probably at the lower end of this range since the value of R_{max} is likely to be greater than 1.1 for populations not considered population sinks. A minimum patch size supporting

more than 50 gnatcatcher pairs is probably sufficient for moderately productive populations. Minimum patch sizes for highly productive habitats may support as few as 20 gnatcatcher pairs as suggested by empirical studies of insular songbird populations (Soulé 1983, Pimm et al. 1988, Tracy and George 1992) and the continued existence of the isolated gnatcatcher population on the Palos Verdes peninsula in Los Angeles County (Atwood 1990). These recommended minimum patch sizes should be for "satellite" (steppingstone) reserves that are between larger "core" reserves. Satellite reserves function to enhance the connectivity between core reserves and substantially contribute to the overall viability of the metapopulation.

Table 5

**SIMULATION OF SINGLE ISOLATED POPULATION
OF VARYING SIZE FOR A 50-YEAR PLANNING HORIZON**

| Population Size (pairs) | R _{max} | Extinction Probability (%) |
|-------------------------|------------------|----------------------------|
| 20 | 1.10 | 79 |
| 20 | 1.20 | 70 |
| 50 | 1.10 | 47 |
| 50 | 1.20 | 29 |
| 100 | 1.10 | 25 |
| 100 | 1.20 | 5 |
| 200 | 1.10 | 16 |
| 200 | 1.20 | 1 |

Simulations run with CV of R = 30%, S = 0.55, K = initial population size, 100 replications, and active demographic stochasticity function.

5.0 CONCLUSIONS

Population modeling can provide a heuristic method of estimating the viability of alternative reserve designs. Such models can be used in a comparative manner to determine minimum patch size, the relative importance of a given patch within a metapopulation network of habitat patches, or which potential addition to the reserve system would increase the viability of the network the most. We have used this model to compare the adequacy of several preliminary alternative reserve designs. A primary lesson of this analysis is the importance of retaining linkages between the populations. It is clear that retaining the interconnections of the metapopulation is critical to the viability of each gnatcatcher

population. Without functioning corridors to link the populations, the metapopulation viability will likely be low.

Metapopulation simulation models have shown that the dynamics of simulated metapopulations are driven to a large extent by the larger populations. Smaller, more peripheral populations usually can be lost without greatly affecting the viability of the entire system, but the loss or serious reduction of one or more of the larger populations has a great effect on the overall viability of the model system (Gilpin 1990). The largest gnatcatcher populations will likely be most critical to the overall viability of the metapopulation. The expectation that a given population is critical to the metapopulation can be tested by simulating the gnatcatcher metapopulation to estimate the viability of the metapopulation with one or more populations removed or reduced in size.

The gnatcatcher reserve system must sufficiently span the length and width of the MSCP study area to facilitate demographic and genetic exchange within and outside of the study area and minimize the adverse effects of environmental correlation between adjacent populations. The relative distribution of source and sink populations within the metapopulation will also influence metapopulation viability. Conserved habitat should be prioritized toward retaining as many of the larger source populations as is feasible. Due to the current distribution of sage scrub and gnatcatchers, the reserve system must consist of several reserves primarily aligned along a north-south axis. Our initial reserve design (based on our current knowledge) is a system of at least twelve (12) "core" reserves of relatively large blocks of gnatcatcher-occupied coastal sage scrub. These core reserves are (see Figure 4, Appendix C): Lake Hodges area (population 6), Black Mountain (population 9), Escondido/San Pasqual Valley (populations 10 and 11), North Poway (populations 12 and 13), South Poway (including Van Damm Peak; population 14), Los Peñasquitos Canyon (population 15), Mission Trails/Camp Elliot/Santee (including Rattlesnake Mountain; populations 19, 20, and 21), South San Vicente/Lake Jennings (populations 23 and 24), Dehesa/Upper Sweetwater River (including McGinty Mountain; populations 24 and 25), Lower Sweetwater River/San Miguel Mountains (including Dictionary Hill; population 28), Jamul Mountains (population 32), San Ysidro Mountains/Otay River/Otay Mesa (populations 37, 39, 40, and 41). These core reserves will need to be supplemented with a sufficient number of smaller "satellite" (steppingstone) reserves in between to enhance connectivity between core reserves and achieve a minimum viable metapopulation size.

This population viability analysis used estimates of model input parameters that were on the conservative side of the range of biologically realistic values. For example, we used 1.2 as the largest value of R_{max} in our simulations, a value that is at the low end of the range of estimates reported in long-term songbird population studies. Gnatcatcher populations appeared to increase 75% or more in many areas between 1991 and 1992. Our sensitivity analysis of RAMAS/space showed that R_{max} is the most sensitive parameter influencing extinction probability. Therefore, the simulations presented in this analysis likely overestimate the extinction probabilities for the various metapopulations configured.

We also assumed that all of the existing coastal sage scrub habitat potentially supported gnatcatchers. Less than half of the the CSS habitat within the study area has been adequately surveyed. We likely overestimated the size of many of the potential populations in the transitional climate zone and possibly underestimated the size of some populations within the coastal or maritime climate zones. Population size and carrying capacity also significantly influence the outcome of the RAMAS/space model, as demonstrated in our simulations of an isolated population. We assumed carrying capacity was 20% larger than the initial population size. Potential effects of cowbird nest parasitism were not incorporated into this analysis due to the lack of information on the relative extent of this potential problem within and between populations. Certain populations may be significantly affected by cowbird parasitism (e.g., Bontrager 1991, Braden 1992), hence, model input parameters for parasitized populations would be substantially different (e.g., lower R and higher CV of R) from populations without this problem.

Adequate surveys of all potential gnatcatcher habitat within the study area and population studies of several gnatcatcher populations in geographically distinct locations (i.e., representative populations in different climate zones) are needed to refine this population viability analysis. These studies should gather information on variation in population size/density, reproductive success, annual survival, juvenile recruitment, and dispersal capability, particularly in response to adjacent development and variation in predation/parasitism and weather. Within-year comparisons of these populations would verify our assumptions of source-sink population dynamics and distance-dependent environmental correlation between populations.

6.0 LITERATURE CITED

- Akçakaya, H.R. 1991. A method for simulating demographic stochasticity. *Ecological Modeling* 54:133-136.
- Alberts, A.C., A.D. Richman, Y. Tran, R. Sanvajot, C. McCalvin, and D.T. Bolger. *in press*. Effects of habitat fragmentation on populations of native and exotic plants in southern California coastal scrub. *In* J. Keeley (ed.). *The interface between ecology and land development in California*. Occidental College.
- Alatalo, R., A. Carlson, and A. Lundberg. 1990. Polygyny and breeding success of pied flycatchers nesting in natural cavities. Pages 331-344 *in* J. Blondel, A. Gosler, J-D Lebreton, and R. McCleery (eds.). *Population biology of passerine birds*. Springer-Verlag.
- American Ornithologists' Union (AOU). 1989. Thirty-seventh supplement to the AOU checklist of North American birds. *Auk* 106:532-538.
- Anderson, A.H. and A. Anderson. 1973. *The cactus wren*. University of Arizona Press, Tucson, AZ.
- Askenmo, C. and R. Neergaard. 1990. Polygyny and nest predation in the rock pipit. Do females trade male assistance against safety? Pages 331-344 *in* J. Blondel, A. Gosler, J-D Lebreton, and R. McCleery (eds.). *Population biology of passerine birds*. Springer-Verlag.
- Atwood, J.L. 1980. The United States distribution of the California black-tailed gnatcatcher. *Western Birds* 11:65-78.
- Atwood, J.L. 1988. Speciation and geographic variation in black-tailed gnatcatchers. *Ornithological Monograph*. No. 42.
- Atwood, J.L. 1990. Status review of the California gnatcatcher (*Polioptila californica*). *Manomet Bird Observatory, Manomet, MA*. 79 pp.
- Atwood, J.L. 1991. Subspecies limits and geographic patterns of morphological variation in California gnatcatchers (*Polioptila californica*). *Bulletin Southern California Academy of Sciences* 90:118-133.
- Atwood, J.L. 1992. A maximum estimate of the California gnatcatcher's population size in the United States. *Western Birds* 23:1-9.
- Atwood, J.L. and J.S. Bolsinger. 1992. Elevational distribution of California Gnatcatchers in the United States. *Journal of Field Ornithology* 63:159-168.
- Blondel, J. and R. Pradel. 1990. Is adult survival of the blue tit higher in a low fecundity insular population than in a high fecundity mainland one? Pages 131-144 *in* J. Blondel, A. Gosler, J-D Lebreton, and R. McCleery (eds.). *Population biology of passerine birds*. Springer-Verlag.
- Bolger, D.T., A.C. Alberts, and M.E. Soulé. 1991. Occurrence patterns of bird species in habitat fragments: sampling, extinction, and nested species subsets. *American Naturalist* 137:155-166.

- Bontrager, D. 1991. Habitat requirements, home range, and breeding biology of the California gnatcatcher (*Polioptila californica*) in south Orange County. Prepared for Santa Margarita Co. April. 19 pp.
- Braden, G. 1992. Draft report: California gnatcatchers (*Polioptila californica*) at three sites in western Riverside County. Prepared by USFWS for Metropolitan Water District. 29 pp. November.
- Brillinger, D.R. 1986. The natural variability of vital rates and associated statistics. *Biometrics* 42:693-734.
- Brown, J.H. and A. Kodric-Brown. 1977. Turnover rates in insular biogeography: effect of immigration on extinction. *Ecology* 58:445-449.
- Churcher, P.B. and J.H. Lawton. 1987. Predation by domestic cats in an English UK village. *Journal of Zoology (London)* 212:439-456.
- Clobert, J., C.M. Perrins, R.H. McCleery, and A.G. Gosler. 1988. Survival rate in the great tit *Parus major* in relation to sex, age, and immigration status. *Journal of Animal Ecology* 57:287-306.
- Cunningham, M.A. 1986. Dispersal in white-crowned sparrows: a computer simulation of the effect of study area size on estimates of local recruitment. *Auk* 103:79-85.
- Dennis, B., P.L. Munholland, and J.M. Scott. 1991. Estimation of growth and extinction parameters for endangered species. *Ecological Monographs* 61:115-143.
- Dhondt, A. A., E. Matthysen, F. Adriaensen, and M. M. Lambrechts. 1990. Population dynamics and regulation of a high density blue tit population. Pages 39-54 in J. Blondel, A. Gosler, J-D Lebreton, and R. McCleery (eds.). *Population biology of passerine birds*. Springer-Verlag.
- Dunn, J.L. and K.L. Garrett. 1987. The identification of North American gnatcatchers. *Birding* 19:17-29.
- Dunning, J.B., B.J. Danielson, and H.R. Pulliam. 1992. Ecological processes that affect populations in complex landscapes. *Oikos* 65:169-175.
- Ekman, J. 1984. Density-dependent seasonal mortality and population fluctuations of the temperate-zone willow tit *Parus montanus*. *Journal of Animal Ecology* 53:119-134.
- ERC Environmental and Energy Services (ERCE) [Ogden]. 1991. Phase I report, Amber Ridge California gnatcatcher study. Prepared for Weingarten, Siegel, Fletcher Group, Inc. April. 26 pp.
- Gessaman, J.A. and G.L. Worthen. 1982. The effects of weather on avian mortality. Utah State University.
- Gilpin, M.E. 1990. Extinction of finite metapopulations in correlated environments. Pages 177-186 in B. Shorrocks and I.R. Swingland (eds). *Living in a patchy environment*. Oxford University Press, Oxford, UK

- Grinnell, J. 1898. Birds of the Pacific slopes of Los Angeles County. Pasadena Academy of Sciences Publ. No. 11.
- Grinnell, J. and A.H. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna No. 27.
- Harris, L.D. 1988. Edge effects and conservation of biotic diversity. Conservation Biology 2:330-332.
- Hildén, O. 1990. Long-term study of a northern population of the Blue Tit *Parus caeruleus*. Pages 39-65 in J. Blondel, A. Gosler, J-D Lebreton, and R. McCleery (eds.). Population biology of passerine birds. Springer-Verlag.
- Holmes, R.T., T.W. Sherry, and F.W. Sturges. 1991. Numerical and demographic responses of temperate forest birds to annual fluctuations in their food resources. Proceedings 20th International Ornithological Congress Pages 1559-1567.
- Holmes, R.T., T.W. Sherry, P.P. Marra, and K.E. Petit. 1992. Multiple brooding and productivity of a neotropical migrant, the black-throated blue warbler (*Dendroica caerulescens*), in an unfragmented temperate forest. Auk 109:321-333.
- Järvinen, A. 1989. Patterns and causes of long-term variation in reproductive traits of the pied flycatcher *Ficedula hypoleuca* in Finnish Lapland. Ornis Fennica 66:24-31.
- Järvinen, A. and R.A. Väsänen. 1984. Reproduction of pied flycatchers (*Ficedula hypoleuca*) in good and bad breeding seasons in a northern marginal area. Auk 101:439-450.
- Karr, J.R., J.D. Nichols, M.K. Klimkiewicz, and J.D. Brawn. 1990. Survival rates of birds of tropical and temperate forests: Will the dogma survive? American Naturalist 136:277-291.
- Kelly, P.A. and J.T. Rotenberry. *in press*. Buffer zones for ecological reserves: replacing guesswork with science. In J. Keeley (ed.). The interface between ecology and land development in California. Occidental College.
- Lamberson, R. 1992. Software review of RAMAS - Age, Stage, Space. Natural Resource Modeling 6:99-102.
- Laurence, W.F. and E. Yensen. 1991. Predicting the impacts of edge effects in fragmented habitats. Biological Conservation 55:77-92.
- Lebreton, J-D., K. P. Burnham, J. Clobert, D.R. Anderson. 1992. Modeling survival and testing biological hypotheses using marked animals: a unified approach with case studies. Ecological Monographs 62:67-118.
- Lima, S.L. 1987. Clutch size in birds: a predation perspective. Ecology 68:1062-1070.
- Lustick, S.A. and J. Adams. 1977. Seasonal variation in the effects of wetting on the energetics and survival of starlings (*Sturnus vulgaris*). Comparative Biochemistry and Physiology 56A:173-177.

- Marr, T.G. and R.J. Raitt. 1983. Annual variation in patterns of reproduction of the cactus wren (*Campylorhynchus brunneicapillus*). *Southwestern Naturalist* 28:149-156.
- Martin, T.E. 1987. Food as a limitation on breeding birds: A life history perspective. *Annual Review of Ecology and Systematics* 19:453-487.
- Martin, T.E. 1992. Breeding productivity considerations: What are appropriate habitat features for management? Pages 455-473 in J.M. Hagan and D. W. Johnson (eds.). *Ecology and conservation of neotropical migrant landbirds*. Smithsonian Institution Press, Washington, D.C.
- Martin, T.E. and P. Li. 1992. Life history traits of open- vs. cavity-nesting birds. *Ecology* 73:579-592.
- McCallum, D.A. 1990. Variable cone crops, migration, and dynamics of a population of mountain chickadees (*Parus gambeli*). Pages 103-116 in J. Blondel, A. Gosler, J-D Lebreton, and R. McCleery (eds.). *Population biology of passerine birds*. Springer-Verlag.
- McCaskie, G. and E.A. Pugh. 1964. Nesting season. Southern Pacific coast region. *Audubon Field Notes* 18:534-536.
- Mewaldt, C.R. and J.R. King. 1985. Breeding site faithfulness, reproductive biology, and adult survivorship of Cassin's finches. *Condor* 87:494-510.
- Möller, A.P. 1989. Dynamics of a declining swallow *Hirundo rustica* population. *Journal of Animal Ecology*. 58:1051-1063.
- Mock, P.J. 1992. The ecology of the California gnatcatcher: Implications for habitat management and preserve design. Abstract, Western Section meeting of The Wildlife Society, San Diego, California. February.
- Mock, P. J., B. L. Jones, M. Grishaver, J. Konecny, and D. King. 1990. Home range size and habitat preferences of the California gnatcatcher in San Diego County. Abstract, Joint American Ornithologists' Union / Cooper Ornithological Society meetings, Los Angeles, California. June.
- Nolan, V. 1978. The ecology and behavior of the prairie warbler *Dendroica discolor*. *Ornithological Monographs* No. 26. 595 pp.
- Ogden Environmental and Energy Services (Ogden). 1992. Ecology of the California gnatcatcher at Rancho San Diego. Technical appendix for the Rancho San Diego Habitat Conservation Plan. Prepared for Home Capital Development Corporation. 54 pp. December.
- Orell, M. 1983. Breeding success and population dynamics in a northern great tit (*Parus major*) population. Ph.D. dissertation, Oulu University, Finland.
- Orell, M. and M. Ojanen. 1983. Breeding biology and population dynamics of the willow tit *Parus montanus*. *Ann. Zool. Fennici* 20:99-114.
- O'Leary, J.F. 1990. Californian coastal sage scrub: general characteristics and considerations for biological conservation. Pages 24-41 in A. A. Schoenherr (ed.).

Endangered plant communities of Southern California, Southern California Botanist
Special Publ. No. 3.

- Perrins, C.M. and D. Moss. 1975. Reproductive rates of the great tit. *Journal of Animal Ecology* 44:695-706.
- Persson, C. 1987a. Age structure and survival rates in a south Swedish sand martin *Riparia riparia* population, 1964 to 1984. *Journal of Zoology (London) Series B* 43:639-670.
- Persson, C. 1987b. Population processes in southwestern Scandinavian sand martins *Riparia riparia*. *Journal of Zoology (London) Series B* 43:671-692.
- Petrinovitch, L. and T.L. Patterson. 1983. The white-crowned sparrow: reproductive success (1975-1980). *Auk* 100:811-825.
- Pimm, S.L., H.L. Jones, and J. Diamond. 1988. On the risk of extinction. *American Naturalist* 132:757-785.
- Pyle, R.L. and A. Small. 1961. Annotated field list, birds of southern California. Los Angeles Audubon Society, Los Angeles, California.
- Pulliam, H.R. 1988. Sources, sinks, and population regulation. *American Naturalist* 132:652-661.
- Pulliam, H.R. and B.J. Danielson. 1991. Sources, sinks, and habitat selection: a landscape perspective on population dynamics. *American Naturalist* 137:S50-S66.
- Regional Environmental Consultants (RECON). 1987. Home range, nest site, and territory parameters of the black-tailed gnatcatcher population on the Rancho Santa Fe Highlands study area. September. Unpublished report submitted to County of San Diego.
- Regional Environmental Consultants (RECON). 1992. Technical analysis of potential noise effects on California gnatcatcher habitat adjacent to future Orange Avenue. RECON No. 2232B. Prepared for EastLake Development Co. 24 pp. March.
- Reitsma, L.R., R.T. Holmes, and T.W. Sherry. 1990. Effects of removal of red squirrels, *Tamiasciurus hudsonicus*, and eastern chipmunks, *Tamias striatus*, on nest predation in a northern hardwood forest: An artificial nest experiment. *Oikos* 57:375-380.
- Rodénhouse, N.L. and R.T. Holmes. 1992. Food limitation of breeding black-throated blue warblers: results of experimental and natural food reductions. *Ecology* 73:357-372.
- Rolstad, J. 1991. Consequences of forest fragmentation for the dynamics of bird populations: conceptual issues and the evidence. *Biological Journal of the Linnean Society* 42:149-163.
- Rotenberry, J.T., and J.A. Wiens. 1989. Reproductive biology of shrubsteppe passerine birds: Geographical and temporal variation in clutch size, brood size, and fledgling success. *Condor* 91:1-14.

- Sanders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. *Conservation Biology* 5:18-32.
- Sherry, T.W. and R.T. Holmes. 1992. Population fluctuations in a long-distance neotropical migrant: Demographic evidence for the importance of breeding season events in the American redstart. Pages 431-442 in J. M. Hagan and D. W. Johnson (eds.). *Ecology and conservation of neotropical migrant landbirds*. Smithsonian Institution Press, Washington, D.C.
- Simons, L.S. and T.E. Martin. 1990. Food limitation of avian reproduction: an experiment with the cactus wren. *Ecology* 71:869-876.
- Soulé, M.E. 1983. What do we really know about extinction? Pages 111-124 in C. M. Schonewald-Cox, S. M. Chambers, B. McBryde, and W. L. Thomas (eds.). *Genetics and conservation*. Benjamin/Cummings Publishing Co., Menlo Park, CA.
- Soulé, M.E., D.T. Bolger, A.C. Alberts, R. Sauvajot, J. Wright, M. Sorice, and S. Hill. 1988. Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. *Conservation Biology* 2:75-92.
- Stacey, P.B., and M. Taper. 1992. Environmental variation and the persistence of small populations. *Ecological Applications* 2:18-29.
- Stenning, M.J., P.H. Harvey, B. Cambell. 1988. Searching for density-dependent regulation in a population of pied flycatchers *Ficedula hypoleuca pallas*. *Journal of Animal Ecology* 57:307-317.
- Sullivan, K.A. 1989. Starvation and predation: age-specific mortality in juvenile juncos (*Junco phaeonotus*). *Journal of Animal Ecology* 58:275-286.
- Svensson, S. 1986. Numbers of pairs, timing of egg-laying and clutch size in a sand martin *Riparia riparia* colony, 1968-1985. *Ornis Scandinavica* 17:221-229.
- Sweetwater Environmental Biologists (SEB). 1986. Fuerte Knolls California black-tailed gnatcatcher study. Prepared for The Collings Co., Inc., Newport Beach, California.
- Szép, T. 1991. Monitoring of abundance and survival rate of sand martin (*Riparia riparia*) population in the upper reaches of the River Tisza, 1986-1990. *Ornis Hungarica* 1:37-44.
- Sydeman, W.J., Güntert, and R.P. Balda. 1988. Annual reproductive yield in the cooperative pygmy nuthatch. *Auk* 105:70-77.
- Török, J. and J. Tóth. 1987. Density dependence in reproduction of collared flycatcher (*Ficedula albicollis*) at high population levels. *Journal of Animal Ecology* 57:251-258.
- Tracy, C.R. and T.L. George. 1992. On the determinants of extinction. *American Naturalist* 139:102-122.
- Tyson, B., W. Dement, and H. Mooney. 1974. Volatilization of terpenes from *Salvia mellifera*. *Nature* 252:119-120.

- Unitt, P. 1984. The birds of San Diego County. San Diego Society of Natural History Memoir 13. 276 pp.
- U. C. Agricultural Extension Service. 1970. San Diego County agricultural relationships. In cooperation with Environmental Science Services Administration and U.S. Weather Bureau.
- U.S. Fish and Wildlife Service (USFWS). 1991. Summary of the proposed rule to list the coastal California gnatcatcher (*Polioptila californica californica*) as endangered in California and Baja, Mexico. September. 114 pp.
- Virkkala, R. 1991. Population trends of forest birds in a Finnish Lapland landscape of large habitat blocks: consequences of stochastic environmental variation or regional habitat alteration. *Biological Conservation* 56:223-240.
- Wilcox, B.A., and D.D. Murphy. 1985. Conservation strategy: the effects of fragmentation on extinction. *American Naturalist* 125:879-887.

APPENDIX A

**GIS HABITAT EVALUATION MODEL
FOR THE MSCP STUDY AREA**

[SEE APPENDIX A-10 OF MSCP PLAN REPORT]

Appendix B
Habitat and population parameters for County-wide simulations

| Population | Pop. ID | Climate Zone | CSS below 40% slope | CSS other factors | CSS With Edge Effects | Initial Pop. Est. (pairs) | K (pairs) | Comments |
|-------------------------|---------|--------------|---------------------|-------------------|-----------------------|---------------------------|-----------|---|
| Calavera | 1 | M | 550 | | 110 | 20 | 24 | Acreage from Calabard HMP, assumed 20% edge CSS |
| Hedionda | 2 | M | 208 | | 42 | 8 | 9 | Acreage from Calabard HMP, assumed 20% edge CSS |
| Aviaria | 3 | M | 200 | | 40 | 7 | 9 | Acreage from Calabard HMP, assumed 20% edge CSS |
| E LaCosta-SW San Marcos | 4 | C | 1500 | | 300 | 31 | 37 | Acreage from Calabard HMP, Uni Comun., SE Ranch |
| E Rancho Santa Fe | 5 | C | 3200 | | 640 | 66 | 79 | Rough acreage estimates, assumed 20% edge CSS |
| Lake Hodges | 6 | C/T | 3097 | 1833 | 1793 | 202 | 242 | known pop. size, K=1.2 initial pop. |
| San Elijo Lagoon | 7 | M | 200 | | 40 | 7 | 9 | Rough acreage estimates, assumed 20% edge CSS |
| Del Mar Mesa | 8 | M | 167 | 315 | 396 | 13 | 16 | |
| Black Mtn. | 9 | C/T | 1152 | 527 | 561 | 41 | 49 | known pop. size, K=1.2 initial pop. |
| S Escondido | 10 | T | 2349 | 1746 | 1169 | 35 | 42 | |
| SE San Pasqual | 11 | T | 693 | 743 | 430 | 11 | 13 | |
| N Poway | 12 | T | 1512 | 1106 | 1234 | 52 | 62 | |
| Blue Sky Preserve | 13 | T | 560 | 240 | 401 | 13 | 16 | known pop. size, K=1.2 initial pop. |
| S Poway | 14 | T | 3978 | 1885 | 2015 | 113 | 136 | known pop. size, K=1.2 initial pop. |
| Peñasquitos Preserve | 15 | M/C | 2034 | 1116 | 1447 | 80 | 96 | known pop. size, K=1.2 initial pop. |
| Bonsall to J-15 | 16 | C/T | 1000 | 300 | 260 | 17 | 20 | Rough acreage estimates, assumed 20% edge CSS |
| Sycamore Canyon | 17 | T | 430 | 679 | 174 | 20 | 44 | |
| N Vicente Res. | 18 | T | 1081 | 615 | 178 | 11 | 14 | |
| Santee | 19 | T | 3069 | 1007 | 1147 | 78 | 93 | |
| Camp Elliot | 20 | T | 2250 | 1520 | 694 | 71 | 85 | |
| Mission Trails | 21 | C | 3355 | 1791 | 1798 | 89 | 107 | |
| N Escondido | 22 | T | 3000 | 1500 | 900 | 28 | 34 | Rough acreage estimates, assumed 20% edge CSS |
| S Vicente Res. | 23 | T | 1678 | 1420 | 937 | 13 | 16 | |
| Lake Jennings | 24 | T | 1965 | 1278 | 2087 | 61 | 73 | known pop. size, K=1.2 initial pop. |
| Dehesa | 25 | T | 2204 | 1042 | 1053 | 62 | 75 | |

Appendix B
Habitat and population parameters for County-wide simulations

| Population | Pop. ID | Climate Zone | CSS below 40% slope | CSS other factors | CSS With Edge Effects | Initial Pop. Est. (pairs) | K (pairs) | Comments |
|---------------------|---------|--------------|---------------------|-------------------|-----------------------|---------------------------|-----------|---|
| | | | | | | | | |
| E Sweetwater River | 26 | T | 3847 | 1450 | 268 | 39 | 46 | |
| McGinty Mesa | 27 | T | 3529 | 1686 | 2015 | 68 | 82 | |
| Sweetwater Res. | 28 | C | 4608 | 1191 | 1429 | 169 | 203 | known pop. size, K=1.2 initial pop. |
| Point Loma | 30 | M | 487 | 234 | 500 | 14 | 17 | |
| Rancho del Rey | 31 | C | 1461 | 613 | 1517 | 66 | 79 | known pop. size, K=1.2 initial pop. |
| Jamul Mtns | 32 | T | 6209 | 2353 | 608 | 108 | 130 | |
| Hollenbeck Cyn. | 34 | T | 4771 | 1394 | 666 | 44 | 53 | |
| Dulzura | 35 | T | 1528 | 1134 | 57 | 19 | 22 | |
| N Otay Mt. | 36 | T | 3936 | 1167 | 107 | 39 | 46 | |
| N San Ysidro | 37 | T | 1722 | 586 | 81 | 44 | 53 | known pop. size, K=1.2 initial pop. |
| Marron Valley | 38 | T | 2856 | 2626 | 154 | 38 | 45 | |
| E Otay Mesa-River | 39 | C | 5149 | 1654 | 1039 | 175 | 210 | known pop. size, K=1.2 initial pop. |
| W Otay Mesa | 40 | C | 1582 | 412 | 433 | 62 | 75 | known pop. size, K=1.2 initial pop. |
| Poggi/Wolf Cyns. | 41 | C | 573 | 186 | 493 | 18 | 22 | known pop. size, K=1.2 initial pop. |
| Spooner's Mesa | 42 | M | 330 | 138 | 338 | 15 | 18 | |
| NAS Miramar | 43 | C | 400 | | 80 | 21 | 25 | known pop. size, K=1.2 initial pop. |
| SE of Ramona | 44 | T | 400 | 400 | 100 | 20 | 24 | Rough acreage estimates, assumed 20% edge CSS |
| Ramona | 45 | T | 800 | 800 | 160 | 10 | 12 | Rough acreage estimates, assumed 20% edge CSS |
| El Capitan | 46 | T | 1350 | 560 | 642 | 11 | 13 | Rough acreage estimates, assumed 20% edge CSS |
| Pendleton/Fallbrook | 47 | C | 18000 | 27000 | 18000 | 200 | 290 | Rough acreage estimates, assumed 33% edge CSS |
| Jamul | 49 | C/T | 1877 | 213 | 276 | 15 | 18 | |
| La Jolla-Tecolote | 50 | M/C | 2090 | 2408 | 3621 | 30 | 35 | |

Appendix B
Habitat and population parameters for County-wide simulations

| Population | Pop. ID | Climate Zone | CSS below 40% slope | CSS other factors | CSS With Edge Effects | Initial Pop. Est. (pairs) | K (pairs) | Comments |
|--|---------|--------------|---------------------|-------------------|-----------------------|---------------------------|-----------|----------|
| Total County Metapopulation | | | 108,937 | 68,868 | 52,430 | 2,373 | 2,920 | |
| Total CSS acres | | | 177,805 | | | | | |
| Proportion of Metapopulation in Transitional Climate Zone | | | | | | | | |
| | | | | | | | 42% | |

Assumptions and input parameters used in model

R = 1.05, 1.1, or 1.2; CV of R = 30% or 40%; S = 0.4 or 0.55

Envir. Correlation = $0.86 \exp(-d/500)$; r-values range from 0.86 to 0.78 for San Diego County and are consistent with correlations of weather data.

Density-dependent migration = 0.5. Demographic stochasticity function active.

Percent Migration = $0.46 \exp(-d/1.75)$; this approximates Ogden's exponential dispersal model.

Model set for 200 year horizon and 300 replicate simulations. Initial Pop. assumed = $K/1.2$ unless known pop. size was greater.

K estimated by Climate Zone and habitat acreage:

Maritime K = $(CSS < 40\% / 20) + (Other CSS / 35) - (CSS \text{ w/edge effect} / 35)$
 Coastal K = $(CSS < 40\% / 35) + (Other CSS / 50) - (CSS \text{ w/edge effect} / 50)$
 Transition K = $(CSS < 40\% / 100) + (Other CSS / 150) - (CSS \text{ w/edge effect} / 150)$

For Source-Sink model input parameters varied by Climate zone (R, %SD, S):
 Maritime = 1.2, 30%, 0.55; Maritime/Coastal = 1.2, 40%, 0.55; Coastal = 1.1, 30%, 0.55; Coastal/Transitional = 1.1, 40%, 0.55;
 Transitional = 1.05, 40%, 0.40

Appendix C

Habitat, gnatcatcher sightings and population parameters for MSCP study area and reserve design alternatives simulations.

| Population | Pop. ID | Climate Zone | Acres of Coastal Sage Scrub | | | | No. of Gnatcatcher Sightings (pairs) | | | | Values Used in Simulations | | | | | | | |
|--------------------|---------|--------------|-----------------------------|-----------|------|----------|--------------------------------------|-------|-----------|------|----------------------------|-----|---------------|---------|-----------------|-----|-----|-----|
| | | | Total | Very High | High | Moderate | Low | Total | Very High | High | Moderate | Low | Very High CSS | all CSS | Reduce K 30/50% | | | |
| | | | | | | | | | | | | | Initial | K | Initial | K | | |
| Lake Hodges | 6 | C/T | 4579 | 3873 | 397 | 303 | 6 | 202 | 168 | 19 | 13 | 2 | 168 | 202 | 202 | 242 | 141 | 170 |
| Del Mar Mesa | 8 | M | 447 | 89 | 136 | 222 | 0 | 13 | 2 | 2 | 8 | 1 | 4 | 4 | 13 | 16 | 7 | 8 |
| Black Mtn. | 9 | C/T | 1532 | 1256 | 115 | 156 | 5 | 41 | 30 | 4 | 7 | 0 | 30 | 36 | 41 | 49 | 29 | 34 |
| S Escondido | 10 | T | 3931 | 2242 | 656 | 1005 | 28 | 35 | 29 | 3 | 3 | 0 | 29 | 35 | 35 | 42 | 25 | 29 |
| SE San Pasqual | 11 | T | 1375 | 617 | 470 | 285 | 3 | 11 | 6 | 5 | 0 | 0 | 6 | 7 | 11 | 13 | 8 | 9 |
| N Poway | 12 | T | 2490 | 1402 | 283 | 780 | 25 | 26 | 9 | 10 | 7 | 0 | 12 | 14 | 28 | 34 | 20 | 24 |
| Blue Sky Preserve | 13 | T | 797 | 477 | 180 | 125 | 15 | 13 | 12 | 1 | 0 | 0 | 12 | 15 | 13 | 16 | 9 | 11 |
| S Poway | 14 | T | 5523 | 3797 | 940 | 760 | 26 | 113 | 75 | 26 | 12 | 0 | 75 | 90 | 113 | 136 | 79 | 95 |
| Peñasquitos Canyon | 15 | M/C | 3525 | 2919 | 193 | 409 | 4 | 65 | 58 | 4 | 1 | 2 | 97 | 117 | 83 | 100 | 58 | 70 |
| Sycamore Canyon | 17 | T | 1102 | 239 | 769 | 75 | 19 | 1 | 1 | 0 | 0 | 0 | 3 | 3 | 3 | 4 | 2 | 2 |
| N Vicente Res. | 18 | T | 1721 | 1303 | 380 | 37 | 1 | 1 | 1 | 0 | 0 | 0 | 11 | 13 | 11 | 13 | 6 | 7 |
| Santee | 19 | T | 3903 | 2833 | 522 | 512 | 36 | 51 | 40 | 4 | 6 | 1 | 40 | 48 | 78 | 94 | 55 | 66 |
| Camp Elliott | 20 | T | 3562 | 2885 | 487 | 181 | 9 | 39 | 28 | 0 | 7 | 4 | 28 | 34 | 71 | 85 | 50 | 60 |
| Mission Trails | 21 | C | 4799 | 3350 | 431 | 995 | 23 | 89 | 69 | 10 | 10 | 0 | 80 | 96 | 89 | 107 | 62 | 75 |
| S Vicente Res. | 23 | T | 3072 | 1557 | 533 | 834 | 148 | 4 | 3 | 1 | 0 | 0 | 13 | 16 | 13 | 16 | 9 | 11 |
| Lake Jennings | 24 | T | 3134 | 1545 | 160 | 1222 | 207 | 61 | 49 | 0 | 12 | 0 | 49 | 59 | 61 | 73 | 43 | 51 |
| Dehesa | 25 | T | 3120 | 1532 | 394 | 1093 | 101 | 21 | 10 | 0 | 11 | 0 | 30 | 36 | 62 | 74 | 43 | 52 |
| E Sweetwater River | 26 | T | 5161 | 717 | 1995 | 2089 | 360 | 5 | 0 | 1 | 4 | 0 | 6 | 7 | 7 | 8 | 4 | 4 |
| McGinty Mesa | 27 | T | 5112 | 2803 | 602 | 1605 | 102 | 68 | 23 | 5 | 39 | 1 | 80 | 96 | 68 | 82 | 48 | 57 |
| Sweetwater Res. | 28 | C | 5513 | 4737 | 214 | 555 | 7 | 169 | 145 | 14 | 9 | 1 | 145 | 174 | 169 | 203 | 118 | 142 |
| Point Loma | 30 | M | 715 | 279 | 279 | 11 | 146 | 2 | 1 | 0 | 0 | 1 | 30 | 36 | 16 | 19 | 8 | 10 |
| Rancho del Rey | 31 | C | 1391 | 173 | 782 | 429 | 7 | 40 | 18 | 19 | 3 | 0 | 31 | 37 | 66 | 79 | 33 | 40 |
| Jamul Mtns | 32 | T | 8263 | 5759 | 1375 | 1078 | 51 | 108 | 89 | 11 | 7 | 1 | 89 | 107 | 108 | 130 | 76 | 91 |
| Hollenbeck Cyn. | 34 | T | 6000 | 1293 | 2179 | 2308 | 220 | 2 | 2 | 0 | 0 | 0 | 11 | 13 | 44 | 53 | 22 | 26 |
| Dulzura | 35 | T | 2574 | 421 | 1364 | 718 | 71 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 19 | 23 | 10 | 11 |
| N Otay Mt. | 36 | T | 5030 | 2165 | 1702 | 1137 | 26 | 4 | 2 | 2 | 0 | 0 | 18 | 22 | 39 | 47 | 20 | 23 |
| N San Ysidro | 37 | T | 2294 | 1979 | 138 | 75 | 102 | 44 | 37 | 3 | 4 | 0 | 37 | 45 | 45 | 54 | 32 | 38 |
| Marron Valley | 38 | T | 5416 | 2172 | 2502 | 678 | 64 | 2 | 0 | 1 | 1 | 0 | 18 | 22 | 38 | 46 | 19 | 23 |
| E Otay Mesa-River | 39 | C | 6524 | 5929 | 287 | 293 | 15 | 175 | 150 | 12 | 12 | 1 | 150 | 180 | 175 | 210 | 123 | 147 |
| W Otay Mesa | 40 | C | 1842 | 1693 | 37 | 109 | 3 | 62 | 59 | 0 | 2 | 1 | 59 | 71 | 62 | 74 | 43 | 52 |

Appendix C
Habitat, gnatcatcher sightings and population parameters for MSCP study area and reserve design alternatives simulations.

| Population | Pop. ID | Climate Zone | Acres of Coastal Sage Scrub | | | No. of Gnatcatcher Sightings (pairs) | | | Values Used in Simulations | | | | | | | | | | |
|--|---------|--------------|-----------------------------|-----------|------|--------------------------------------|-----|-------|----------------------------|------|----------|-----|---------------|-----|---------|----|-----------------|----|---------|
| | | | Total | Very High | High | Moderate | Low | Total | Very High | High | Moderate | Low | Very High CSS | | all CSS | | Reduce K 30/50% | | |
| | | | | | | | | | | | | | Initial | K | Initial | K | Initial | K | Initial |
| Poggi/Wolf Cyns. | 41 | C | 1203 | 981 | 44 | 178 | 0 | 38 | 34 | 1 | 3 | 0 | 16 | 20 | 18 | 22 | 13 | 15 | |
| Spooner's Mesa | 42 | M | 457 | 87 | 297 | 62 | 11 | 15 | 1 | 8 | 5 | 1 | 4 | 4 | 15 | 18 | 8 | 9 | |
| NAS Miramar | 43 | C | 998 | 144 | 117 | 46 | 691 | 21 | 9 | 7 | 2 | 3 | 9 | 11 | 21 | 25 | 11 | 13 | |
| Jamul | 49 | C/T | 2001 | 502 | 812 | 687 | 0 | 3 | 0 | 0 | 3 | 0 | 12 | 14 | 50 | 60 | 25 | 30 | |
| La Jolla-Tecalote | 50 | M/C | 4044 | 281 | 1307 | 2363 | 93 | 10 | 1 | 7 | 2 | 0 | 30 | 36 | 30 | 36 | 15 | 18 | |
| Coastal Populations in North County | | | | | | | | | | | | | | | | | | | |
| Carlsbad/ | | | | | | | | | | | | | 100 | 120 | | | | | |
| E Rancho Santa Fe | 4,5 | C | | | | | | | | | | | 7 | 9 | | | | | |
| San Elijo Lagoon | 7 | M | | | | | | | | | | | 175 | 210 | | | | | |
| Pendleton/Fallbrook | 47 | C | | | | | | | | | | | | | | | | | |

Appendix C
Habitat, gnatcatcher sightings and population parameters for MSCP study area and reserve design alternatives simulations.

| Population | Pop. ID | Climate Zone | Acres of Coastal Sage Scrub | | | | No. of Gnatcatcher Sightings (pairs) | | | | Values Used in Simulations | | | | | | | |
|---|---------|--------------|-----------------------------|-----------|--------|----------|--------------------------------------|-------|-----------|------|----------------------------|-----|-----------------------|-------|-----------------|-------|-------------------------|-------|
| | | | Total | Very High | High | Moderate | Low | Total | Very High | High | Moderate | Low | Very High CSS Initial | K | all CSS Initial | K | Reduce K 30/50% Initial | K |
| TOTAL MSCP METAPOPULATION | | | | | | | | | | | | | | | | | | |
| Total | | | 113,150 | 64,031 | 23,079 | 23,415 | 2,625 | 1,554 | 1,161 | 180 | 193 | 20 | 1,434 | 1,724 | 1,917 | 2,300 | 1,268 | 1,521 |
| Percent of Total | | | 100% | 57% | 20% | 21% | 2% | 100% | 75% | 12% | 12% | 1% | 40% | 45% | 45% | 43% | 45% | |
| Proportion of Metapopulation in Transitional Climate Zone | | | | | | | | | | | | | | | | | | |
| 21 MSCP Core Populations | | | 76,093 | 54,166 | 8,458 | 12,553 | 916 | 1435 | 1,123 | 133 | 165 | 14 | 1,245 | 1,497 | 1,545 | 1,854 | | |
| Percent of Total within | | | | | | | | | | | | | | | | | | |
| Core Populations. | | | 100% | 71% | 11% | 16% | 1% | 100% | 78% | 9% | 11% | 1% | 37% | 43% | | | | |
| Proportion of Metapopulation in Transitional Climate Zone | | | | | | | | | | | | | | | | | | |
| All High Value CSS plus 3 No. Co. Populations | | | | | | | | | | | | | 1,716 | 2,063 | | | | |
| Proportion of Metapopulation in Transitional Climate Zone | | | | | | | | | | | | | 31% | | | | | |

Assumptions and input parameters used in model

R = 1.05, 1.1, or 1.2; CV of R = 30% or 40%; S = 0.4 or 0.55
 Density-dependent migration = 0.5
 Percent Migration = $0.46 \exp(-d/1.75)$; this approximates Ogden's exponential dispersal model.
 Envir. Correlation = $0.86 \exp(-d/500)$; r-values range from 0.86 to 0.78 for San Diego County and are consistent with correlations of weather data.
 Model set for 200 year horizon, 300 replicate simulations, active demographic stochasticity function.
 Initial Pop. assumed = K/1.2 unless known pop. size was greater. K estimated by Climate Zone and habitat acreage in Very High CSS or by No. of gnatcatcher sightings times 1.2, whichever was larger.
 Maritime K = Very High CSS/20; Coastal K = Very High CSS/35; Transition K = Very High CSS/50
 For Source-Sink model input parameters varied by Climate zone (R, CV of R, S):
 Maritime = 1.2, 30%, 0.55; Maritime/Coastal = 1.2, 40%, 0.55; Coastal = 1.1, 30%, 0.55; Coastal/Transitional = 1.1, 40%, 0.55; Transitional = 1.05, 40%, 0.40

APPENDIX A-8

**Population Viability Analysis
for the Coastal Cactus Wren
within the MSCP Study Area**

**Prepared for
The Clean Water Program
City of San Diego**

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1.0 INTRODUCTION

The objective of a population viability analysis (PVA) is to identify all threats, natural and human-caused, to a population and determine if these threats endanger the continued existence of the population. This PVA is closely related in scope and format to the PVA prepared for the California gnatcatcher (Ogden 1992). These two bird species co-occur in sage scrub habitats, but the cactus wren has the additional requirement of nesting only in tall cactus. This report discusses the status, biology, and threats to the coastal cactus wren within the Multiple Species Conservation Program (MSCP) study area.

2.0 BACKGROUND

2.1 DECLINE IN POPULATION OF THE COASTAL CACTUS WREN

The coastal cactus wren (*Campylorhynchus brunneicapillus*) represents a disjunct population of a widely distributed and relatively common desert-dwelling species. The distributional limits of the coastal cactus wren are entirely within the coastal slope of southern California and northern Baja California, including the counties of Ventura, San Bernardino, Los Angeles, Orange, and San Diego. The southern portion of the coastal cactus wren population has been proposed as a distinct subspecies (*C. b. sandiegensis*; Rea and Weaver 1990). The southern California coastal slope has undergone extensive agricultural and urban development over the past 150 years, which is the primary cause for the decline and fragmentation of this regional wren population (Grinnell and Miller 1944). Rea and Weaver (1990) documented a loss of 33% of the 78 sites known to be occupied by the presumptive *C. b. sandiegensis* in southern Orange County and San Diego County during the mid-1980s. Cactus wren subpopulations elsewhere in the coastal slope are known to have been severely impacted by development (K. Garrett, B. McKernan, L. Salata, F. Roberts pers. comms.).

There is limited information on the abundance of coastal cactus wrens within each county. Gross population estimates by local ornithological experts place the total population estimate at between 1,900 and 2,500 pairs, with the majority of birds (65%) in Orange County (Table 1).

Table 1
POPULATION ESTIMATES OF COASTAL CACTUS WREN WITHIN
EACH COUNTY

| County | Number of Pairs | Source |
|----------------|-----------------|-------------------------|
| Ventura | < 200 | Garrett 1992 |
| Los Angeles | 125 - 160 | Garrett 1992 |
| San Bernardino | 40 - 70 | B. McKernan pers. comm. |
| Riverside | 65 - 150 | B. McKernan pers. comm. |
| Orange | 1200 - 1600 | L. Salata pers. comm. |
| San Diego | < 270 | Rea and Weaver 1990 |
| Total | 1900 - 2450 | |

Within San Diego County, the coastal cactus wren is limited to five substantial subpopulations having more than 20 pairs (Figure 1): Camp Pendleton (70 pairs), Lake Hodges/Wild Animal Park (90 pairs), Santee/Lake Jennings (25 pairs), Sweetwater River (25 pairs), and Otay River/Mesa (55 pairs). Other isolated localities each support less than 5 pairs (Rea and Weaver 1990). The MSCP study area encompasses about 200 pairs of cactus wren distributed primarily in four subpopulations. The potential for undocumented subpopulations of substantial size within San Diego County is believed to be low (K. Weaver pers. comm.).

2.2 CURRENT STATE AND FEDERAL STATUS OF THE COASTAL CACTUS WREN

To date, the coastal cactus wren is not listed by federal or state resource agencies. It is presently a federal Candidate 2 species and a state Species of Special Concern. On September 18, 1990, the San Diego Biodiversity Project and Palomar Audubon Society filed a petition with the Portland Regional Office of the U.S. Fish and Wildlife Service

(USFWS) to list the coastal cactus wren as endangered under the federal Endangered Species Act of 1973. A preliminary decision on whether listing of this species may be warranted is pending and is expected soon (L. Salata pers. comm.).

2.3 CACTUS WREN BIOLOGY

There are few quantitative studies of cactus wren biology for the coastal population (Rea and Weaver 1990), but some focused studies have recently been initiated (L. Szijj, B. McKernan pers. comms.). The majority of the species' biology is known from studies of desert populations in Arizona, New Mexico, and California (e.g., Anderson and Anderson 1973, Marr and Raitt 1983, Miles 1990, Simons and Simons 1990, Simons and Martin 1990).

The coastal cactus wren is a moderate-sized (33 to 47 g), year-round resident species that is dependent upon tall (>1 m in height) cactus (*Opuntia* spp.) for nest and roost sites. Arboreal cacti provide the firm support required for the wren's large, pouch-shaped nests used for roosting and breeding. In San Diego County, three *Opuntia* cactus species are used by wrens (*O. prolifera*, *O. littoralis*, and *O. oricola*). Wren-occupied cactus patches are found within coastal sage scrub, a habitat considered to be increasingly rare and threatened by development (O'Leary 1990). Rea and Weaver (1990) suggest that coastal cactus wrens tend to prefer sage scrub that is dominated by California sagebrush (*Artemisia californica*) and flat-top buckwheat (*Eriogonum fasciculatum*). Rea and Weaver (1990) found the size of 13 coastal cactus wren territories ranged from 2 to 5 acres (mean = 3.25 acres). In Arizona, Anderson and Anderson (1973) found wren territories ranged from 3 to 10 acres (mean = 4.75 acres).

Cactus wrens are primarily insectivorous birds, especially during the breeding season. Beal (1907) reported an examination of 41 cactus wren stomachs taken from the region between Los Angeles and San Bernardino during July to January. Insects and vegetable matter (fruit pulp and seeds) constituted 83% and 17%, respectively, of the diet. In Arizona, Simons and Martin (1990) reported a nestling diet of insects, consisting of mostly caterpillars, grasshoppers, and moths. Two quantitative studies of cactus wren foraging ecology have been conducted (Parker 1986, Miles 1990). Cactus wrens appear to forage on both the ground and in vegetation (Ricklefs and Hainsworth 1968, Parker 1986,

Anderson and Anderson 1973, L. Szijj, K. Garrett pers comms.). Foraging substrate and technique of the cactus wren appear to vary seasonally (Miles 1990).

The breeding season for the coastal cactus wren extends from late February to August (Unitt 1984, L. Szijj, B. McKernan pers. comms.). Unitt reported egg dates ranging from March 14 to July 10 (n = 42 clutches) for coastal San Diego County. The domed nest is composed of grasses, leaves, small twigs, and rootlets (Harrison 1979) and is typically placed about 1 m above the ground (Rea and Weaver 1990). Cactus wrens typically build 4 to 6 nests within their year-round territory (Anderson and Anderson 1973). Cactus wrens often orient the entrance of the nest to take advantage of convective ventilation provided by prevailing winds (Austin 1974, Facemire et al. 1990).

During favorable years, cactus wrens can fledge two or three successful broods. Clutch size ranges from 2 to 5 eggs, with 3 or 4 eggs being the most common clutch sizes (Anderson and Anderson 1973, Marr and Raitt 1983, Simons and Martin 1990). The male has the primary responsibility of territorial defense while the female incubates the eggs. Both parents participate in feeding and protecting the young. The incubation period lasts for 16 days and nestlings fledge at 19 to 23 days of age (Anderson and Anderson 1973, Ricklefs 1975). Fledglings are dependent on their parents for food for four to six weeks and often remain within their parents' territory for several months thereafter. During this time, juveniles often participate in territorial disputes and occasionally help to feed siblings in second broods (Anderson and Anderson 1973).

Cactus wren nesting success is highly variable between years, being dependent upon fall/winter precipitation and predation rates (Anderson and Anderson 1973, Marr and Raitt 1983, Simons and Martin 1990). The coefficient of variation (CV) of annual productivity in a six-year study by Anderson and Anderson (1973) was 26.5% (overall mean = 4.3 fledglings per pair). No nest success data are available for coastal cactus wren populations.

Information on annual survival of adult and juvenile cactus wrens is limited to studies conducted in Arizona. Anderson and Anderson (1973) reported an overall adult survival rate of 50.6% for a six-year study. The coefficient of variation in annual adult survival rate for four years that had sufficient number of banded birds was 42.7% (mean survival rate = 52.8% per year). Less than 11% (n = 74 adult birds) of the Andersons' banded population

survived to breed more than three seasons. The annual adult survival rate reported for cactus wrens is consistent with that of other songbird species (Karr et al. 1990).

Information on juvenile survival is much more difficult to obtain since mortality and emigration can not be easily distinguished. Survival of juvenile songbirds is considered to be typically low (e.g., Sullivan 1989). Anderson and Anderson (1973) reported juvenile cactus wren survival to be about 50% after one month of age and less than 15% beyond two months of age (n = 55 juvenile birds). Simons and Martin (1990) reported survival rates of juveniles after 4 to 6 weeks to be 48.5% (n = 33) and 20.5% (n = 34) during two different years. Fledging mass of surviving juveniles was significantly greater than that of nonsurvivors during the year with lower juvenile survival. For both of these studies, there is a potential to categorize birds that dispersed away from the study area as nonsurvivors. Known and potential predators of cactus wren include snakes, domestic cats, Cooper's hawks, American kestrels, roadrunners, and woodrats (Anderson and Anderson 1973, Austin et al. 1972, L. Szijj pers. comm.).

Information on the dispersal capacity of cactus wrens is very limited. Adult cactus wrens are considered to be highly sedentary, remaining in their territory for their entire adult life (Anderson and Anderson 1973). Sightings of vagrant individuals away from suitable habitat are rare (Unitt 1984, K. Garrett pers. comm.). Limited data from Arizona suggest that juvenile female cactus wrens tend to disperse farther away from their natal territories than juvenile males (Anderson and Anderson 1973).

3.0 POPULATION VIABILITY ANALYSIS

3.1 THREATS TO THE VIABILITY OF THE COASTAL CACTUS WREN POPULATION

3.1.1 Direct Human Impacts

In general, the greatest threats to wildlife populations come as a direct consequence of human activities such as habitat destruction, degradation, and fragmentation. The first two directly reduce population size while the impact of fragmentation may be more subtle (Wilcox and Murphy 1985, Rolstad 1991, Sanders et al. 1991). The fragmenting of habitat has been shown to lead to increased mortality in animal populations through a

number of mechanisms. Fragmentation causes edges. Ecological edges can be beneficial to some species. However, edges between natural habitat and human-modified habitat are often associated with negative impacts that are generally detrimental to the value of the habitat to wildlife (Harris 1988, Laurence and Yensen 1991).

The physical conditions along the edge of a patch of vegetation are different from those in the center. For this and other reasons, the composition of the vegetation is usually different at the edge than at the core of the patch. Also, human impacts penetrate across the edge. Trampling of vegetation and path creation is usually greater near the edge of a patch. Exotic plants and animals invade the native habitat at edges. Introduced predators, such as domestic cats, and enhanced predators (natural predators whose densities are enhanced by the presence of humans) penetrate the native vegetation along edges (Churcher and Lawton 1987, Yahner et al. 1989). Because more of the area of a small patch is close to an edge than that of a large patch, the usefulness of small patches as wildlife habitat is reduced. Direct impacts can be controlled through habitat preservation and proper management, including buffers between the habitat and development.

3.1.2 Loss of Genetic Variation in Isolated Populations

Genetic drift refers to random changes in gene frequencies that occur from generation to generation in any finite breeding population of organisms (Crow 1986). Ultimately, genetic drift can lead to fixation at all genetic loci and a total loss of genetic variability (Franklin 1980). Small populations are expected to lose genetic variation as a consequence of genetic drift more rapidly than large populations, since sampling from a smaller number of genes each generation leads to greater fluctuations in gene frequencies than sampling from a larger number of genes. In small populations, the contribution of mutation is negligible and genetic drift is probably the most important factor affecting levels of genetic variation (Lacy 1987).

Loss of genetic variation in small populations has both short and long-term consequences (Lacy 1987). Over the short term, it will result in increased levels of genetic uniformity (homozygosity) within subpopulations and high levels of genetic differentiation between isolated subpopulations (e.g., Leberg 1991). In many organisms, increases in homozygosity can lower survival and diminish reproductive output. Elevated levels of homozygosity have been associated with poor growth, higher frequencies of disease, and

decreased survival during periods of stress (Franklin 1980; Soulé and Simberloff 1986). Although information on the degree of inbreeding that negatively affects long-term survival is lacking for most species, even small amounts of inbreeding can have deleterious effects (Soulé and Simberloff 1986). Because birds and mammals have relatively low rates of reproduction, they may be more sensitive than other organisms to the negative effects of inbreeding (Franklin, 1980).

Over the long-term, depletion of genetic variation in small populations could lead to an inability to adapt to changing environmental conditions, rendering organisms more vulnerable to new predators, parasites, and diseases (Lacy, 1987). Genetic models suggest that the amount of genetic variation maintained in a population is inversely related to its rate of extinction (Lande and Barrowclough 1987). In a review article on evolutionary change in small populations, Franklin (1980) concludes that in order to preserve genetic variation for complex traits, effective population size in the short-term should not be less than 50 individuals and in the long-term should not be less than 500 individuals. Loss of genetic variation in fragmented cactus wren subpopulations is of concern since the dispersal capability of juvenile cactus wrens is unknown and is likely to be a constraining factor.

3.1.3 Demographic Variability

Demographic variability is simply chance events that independently affect the survival and reproduction of individuals within a population. These are most important in very small populations. For instance, in a very small population (e.g., ten individuals), it is possible all ten individuals would die in a single year, independent of any climatic effects; or all offspring born during a given period would be the same sex and if all the adults died, the population would be doomed because it would consist solely of the same sex. These types of demographic anomalies are only a serious threat to very small, isolated populations (<20 individuals; Soulé 1983, Pimm et al. 1988, Tracy and George 1992), as is the case for some of the cactus wren subpopulations in San Diego County.

3.1.4 Environmental Variability

Environmental variability is simply the natural vagaries of climate. Year to year variation in temperature, precipitation, and food supply affect the survival and reproduction of organisms. The viability of most populations decreases with greater environmental

variation. A long series of bad years (i.e., years in which survival and/or birth rate are low) may threaten the existence of a population. In the absence of human-caused threats, environmental variation is probably the greatest threat to population viability.

Annual fluctuations in birth rate and survival are the expression of environmental variability. Long-term population data, which would allow us to directly estimate survival, fecundity, and how population density varies from year to year, do not exist for the coastal cactus wren population. Instead, we have considered the information that is available in the literature on fluctuations in songbird populations.

The traditional view is that annual variation in reproductive rate of arid region songbird populations is driven by variation in precipitation. It has been amply demonstrated that primary productivity in arid zone vegetation is tightly correlated with precipitation. The density of plant-feeding insects upon which insectivorous birds, such as the cactus wren, feed also varies with precipitation. Thus, the level of precipitation determines the amount of food resources available to the birds. This should affect not only birth rate, but survival as well. Some empirical work has shown a linkage between precipitation and reproductive parameters (e.g., Marr and Raitt 1983).

More recent studies have shown a more complex interaction between precipitation, nest predator density, and avian reproductive success. Rotenberry and Wiens (1989) found weak and often insignificant correlations between precipitation and reproductive parameters, including fledgling number, in three species of arid zone birds. They also found nest predation rates to be the most important factor determining the number of offspring successfully fledged. The density of nest predators, primarily snakes and ground squirrels, did not respond directly to annual precipitation, but rather the response was lagged in time. Ground squirrels at one of their sites reached very high levels only after two consecutive wet years. Based on their results, it appears that nest predation is an important determinant of reproductive success, and the relationship between precipitation and birth rate may be lagged in time. Nest predation has been shown to be an important determinant of reproductive success in a number of passerine birds. Nest failure due to predation is common in cactus wren populations (Anderson and Anderson 1973, Simons and Simons 1990). It is likely that cactus wren densities do respond to changes in precipitation; however, the relationship is likely to be a complex interaction with variation in predation pressure (Rotenberry and Wiens 1989, Lima 1987).

3.2 SPATIAL ARRANGEMENT OF COASTAL CACTUS WREN POPULATIONS IN THE MSCP STUDY AREA

The four major subpopulations of coastal cactus wren within the MSCP study area may be isolated from each other due to the relatively large distances between subpopulations (Figure 1). The Otay River and Sweetwater River subpopulations are sufficiently close to expect an occasional exchange of individuals. Population exchange between other subpopulations appears less likely due to greater dispersal distances and the presence of intervening development. Ornithological experts have suggested that coastal cactus wrens may be highly sedentary (K. Garrett, B. McKernan pers. comms.). Anderson and Anderson (1973) also believed that their study populations were sedentary. The lack of quantitative information on dispersal capability of cactus wrens makes evaluating connectivity between subpopulations problematical.

The distribution of suitable cactus habitat within the coastal slope may historically have been patchily distributed prior to extensive development (Grinnell and Miller 1944). Therefore, one might expect that the dispersal capability of coastal cactus wrens may be sufficient to allow for a moderate (e.g., about 1%) migration rate between adjacent populations. Cactus wrens are believed to have respectable flying abilities, and their moderate body size allows for sufficient storage of energy reserves necessary for dispersing between suitable habitat patches. Cactus wrens are similar to acorn woodpeckers in body size and both are dependent on nesting habitat that is patchily distributed at the landscape scale. Stacey and Taper (1992) report on their long-term study of an acorn woodpecker population in New Mexico they presumed to be isolated. They suggest that this woodpecker population is maintained by a regular influx of immigrating juveniles, presumably from the nearest subpopulation located nearly 27 miles away.

3.3 METAPOPULATION SIMULATION MODEL

As with our California gnatcatcher PVA (Ogden 1992), we are employing a metapopulation simulation program, RAMAS/space (Exeter Software, Setauket, New York) to explore the metapopulation dynamics of the cactus wren population within the MSCP study area. The RAMAS/space model is a generalized model that is best used in a comparative fashion to explore the relative merits of alternative reserve designs. The uncertainty of the model's

input parameter values (i.e., long-term population averages and variances) and the degree of approximation required to realistically represent cactus wren population dynamics make this relatively simple population model primarily a heuristic tool. The MSCP cactus wren population is limited to about 200 pairs distributed unevenly between four subpopulations having more than 20 pairs each (Figure 1). An additional 200 pairs occur in two subpopulations north of the study area (Camp Pendleton and southern Orange County). The simulation model was run with and without these northern subpopulations.

We configured the wren model in a similar manner as the California gnatcatcher model; however, information on survival and dispersal capability are lacking for the coastal cactus wren. For survival rate, we used either the typical passerine value of 55% (Karr et al. 1990) or a conservative value of 40% in this set of simulations. Since the issue of connectivity between subpopulations is unclear, we set the migration rate between adjacent subpopulations at either zero (no migration) or one percent. The average rate of population increase (R) was set at either 1.15 or 1.2 with a 30% variance of R since these appear to be appropriate values for passerine populations (Ogden 1992). The carrying capacity of each subpopulation was assumed to be 1.2 times the initial subpopulation size. All simulations were run with a 200-year horizon for 100 iterations.

4.0 VIABILITY OF THE COASTAL CACTUS WREN META-POPULATION IN THE MSCP STUDY AREA

The current coastal cactus wren population in the MSCP study area is about 200 pairs. We simulated this population size, divided into four subpopulations. The results of the simulation presented in Table 2 suggest the viability of the current MSCP population may be marginal. This outcome is likely due to the relatively small size of each subpopulation and the perceived low rate of exchange between adjacent subpopulations. The addition of two large subpopulations north of the MSCP study area to the model increased the metapopulation viability, meeting a 5% extinction threshold even without migration between subpopulations, except for one scenario.

The simulation model appears to be moderately sensitive to the annual survival rate parameter. The extinction rate was halved by increasing the survival parameter from 40% to 55%. Allowing for a small amount of exchange between subpopulations also reduced the extinction rate, although to a lesser degree (Table 2).

Table 2

SIMULATION OF CURRENT CACTUS WREN POPULATION WITHIN THE MSCP STUDY AREA (200 PAIRS) AND WITH TWO ADDITIONAL SUBPOPULATIONS (400 PAIRS)

| Metapopulation Size (No. subpopulations) | R | %SD | % Survival | Migration Rate (%) | Extinction Probability (%) |
|---|------|-----|------------|-----------------------|-------------------------------|
| 200 (4) | 1.15 | 30 | 40 | 1 | 35 |
| 200 (4) | 1.15 | 30 | 55 | 0 | 23 |
| 200 (4) | 1.15 | 30 | 55 | 1 | 14 |
| 200 (4) | 1.2 | 30 | 40 | 1 | 16 |
| 200 (4) | 1.2 | 30 | 55 | 0 | 9 |
| 200 (4) | 1.2 | 30 | 55 | 1 | 7 |
| 400 (6) | 1.15 | 30 | 40 | 1 | 8 |
| 400 (6) | 1.15 | 30 | 55 | 0 | 1 |
| 400 (6) | 1.15 | 30 | 55 | 1 | 1 |
| 400 (6) | 1.2 | 30 | 40 | 1 | 2 |
| 400 (6) | 1.2 | 30 | 55 | 0 | 1 |
| 400 (6) | 1.2 | 30 | 55 | 1 | < 1 |

5.0 CONCLUSIONS

Simulation models of metapopulations have shown that the dynamics of simulated metapopulations are driven to a large extent by the larger subpopulations. Smaller, more peripheral subpopulations can be lost without greatly affecting the viability of the entire system, but the loss or serious reduction of one or more of the larger subpopulations has a great effect on the overall viability of the model system (Gilpin MS). Unfortunately, the coastal cactus wren metapopulation within the MSCP study area is relatively small and severely fragmented.

The simple simulation model presented here used input values (e.g., survival and migration rates) that were educated estimates based on studies of desert-dwelling cactus wren populations and other songbird species. A more detailed simulation model requires population studies of the metapopulation of concern. This simple model suggests that small population size and habitat fragmentation constrain the long-term viability of the

coastal cactus wren metapopulation within the MSCP study area in the absence of direct and indirect effects of development. Incorporating the adverse effects of development would further reduce the metapopulation viability. The largest subpopulations of coastal cactus wren occur in Orange County which may be interconnected with the Camp Pendleton subpopulation. However, the connectivity between the Pendleton subpopulation and the nearest MSCP subpopulation (Lake Hodges/Wild Animal Park) is likely to be low to nonexistent due to distance and existing development.

To achieve the MSCP objective of maintaining viable populations of the coastal cactus wren, most or all of the existing cactus wren subpopulations and habitat within the MSCP study area must be conserved and expanded by creation of additional cactus habitat. New subpopulations would also need to be established between currently occupied localities to further increase the size of the metapopulation and to promote connectivity between subpopulations. Information is required on coastal cactus wren demographics, especially in terms of dispersal capacity and annual variation in reproductive success and survival. A study of coastal cactus wren population genetics with regard to levels of homozygosity is also recommended.

6.0 LITERATURE CITED

- Anderson, A.H. and A. Anderson 1973. The Cactus Wren. University of Arizona Press, Tucson, AZ.
- Austin, G.T. 1974. Nesting success of the cactus wren in relation to nest orientation. *Condor* 76:216-217.
- Austin, G.T., E. Yensen, and C.S. Tomoff. 1972. Snake predation on cactus wren nestlings. *Condor* 74:492.
- Beal, F.E.L. 1907. Birds of California in relation to the fruit industry. USDA Biological Survey Bulletin 195.
- Churcher, P.B. and J.H. Lawton. 1987. Predation by domestic cats in an English UK village. *Journal of Zoology (London)* 212:439-456.
- Crow, J.F. 1986. Basic Concepts in Population, Quantitative, and Evolutionary Genetics. W.H. Freeman, New York.
- Facemire, C.F., M.E. Facemire, and M.C. Facemire. 1990. Wind as a factor in the orientation of entrances of cactus wren nests. *Condor* 92:1073-1075.
- Franklin, I.R. 1980. Evolutionary change in small populations. Pages 135-149 in M.E. Soulé and B.A. Wilcox (eds.). *Conservation Biology: An Evolutionary-Ecological Perspective*. Sinauer, Sunderland, MA.
- Garrett, K.L. 1992. The status of the cactus wren, *Camplorhynchus brunneicapillus*, in Los Angeles County, California. Prepared for USFWS.
- Gilpin, M.E. Unpublished MS. Extinction of finite metapopulations in correlated environments.
- Grinnell, J. and A.H. Miller. 1944. The distribution of the birds of California. *Pacific Coast Avifauna* No. 27.
- Harris, L.D. 1988. Edge effects and conservation of biotic diversity. *Conservation Biology* 2:330-332.
- Harrison, H.H. 1979. A field guide to western bird nests. Houghton Mifflin Company, Boston.
- Karr, J.R., J.D. Nichols, M.K. Klimkiewicz, and J.D. Brawn. 1990. Survival rates of birds of tropical and temperate forests: Will the dogma survive? *American Naturalist* 136: 277-291.
- Lacy, R.C. 1987. Loss of genetic diversity from managed populations: interacting effects of drift, mutation, immigration, selection, and population subdivision. *Conservation Biology* 1:143-158.

- Laurence, W.F. and E. Yensen. 1991. Predicting the impacts of edge effects in fragmented habitats. *Biological Conservation* 55:77-92.
- Leberg, P.I. 1991. Influence of fragmentation and bottlenecks on genetic divergence of wild turkey populations. *Conservation Biology* 5:522-530.
- Lima, S.L. 1987. Clutch size in birds: a predation perspective. *Ecology* 68:1062-1070.
- Marr, T.G. and R.J. Raitt. 1983. Annual variation in patterns of reproduction of the cactus wren (*Camplorhynchus brunneicapillus*). *Southwestern Naturalist* 28:149-156.
- Miles, D.B. 1990. The importance and consequences of temporal variation in avian foraging behavior. *Studies in Avian Biology* 13:210-217.
- O'Leary, J.F. 1990. Californian coastal sage scrub: general characteristics and considerations for biological conservation. Pages 24-41 in A. A. Schoenherr (ed.), *Endangered Plant Communities of Southern California*, Southern California Botanist Special Publ. No. 3.
- Ogden Environmental and Energy Services Co. 1992. Population viability analysis for the California gnatcatcher within the MSCP study area. Prepared for The Clean Water Program, City of San Diego. March. 24 pp.
- Parker, K.C. 1986. Partitioning of foraging space and nest sites in a desert shrubland bird community. *American Midland Naturalist* 11:255-267.
- Pimm, S.L., H.L. Jones, and J. Diamond. 1988. On the risk of extinction. *American Naturalist* 132:757-785.
- Rea, A.M. and K.L. Weaver. The taxonomy, distribution, and status of coastal California cactus wrens. *Western Birds* 21:81-126.
- Ricklefs, R.E. 1975. Patterns of growth in birds III: Growth and development of the cactus wren. *Condor* 77:34-45.
- Ricklefs, R.E. and F.R. Hainsworth. 1968. Temperature-dependent behavior of cactus wrens. *Ecology* 49:227-233.
- Rolstad, J. 1991. Consequences of forest fragmentation for the dynamics of bird populations: conceptual issues and the evidence. *Biological Journal of the Linnean Society* 42:149-163.
- Rotenberry, J.T., and J.A. Wiens. 1989. Reproductive biology of shrubsteppe passerine birds: geographical and temporal variation in clutch size, brood size, and fledgling success. *Condor* 91: 1-14.
- Saunders, D.A, R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. *Conservation Biology* 5:18-32.
- Simons, L.S. and L.H. Simons. 1990. Experimental studies of nest-destroying behavior by cactus wrens. *Condor* 92:855-860.

- Simons, L.S. and T.E. Martin. 1990. Food limitation of avian reproduction: an experiment with the cactus wren. *Ecology* 71:869-876.
- Soulé, M.E. 1983. What do we really know about extinction? Pages 111-124 in C.M. Schonewald-Cox, S.M. Chambers, B. McBryde, and W.L. Thomas (eds.). *Genetics and Conservation*. Benjamin/Cummings Publ. Co., Menlo Park, CA.
- Soulé, M.E. and D. Simberloff. 1986. What do genetics and ecology tell us about the design of nature reserves? *Conservation Biology* 35:19-40.
- Stacey, P.B., and M. Taper. 1992. Environmental variation and the persistence of small populations. *Ecological Applications* 2:18-29.
- Sullivan, K.A. 1989. Starvation and predation: age-specific mortality in juvenile juncos (*Junco phaeonotus*). *Journal of Animal Ecology* 58:275-286.
- Tracy, C.R. and T.L. George. 1992. On the determinants of extinction. *American Naturalist* 139:102-122.
- Unitt, P. 1984. *The Birds of San Diego County*. San Diego Society of Natural History Memoir 13. 276 pp.
- Wilcox, B.A. and D.D. Murphy. 1985. Conservation strategy: the effects of fragmentation on extinction. *American Naturalist* 125:879-887.
- Yahner, R.H., T.E. Morrell, and J.S. Rachael. 1989. Effects of edge contrast on depredation of artificial avian nests. *Journal of Wildlife Management* 53:1135-1138.

APPENDIX A-9

**BIOLOGICAL GOALS, STANDARDS,
AND GUIDELINES
FOR MULTIPLE SPECIES PRESERVE DESIGN**

Prepared by:

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and the

**Biological Task Force for Preserve Design
San Diego County, California**

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07939

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USER'S GUIDELINES TO TARGET SPECIES POLICIES

- GOAL** Maintain and enhance biological diversity in the region and conserve viable populations of endangered, threatened, and key sensitive species and their habitats, thereby preventing local extirpation and ultimate extinction.
- OBJECTIVE 1** Maintain the full range of vegetation communities and successional phases in ecologically significant areas, with a focus on habitats considered sensitive, rare, or declining.
- OBJECTIVE 2** Maintain functional wildlife corridors and habitat linkages between critical biological resource areas.
- OBJECTIVE 3** Maintain viable populations of priority plant species.
- OBJECTIVE 4** Maintain viable populations of priority animal species.

REFERENCES

ATTACHMENT A: MSCP TARGET SPECIES LIST

PREAMBLE

Purpose of this Preamble

The purpose of this preamble to the Biological Standards and Guidelines ("Guidelines") is to explain how the Guidelines can be used to reach decisions on specific habitat preserve areas and to establish a context for their use.

Purpose and History Behind Preparation of the Biological Goals, Standards, and Guidelines

The Biological Goals, Standards, and Guidelines (Guidelines) were prepared by a Biological Task Force that was formed in September 1992 as an alternative to prematurely drawing preserve boundaries prior to completion of the plan. The goal of the Guidelines is to allow flexibility in establishing preserve boundaries based on specific surveys, land use, ownership, and economic information. To provide a planning context for conservation standards, a broader understanding of the importance and extent of the region's habitats and target species was needed. The Guidelines are a set of biological goals, standards, and criteria to guide both the preparation of the MSCP Plan and subsequent subarea plans. The guidelines are intended to provide a way to measure the success of the incremental building of a preserve system and to assist in future management and maintenance decisions once the preserve, or portions of it, have been established.

Contents

The guidelines address three areas:

- a. Protection of vegetation communities with a focus on habitats considered sensitive, rare, or declining;
- b. Maintenance of functional wildlife corridors and habitat linkages between critical biological resources areas; and
- c. Maintenance of viable populations of priority plant and animal species.

Information is provided on the present status of the habitat types and species, the general extent or minimum locations needed to maintain the habitats or species (if known), and

specific measures that should be considered during implementation of the preserve system and future management. The list of target species was recommended by the U.S. Fish and Wildlife Service, based on the assumption that the standards would be the biological basis for the future and incremental delineation of a self-sustaining habitat preserve.

Emphasis on Multi-Habitat and Multi-Species Approach

Several points should be kept in mind in using the Guidelines. First, they are a synopsis of the scientific information available on the region's habitats and sensitive species. However, in many cases, it is not known how much of a habitat or species will need to be preserved in order to ensure viable, self-sustaining populations and habitat areas. By preserving multiple habitats and targeting the most critical species, it is expected that many other species will be protected, even though specific data and research may not be available on all the species. Therefore, the emphasis of the Guidelines is to preserve sufficient varieties of habitat types in large enough areas and with sufficient linkages, wildlife corridors, and buffers to create a regional, interconnected system. The consequence of reaching this primary objective will be to preserve our region's biodiversity and maximize our ability to preserve endangered, threatened, and other targeted species and preclude the need for future listings under the state and federal Endangered Species Acts.

To illustrate the interrelationships of habitats and species, the attached Summary Chart (Table A-9-1) has been prepared. This table summarizes the standards for conservation of the habitats and lists the target species that are predominant in each habitat. The Summary Chart also serves as an example of how the many targeted species can be addressed in a manageable way. By placing a priority on preserving some targeted species, such as the ones indicated by an * in the table, many of the other species will also be protected. However, by providing guidelines on all of the targeted species, the selection of so-called "umbrella" species can be carefully made and compared to the geographic extent and needs of the other species.

Multiple Factors Will Determine Location and Extent of Preserve

The biological factors alone cannot be the only factors considered in setting aside lands for conservation. Land use needs and fiscal and socioeconomic considerations will also be key factors in reaching decisions on the extent and location of the preserve system. It is recognized that there are economic constraints to habitat preservation, and non-biological

objectives and needs must be addressed for both public and private lands that contain biological resources. However, it must be recognized that if the biological standards and criteria are not met, future listings of some species as endangered or threatened may become necessary as more information becomes available. The goal of the MSCP is to maximize the number of habitats and species protected in viable preserves in the most cost effective manner possible. Success will mean protection of the region's biodiversity and greater certainty in the development process.

Setting Research and Management Priorities

For each targeted species, the Guidelines describe the type of scientific studies and management techniques needed to ensure that each species maintains a viable, self-sustaining population. The Guidelines recognize that many species will likely persist without implementation of all of the recommended measures. Available resources for conducting studies may also be limited. Therefore, the Guidelines provide three priority levels for directing research and active management efforts. The Guidelines can serve as an important source book; as management plans are developed for established habitat preserves and as research funds become available, the Guidelines provide direction on where scientific information and management attention are needed.

Subarea Planning or Multi-Species Plans on Smaller Geographic Units

The MSCP Plan recommends the preparation of subarea plans or equivalent local plans to delineate specific preserve boundaries. The extent of the habitat preserves needed and the specific boundaries will be subject to much discussion by land owners, community organizations, conservation groups, the resource agencies, and the local decision-makers. The MSCP Plan provides a depiction of the overall habitat preserve recommended for the study area. The regional preserve is described by a regional map and/or a description of the extent and types of habitats and species that are expected to be preserved. The subarea plan proposals will then need to be compared to the regional preserve plan and the Guidelines, and also compared to adjacent lands to ensure the quantities and connectivity needed are provided. The MSCP Plan and the Guidelines (which are a part of the overall plan) have been designed to permit flexibility in local decision-making to the extent possible while not compromising the survival of species.

**Table A.9-1
SUMMARY CHART OF BIOLOGICAL STANDARDS**

| Habitat and Associated Target Species ¹ | Acres in MSCP Area | Standards for Conservation | Actual Conservation |
|---|---|---|--|
| Southern Foredunes Coastal dunes milk vetch C1/CE Nuttall's lotus C2 * Least tern FE/CE * Snowy plover FT/SSC | 188 ac. Mostly State and Navy owned 56% preserved or planned open space | All | 92% / 12 (11 Acres lost) |
| Southern Coastal Bluff Scrub Coast wallflower C2 Shaw's agave C2 | 198 ac. Mostly State and Navy Owned 69% preserved or planned open space | All | 88% / 100 (19 A. lost) Actual 90 |
| Torrey Pine Forest * Torrey pine C2 | 169 ac. 93% State owned 93% preserved open space | All | 85% / 144 A. lost (24 A. lost) |
| Southern Maritime Chaparral Short-leaved dudleya PE/CE * Del Mar manzanita PE * Wart-stemmed ceanothus C2 Orcutt's spineflower PE/CE Del Mar Mesa sand aster PT | 1,777 ac. 66% preserved or planned open space | 100% unless isolated, <50 ac, disturbed, & no sensitive species | 87% / 1111 (55) 2000 2400 |
| Maritime Succulent Scrub Orcutt's bird's beak C2 San Diego barrel cactus C2 Snake cholla C2 | 1,804 ac. 44% preserved or planned open space | 100% unless isolated, <50 ac, disturbed, & no sensitive species | 60% / 955 A (536 A. lost) |
| Vernal Pool Habitat * 7 plant species documented, 4 FE/CE, 1 PT; 2 C2 Riverside fairy shrimp FE | 3,230 ac. 76% publicly owned 60% preserved or planned open space | 98% to be in dedicated managed preserves | 88% / conserved 110 100 200 |
| Salt Marsh Habitat Salt marsh bird's beak FE/CE Salt marsh skipper (invertebrate) C2 * Clapper rail FE/CE * Belding's savannah sparrow C2/CE Reddish egret C2 Elegant tern C2 Least tern FE/CE Large-billed savannah sparrow C2 | 1,870 ac. 88% preserved or planned open space | No net loss | 93% / conserved 124 Acres - no net loss |

Table A.9-1 (Continued)
SUMMARY CHART OF BIOLOGICAL STANDARDS

| Habitat and Associated Target Species ¹ | Acres in MSCP Area | Standards for Conservation |
|---|--|---|
| Wetlands Habitat California red-legged frog PE Western pond turtle Brown pelican FE/CE Bald eagle FE/CE Western snowy plover FT/SSC * California least tern FE/CE Southern willow flycatcher PE/CE Willow monardella C2/CE Palmer's ericameria ² C2 Tri-colored blackbird C2 * Least Bell's vireo FE/CE White-faced ibis C2 | 15,441 ac. 48% preserved or planned open space | No net loss open water 92% Disturbed wetland 80% Natural flood channel 83% Riparian Forest - 82% FUN - 68% Shallow Bay - 4% Deep Bay - Port Authority NFP Riparian Scrub - 80% Riparian Woodland 93% oak/riparian Forest 58% |
| Tecate Cypress Forest * Tecate cypress C2 Mexican flannelbush C2/CR * Thorne's hairstreak PE | 5,696 ac. San Ysidro Mountains 84% preserved or planned open space (BLM) | Conserve all above 1500 ft. or if sensitive species - 98% (30 A lost) |
| Oak Woodland * Cooper's hawk SSC Western bluebird | 5,622 ac. 24% preserved or planned open space | Conserve if important for wildlife, linkages, buffers, etc. 47% 2,943 lost |
| Coastal Sage Scrub & Coastal Sage Scrub/Chaparral Variegated dudleya C2 San Diego barrel cactus C2 Quino checkerspot butterfly PE (if host plant) Hermes copper butterfly C2 (if host plant) Arroyo toad FE/SSC (near washes) * San Diego horned lizard C2 * Orange-throated whiptail C2 * Cactus wren C3B * California gnatcatcher FT/SSC Rufous-crowned sparrow C2 | 115,636 ac. 3,878 ac. 34% and 19%, respectively, preserved or planned open space | Conserve according to species guidelines, esp. gnatcatcher 64% conserved 40,423 lost |

Table A.9-1 (Continued)
SUMMARY CHART OF BIOLOGICAL STANDARDS

| Habitat and Associated Target Species ¹ | Acres in MSCP Area | Standards for Conservation |
|--|--|---|
| Chaparral (Southern mixed, chamise, disturbed) Dunn's mariposa lily (gabbro soils) C2/CR Dehesa beargrass (gabbro soils) C1/CE Parry's tetraococcus (gabbro soils) C2 Hermes copper butterfly (if host plant) C2 Arroyo toad (near washes) FE/SSC Orange-throated whiptail C2 Golden eagle, mule deer, mountain lion (all in multiple habitats) | 110,191 ac. 32% preserved or planned open space | Conserve according to species guidelines & where serves as linkages, wildlife corridors, buffers, etc. |
| Grasslands (native, nonnative) San Diego thornmint (clay soils) C1/CE Orcutt's brodiaea (clay soils) C2 San Diego goldenstar C2 Peregrine falcon FE/CE Ferruginous hawk C2 Mountain plover C2 Swainson's hawk CT * Grasshopper sparrow * Northern harrier SSC (breeding, wintering) * Burrowing owl C2/SSC Badger SSC | 28,400 ac. 32% preserved or planned open space | Conserve per species guidelines, focusing on larger patches & where serves as linkages, wildlife corridors, buffers, etc. Can restore |
| Beach * Least tern FE/CE * Snowy plover FT/SSC Brown Pelican FE/CE Elegant tern C2 | 1,206 ac. 28% preserved or planned open space | Conserve per species guidelines |
| Saltpan * Least tern FE/CE * Snowy plover FT/SSC Elegant tern C2 | 235 ac. 81% in planned open space | Conserve per species guidelines |

54% conserved
46,408/105²

38%
15,979/105²

43% conserved
597 Active Beach
90-95% outside active reach
99% conserved
2 Active last

- 1 Species are only listed under predominant habitat except for Townsend's and California mastiff bats, which use multiple habitats.
- 2 Species is also commonly occurring in other habitat types, and would not be adequately preserved in this association alone.

* Priority/umbrella or indicator species (for illustrative purposes)

Note: See footnote to Table 2-3 for explanation of status codes.

INTRODUCTION

A. THE BIOLOGICAL TASK FORCE ON MULTIPLE SPECIES PRESERVE DESIGN

The Working Group of the Multiple Species Conservation Program (MSCP) appointed a group of local biologists to develop biological criteria for multiple species preserve design that can be applied regionally, yet are specific enough to be interpreted and implemented consistently by others (e.g., local jurisdictions), now and in the future. The Biological Task Force consists of staff from Ogden (representing the MSCP), Dudek (representing the Carlsbad HMP and the North County MHCP), RECON (representing the least Bell's vireo HCPs), the County of San Diego (representing the County's Open Space and Wildlife HMP), the Scientific Review Panel (representing the State's Natural Community Conservation Planning (NCCP) process, the U.S. Fish and Wildlife Service (USFWS), and the California Department of Fish and Game (CDFG).

One work product of the task force is the following "manual" of standards and implementation guidelines for meeting the biological goals and objectives of the MSCP. It should be noted that the standards and implementation guidelines contained herein were developed specifically for the MSCP study area and are separate from, though hopefully consistent with, a more general set of guidelines being developed for the Southern California region as part of the NCCP process. The standards and guidelines herein are intended to be used as tools by land owners and local municipalities in subregional biological open space planning in western San Diego County.

B. GOALS AND OBJECTIVES OF THE STANDARDS AND GUIDELINES

Policies, standards, and implementation guidelines were developed to prescribe measures that should be met in order to achieve the ultimate goals of the multiple species conservation programs in San Diego County (see Section 4.1 for a discussion of general goals and objectives). The overall biological goal of these programs is:

Maintain and enhance biological diversity in the region and conserve viable populations of endangered, threatened, and key sensitive species and their habitats, thereby preventing local extirpation and ultimate extinction, and minimizing the need for future listings, while enabling economic growth in the region.

The standards and guidelines have been developed using the best available scientific information and, where data are lacking, the best professional judgment of local biologists knowledgeable of the resources of San Diego County. The great majority of the standards and guidelines are similar in content to existing regulations and ordinances currently in effect in the County of San Diego, e.g., Resource Protection Ordinances, CEQA, and state and federal Endangered Species Acts. However, the guidelines are intended to reflect more of a regional perspective on the implications of species preservation or losses than do existing regulations, and thus promote more effective and proactive planning. In addition, the guidelines address, in specific terms, the conservation of candidate species, species proposed for listing, and other indicator species which, if applied consistently across the region, would serve to prevent future listings of these species.

There is some redundancy built into the guidelines (e.g., the guidelines address both species and their habitats) to help ensure species viability. Species viability is defined by the USFWS as maintaining the population over a 200-year planning horizon, with 95% probability of survival (see Section 4.2 for additional discussion). The guidelines are intended to be consistent with those necessary to implement the NCCP program at the sub-region level, as described in the NCCP Process Guidelines. Implementing the guidelines consistently in all sub-regions within and outside the MSCP area will ensure that species conservation efforts are distributed geographically, thus reducing the risk of population decline or extirpation of the entire species if a local sub-population fails.

The guidelines also indicate where data are lacking to make accurate assessments and include recommendations for additional studies. The guidelines should be revised as new data become available and/or as a species status changes.

C. USE OF BIOLOGICAL MAPS AND OTHER TOOLS

The following tools were used in developing the guidelines and the Habitat Evaluation Map. Many of these tools will also be necessary for implementing the guidelines, i.e., designing regional preserves:

- Vegetation community maps (1" = 2000')
- Species distribution maps (1" = 2000')
- Written species accounts (Section 2.6 and 2.7)
- Target species list (Attachment A of Appendix A-9)
- California gnatcatcher and cactus wren draft population viability analyses (Appendices A-7 and A-8)
- General objectives and criteria for preserve design (Section 4.1)
- Rare plant and animal preserve design strategy (Section 4.2)
- Public lands and land use maps
- Other GIS layers (soils, elevations, slope)
- Habitat evaluation map based on GIS model (Appendix A-10)

The Habitat Evaluation Map for the MSCP was developed by Ogden and reviewed/evaluated by the Task Force and other peer review groups. The Habitat Evaluation Map shows the regional distribution of critical biological resource areas that are the biological basis for prioritizing lands for preservation and management. The standards and guidelines developed by the Task Force should be used in conjunction with the map and site-specific field survey data (1" = 200') to:

- justify preservation of the lands of highest biological value;
- justify elimination of the lands of lowest biological value from consideration for a preserve; and
- guide decision-making on which lands to preserve within the areas of "medium" biological value.

Note that the regional vegetation and species distribution maps (1" = 2000') prepared as part of the MSCP study do not reflect field survey data for all areas and should be used only in regional planning and not for delineation of specific preserve boundaries. Detailed field surveys (i.e., parcel-level analysis, 1" = 200') are required for all proposed preservation or development areas.

The target species were selected by the USFWS. This list does not include all species considered "sensitive" or rare within the study area, such as many of those included in Resource Protection Ordinances. Most (but not all) of the MSCP target species have a legal status of at least a candidate (category 2) for federal listing; however, the list is intended to include indicator species for all habitat types within the MSCP study area. It should be noted that since the USFWS generated this target list and since the initiation of the MSCP study, additional species have been elevated to candidate species status. These species are not included as MSCP target species.

D. INTERPRETATION AND IMPLEMENTATION OF THE GUIDELINES

The biological standards and guidelines were developed using the best available scientific information and, where data are lacking, the best professional judgment of local biologists knowledgeable of the resources of San Diego County. However, while biological issues are the driving force behind the preserve design process, and thus the starting point for analysis, the biological criteria alone are not the deciding factors in setting aside lands for conservation. The biological guidelines are recommended as tools, not rules, for preserve design. The final preserve design will be the result of combining three components or layers of information:

- biological data and evaluation of regional significance
- land use information
- economic and political feasibility of acquisition

Data on land use, costs, and acquisition feasibility were developed as part of the conservation planning efforts and discussed through the Regional Implementation Strategy Committee. Decisions on how the biological guidelines are interpreted and implemented will be the responsibility of the local jurisdictions and property owners who, together through the subarea planning process, will ultimately decide how the three layers of information will be combined to design biological preserves. Evaluation and weighting of the three factors will be an iterative process; that is, as lands are added and eliminated from consideration, the ultimate boundaries of the preserve will be apparent in those areas that have some flexibility in terms of the three factors. Approval of the process will occur through normal CEQA review and/or discussions with the USFWS and CDFG.

It is recommended that property owners and local jurisdictions seek the aid of qualified biologists to interpret and apply the biological guidelines, in conjunction with the tools available, relative to their proposed development plans. Alternative standards or guidelines may be proposed to achieve the same objectives but must have a measurable biological basis, consistent with guidelines presented herein. Collection of additional regional data (the responsibility of the land owner or local jurisdiction) may serve to substantiate alternative standards.

Each property owner and local jurisdiction should evaluate how successful their projects are in meeting the biological objectives. Project documentation should clearly state which biological objectives cannot be met by project construction, based on land use, economic, or other criteria. Such evaluations will allow a realistic assessment of the overall success of the regional preserve system, and will indicate where revisions to the biological standards and guidelines may be necessary for implementation of future projects.

If the biological standards are not achieved, the goals and objectives of the conservation programs are not met. In the absence of additional biological data to demonstrate otherwise, the consequences of not meeting the conservation objectives on a regional basis may be 1) future listings of target species, if the species' survival is not assured by the preserve design, 2) inability of the conservation program to meet the criteria for a Habitat Conservation Plan, under Section 10a of the federal Endangered Species Act, or a NCCP, and possibly 3) reduction in future development potential.

What are the consequences of successfully meeting the biological standards? Land owners and local jurisdictions will have a better understanding of site-specific and regional planning options and a greater certainty in implementing those options. With a greater emphasis on maintaining the regional integrity of biological resources, in some instances there may be greater flexibility in on-site development planning.

However, adherence to the biological criteria does not necessarily absolve the land owners and local jurisdictions of mitigation responsibilities. For example, direct and indirect impacts to many target species and sensitive habitats are allowed by the guidelines, in situations where the species or habitats are not viable; however, such impacts would still require mitigation. Mitigation efforts would be directed toward building the preferred preserve system. The consequences of successfully meeting the biological standards, and the specific assurances to land owners and jurisdictions who meet the standards, should be

developed by the local jurisdictions and resources agencies and implemented as part of the MSCP, MHCP, and other current and future conservation plans.

E. DEFINITIONS

Goals, objectives, policies, standards, and guidelines are fundamental components of a planning document. The following definitions are taken from the Otay Ranch Resource Management Plan.

Goal. A goal is a direction-setter. It is an ideal future end or condition toward which planning and planning implementation measures are directed. A goal is a general expression of community values and, therefore, is abstract in nature. Consequently, a goal is generally not quantifiable, time-dependent, or suggestive of specific actions for its achievement. A single goal has been identified in this document.

Objective. An objective is a specific end or condition that is an intermediate step toward attaining a goal. It should be achievable and, when possible, measurable and time-specific. An objective may pertain to one particular aspect of a goal or it may be one of several successive steps toward goal achievement. Consequently, there may be more than one objective for a goal. Four objectives have been identified for the one goal in this document.

Policy. A policy is a specific statement that guides decision-making. A policy is based on a plan's goals and objectives as well as the analysis of data. A policy is accomplished by implementation measures such as standards and guidelines.

Standard. A standard is a measurable criterion used to evaluate achievement of a stated policy. Not all policies have quantifiable standards.

Implementation guideline. A guideline is a suggested method or procedure for achieving identified standards.

USER'S GUIDELINES TO TARGET SPECIES POLICIES

Species-specific standards, implementation, and long-term management guidelines have been prepared for each MSCP target species. Although the focus of the MSCP is on

multiple-species conservation, and preserve design will focus on large blocks of inter-connected habitat, it has long been recognized that many rare species may not be adequately captured in this type of preserve design due to highly localized and often limited distributions. The following guidelines are intended to serve two distinct functions. First, they provide a standard by which to measure the adequacy of conservation of a given target species within established or proposed multiple-species preserves. Second, they provide specific guidelines for effective long-term conservation of all target species, including those that may not be captured within a multiple-species preserve design. Individual species accounts, including information on characteristics, habitat requirements, and distribution, are contained in Sections 2.6 and 2.7. Information on vegetation communities is included in Section 2.4. General management guidelines and a discussion of land uses appropriate within and adjacent to preserve areas are provided in Section 8.0.

TERMINOLOGY

The individual target species policies include several terms, phrases, or concepts which are necessarily ambiguous, and therefore subject to interpretation. The following section defines terminology that is potentially problematical in implementing the policies; additional definitions are included in the rare species preserve design strategy (Section 4.2).

Policy recommendations for the conservation of specific populations of a target species were based on an overview of the existing database. In this context, the term "population" refers to all individuals of a species within a given geographic area, without regard to property or jurisdictional boundaries. Each population is assumed to comprise individuals with the same or similar genetic composition. The intent is to conserve the "range of genetic variation" within the species through the conservation of multiple populations. Within a population, priorities should be given to a) ensuring that minimum effective population sizes are met, b) conserving representative habitats, and c) conserving the larger populations in a configuration that will ensure continued existence of these populations with minimal management intervention. Any allowable losses are expected to be small, peripheral, and/or isolated populations or individuals that do not add significantly to the genetic diversity of the regional metapopulation or otherwise contribute to the stability/survivability of the regional metapopulation.

The existing database is not complete and many areas within the MSCP study area have not been surveyed in detail. Therefore, provision has been made in the policies for

incorporating other known populations that occur in or outside the study area, newly discovered populations, and small (possibly isolated, disjunct) populations into the preserve design if these populations are determined to "add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species." In determining genetic significance, spatial position relative to conserved and/or key populations and population size will be major considerations. For example, a small, newly discovered population (population A) in proximity to a larger, conserved population (population B) may have a lower conservation priority than a newly discovered population (population C) of any size that may represent a new geographic locality (and presumably, a distinct genetic type for the species). Population A would likely resemble population B with respect to genetic makeup, due to adequate gene flow between these two populations, and would therefore not represent a significant contribution to the overall genetic diversity of the species. Population C, by virtue of its isolation, may have a higher probability of being genetically unique, or containing different frequencies of alleles (i.e., forms of the same gene that occupy identical locations on homologous chromosomes), than populations A or B. Therefore, conservation of population C would likely add significantly to the genetic diversity of the species. Conversely, the conservation priority for population A might increase if it is in proximity to a small, conserved population, particularly if the conserved population does not meet the effective or minimum viable population size (as defined in Section 4.2). Where a species is represented by only a few populations, retention of multiple populations is encouraged regardless of genetic makeup to provide a buffer against catastrophic events.

In lieu of assigning percentages for conservation, the phrases "an adequate amount" or "sufficient habitat" have been incorporated into many individual target species policies to allow greater flexibility in the preserve design. The use of these phrases also reflects an incomplete data base. The amount to be conserved (e.g., habitat area and/or individuals) should be determined by a qualified biologist with knowledge of the species' life history and current and historic distribution. In determining an "adequate amount," the biologist should apply, on a case-by-case basis, the principles outlined in the rare species preserve design strategy (Section 4.2). Based on these principles, it is envisioned that "an adequate amount" or "sufficient habitat" may approach 100% of a given population for some species (e.g., *Baccharis vanessae*, least Bell's vireo), and be considerably less than 100% for others (e.g., *Ceanothus verrucosus*, orange-throated whiptail). Furthermore, the percent conservation may differ between populations of a given species. Specific, subsequent studies may be required to determine an "adequate amount" for conservation. In general,

these studies will likely consist of a more thorough review of the status and distribution of the species and/or additional surveys to determine its extent in a given area. In some cases, however, more complex studies such as genetic analyses or investigations into the reproductive biology of a species may be required in order to determine appropriate conservation levels.

Implementation measures for all target species call for the stabilization of conserved populations. In this context, stabilization refers strictly to the removal of human-induced threats, and not to any cessation of natural ecological processes. In fact, the overall management goal for target species is not to preserve the status quo at all costs, but to allow species to maintain natural evolutionary processes, realizing that adaptation (i.e., specialization) may eventually lead to an evolutionary dead end and natural extinction (Meffe 1992).

Enhancement of conserved populations and establishment of new populations are recommended for a number of target species to increase their probability for long-term survival. Enhancement is recommended only for those species for which an existing population is below the effective population size (as defined in Section 4.2), thereby reducing the potential for long-term viability, even with 100% conservation. Enhancement refers to expanding the size and/or vigor of an existing population, and may or may not require conservation of additional, adjacent habitat. Establishment is recommended only for species that are extant in one or a few populations, and refers to creating new populations that typically would be disjunct from existing populations. Establishment will be dependent on the availability of "suitable, but unoccupied habitat." The presence of such habitat should be determined through specific surveys and, possibly, other analyses (e.g., soil and groundwater testing, habitat characterization).

For annual plant species, implementation standards call for the incorporation of additional habitat (i.e., conserved areas beyond the habitat occupied when the population was delimited and equal to approximately 25% of the occupied habitat) to allow for temporal-spatial fluctuations that are characteristic of many annual plants (Section 4.2). Annual species are influenced by climatic (e.g., timing and amount of precipitation, temperature, etc.) and other factors, and the combination or pattern of factors leading to optimal germination and survival is not always well-known. Ideally, multiple year studies (i.e., five years or more) that include at least three years of average or above average conditions for a given species should be conducted to delineate population boundaries with a high

degree of accuracy. For most species, rainfall and temperature will be the critical factors; however, post-burn conditions are important for some species, while others thrive under drought conditions. Single season surveys, particularly in suboptimal years, can grossly underestimate areal extent and size of a population. Inclusion of additional habitat into the preserve design to allow for yearly fluctuations attempts to mitigate the need for multiple year surveys. The 25% estimate may be modified on a case-by-case basis if data show that a smaller (or larger) percentage is warranted. For example, a plant species with a strict affinity for gabbro soils would not be expected beyond the extent of those soils, regardless of the acreage. Seedbank studies may also be useful in determining populational extent in a narrow timeframe.

Implementation measures also call for incorporation of buffers into the preserve design to protect conserved plant populations, and to allow sufficient resources to support appropriate pollinators and/or dispersal agents. Language regarding pollinators and/or dispersal agents is tailored to the various life histories of the target plant species. For instance, inclusion of suitable pollinator habitat was not a consideration for wind-pollinated species, nor was habitat for dispersal agents a consideration for those plants that rely upon gravity for seed dispersal. Where pollinators and/or dispersal agents do play a role, however, it must be recognized that these species often require habitats or microsites other than those occupied by the target plant species to complete their life cycles, and incorporation of these additional habitat features into the preserve is critical in allowing these agents (and ultimately, the target species) to persist on a long-term basis. While inclusion of appropriate pollinator and/or dispersal agent habitat may be easily accommodated in a large preserve system, it may be more problematical in smaller, potentially isolated preserves that may be required for some plant species.

PRIORITIZATION OF RESEARCH EFFORTS

The species-specific guidelines were developed from a strictly biological perspective, and include recommendations deemed necessary to *ensure* the long-term survival of the target species. It is acknowledged, however, that 1) many species, particularly those that still exist in substantial populations and/or lend themselves to inclusion in large multiple-species preserve areas, will likely persist without implementation of all of the recommended measures, and 2) available resources (i.e., funding, manpower) for conducting proposed studies may be limited. Therefore, the following hierarchical prioritization system has been developed to assist in directing research and active management efforts (i.e., enhancement,

establishment, etc.). This system assumes that conservation of viable populations of as many target species as possible is a goal of this program, regardless of whether or not the species occurs in association with a number of other target species. The inability of multiple species preserves to adequately address some rare species (particularly, if the preserves focus on specific habitats and/or target species that act as an "umbrella species") has been previously mentioned. In the case of species that are at or near extinction levels in the study area, decisions on whether to proceed with restoration/enhancement/ conservation efforts must be made in consultation with the appropriate regulatory agencies (i.e., USFWS, CDFG). Biologists with specific knowledge of the particular species of concern should also be consulted during this process. Despite the prioritization of research/management efforts, recommended studies are nonetheless included in most species guidelines to direct future studies, should they become necessary.

Three prioritization levels have been identified, based largely on current and historic distribution, population size, and threats to continued survival, with Level 1 species considered the highest priority for research and active management. All species within a given level are similar in terms of general policy standards, as discussed below, although specific guidelines (standards *and* implementation measures) vary within levels, and are tailored to species-specific biology.

Priority Level 1. Species in this category (Table A-9-2) are considered the most vulnerable with respect to their probability for long-term viability. These species generally occur in only one or a few small populations. Hence, the conservation standard for all of these species calls for retention of 100% of existing populations. Enhancement of extant populations (e.g., introduction of individuals and/or specific management techniques) and establishment of new populations in historic or unoccupied but suitable habitat may also be necessary to maintain long-term viability and/or protect against extinction through catastrophic events. In contrast to some of the species in Priority Level 3, which historically occurred in few and/or small populations, Level 1 species formerly occurred in larger numbers and/or several populations and have been directly impacted by human-related events. Of the 13 MSCP target plant species, 1 does not currently occur in the MSCP area (*Chorizanthe orcuttiana*), 2 are possibly extinct in the MSCP area (*Aphanisma blitoides* and *Astragalus tener* var. *itti*), and 1 may be taxonomically invalid (*Erysimum ammophilum*). Of the 14 MSCP Level 1 animal species, 2 are possibly extinct in the study area (California red-legged frog and Pacific pocket mouse).

Priority Level 2. This category (Table A-9-2) generally includes those species for which enough populations are extant to maintain long-term viability; however, one or more populations may require enhancement to remain (or become) viable. Conservation standards of 100% are recommended only for those species that persist in a relatively small number of populations (i.e., five or fewer populations), and prioritization of research/management efforts within Level 2 should focus on this group. Among this group, species that are most subject to impacts from development or other pressures should be given the highest research/management priorities. For example, *Brodiaea filifolia* should receive a higher priority than *Agave shawii* or *Pinus torreyana*, because populations of the latter two species are relatively stable and/or largely protected in existing preserve systems. Peregrine falcon, grasshopper sparrow, California mastiff bat, and American badger are prioritized highest within Level 2 due to small local populations and/or a lack of basic information on the species' ecology to make informed management decisions.

Priority Level 3. This category (Table A-9-2) is relatively heterogeneous, including a) those species that historically occurred in small populations, and b) species that are relatively widespread, occurring in several (often large) populations. In addition, most of these species are considered relatively stable in terms of population fluctuations (e.g., shrubs, herbaceous perennials, and long-lived animal species). In fact, only two annual plant species are included in this group: *Caulanthus stenocarpus* and *Hemizonia conjugens*. The former species appears to be taxonomically invalid. Populations of many of these species occur in areas recommended for preservation of other target species. In this group, conservation standards of 100% are recommended only for species with highly restricted distributions (e.g., *Calochortus dunnii*, *Dudleya viscida*, *Rosa minutifolia*, *Senecio ganderi*, and white-faced ibis). Research/management efforts within this level should focus on those species that are most threatened by human-related impacts, due to their location in developable areas such as the coastal plain and/or on relatively level terrain. Species with the highest research/management priority within this group include *Arctostaphylos glandulosa* var. *crassifolia*, *Baccharis vanessae*, *Brodiaea orcuttii*, *Hemizonia conjugens*, *Muilla clevelandii*, white-faced ibis, Cooper's hawk, and southern mule deer.

It should be noted that research priority levels are not necessarily analogous to conservation priority levels. For example, several species in research Priority Level 3 should receive a high conservation priority due to imminent threats to their long-term viability as a result of development pressures (e.g., *Hemizonia conjugens*, *Arctostaphylos glandulosa* var.

crassifolia). These species are included in the lower research priority level at this time because if they are adequately protected in the near future, then current population size should be sufficient to maintain viable populations with minimal management intervention. Conversely, several of the species in Priority Levels 1 and 2 already receive some degree of protection through existing regulations (e.g., *Cordylanthus maritimus* ssp. *maritimus*, *Eryngium aristulatum* var. *parishii*, *Myosurus minimus* var. *apus*, *Navarretia fossalis*, *Pogogyne abramsii*, *Pogogyne nudiuscula*, California least tern, light-footed clapper rail, and least Bell's vireo) and/or substantial conservation in established preserves (e.g., *Agave shawii*, *Pinus torreyana*). These species have a higher research priority because it is evident that a greater understanding of the species' biology and/or identification of specific management techniques are required to maintain or create viable populations.

MANAGEMENT AND MONITORING GUIDELINES

General guidelines for management and monitoring of preserves are provided in Section 8.0. The implementing or coordinating agency/agencies will be responsible for overseeing long-term management, research, and monitoring. The following discussion provides a brief overview of the guiding principles of management and monitoring as they relate specifically to the target species. Existing management plans, where they exist within the MSCP study area, should be reviewed for their adequacy in meeting MSCP goals and standards.

Management Principles

- The overall management goal for rare species is not to preserve the status quo at all costs, but to allow species to maintain their natural evolutionary processes, realizing that adaptation may lead to an evolutionary dead end and eventual natural extinction of a species (Meffe 1992).
- Management practices that address environmental, demographic, and genetic factors will minimize the chances of extinction of a given population in the short-term.
- Management practices that focus on maintaining large populations will tend to conserve genetic diversity, and must be a priority to the extent practicable. However, many rare high priority species have suffered recent changes in distribution and population size, and no longer occur in large populations. In these

cases, it will be necessary to focus efforts on increasing these small populations to a viable size.

- If management opportunities need to be prioritized based on cost and/or manpower availability, efforts should be focused first on declining populations of high priority species, rather than on stable or expanding populations. Stable populations would become a management priority if they were below the minimum effective population size.
- Seed banking should be considered as a form of *ex situ* conservation for plants, to be used in conjunction with (not in place of) *in situ* preservation. Seed banking can provide relatively inexpensive insurance against extinction. Furthermore, relatively few populations need to be sampled to obtain a representation of the genetic diversity within a species, and sample sizes do not have to be large or taken in a destructive manner. For example, seed from 50-100 individuals will usually provide a 95% chance of capturing all alleles present in a frequency of >5% (Holsinger and Gottlieb 1991). Seed banking efforts should initially focus on high priority species and/or species subject to large fluctuations in population size based on environmental conditions (i.e., annuals).

Monitoring Principles

- Although monitoring of preserves will likely involve a number of measurements, assessment of the *success* of the preserves should focus on demographic processes rather than population size. Population size can be a misleading measure of the vigor or health of a population (Van Horne 1982). An understanding of the life history of a species is required to assess the significance of short-term fluctuations in population size and, for most of the species of concern, this type of information is not yet available. As an example, in detailed studies in Riverside County (ERCE 1989, 1990, 1991; Ogden 1992), very large populations of the sensitive plant species *Chorizanthe parryi* var. *parryi* and *Caulanthus simulans* were observed under seemingly adverse conditions (i.e., the fourth and fifth years of drought). Conversely, few individuals of these species were observed in the same locations in the following year, which was characterized by higher (and well-timed) rainfall and moderate temperatures (i.e., optimal growing conditions for many species). This large fluctuation in population size was most likely attributable to the increase in

competition from other herbaceous species (particularly, grasses) that were not present in significant numbers during the later drought years, and does not necessarily indicate that the populations are in danger of extinction. In fact, it is highly likely that a viable seed bank for these species occurs in these locations, and will persist for a number of years.

- Monitoring efforts should focus on obtaining a greater understanding of the species of concern (life history information, genetic analyses, etc.) and identifying appropriate management techniques through experimental methods.
- For animals, connectivity between preserves is important to maintain genetic diversity within and between preserve areas. Connectivity minimizes the chance of local extinction and local reduction of genetic diversity; however, preserves sufficiently isolated by distance allow for maintenance of regional genetic diversity, especially for vagile species (Lande and Barrowclough 1987). Thus, a network of interconnected preserves sufficiently distributed across the regional landscape allows for the maintenance of viable animal populations. The appropriate scale for the preserve network is determined by ecology (e.g., habitat preferences, home range size, dispersal capability, etc.) of the species under consideration.

SUMMARY OF IMPLEMENTATION

The target species policies are intended to serve two functions: 1) provide a standard to measure the adequacy of species conservation within existing or proposed preserve systems and 2) provide specific conservation guidelines for all target species, including those not adequately protected in a multiple-species preserve.

Gap analyses for the entire study area or individual preserves can utilize policy standards to evaluate the adequacy of existing or proposed preserves for target species. These analyses will indicate which target species already occur within protected areas, whether conserved populations are adequate to meet the policy objective of preserving long-term viability, and which species are inadequately represented. If gaps in the adequacy of a species' preservation are identified, locational information in the guidelines can be used in identifying critical acquisition areas to ensure species protection.

Gap analyses will also identify those species that do not lend themselves to preservation in larger multiple-species preserves. For these species, individual policies are sufficiently detailed to allow identification of smaller preserves and include parameters necessary to ensure that these preserves are viable on a long-term basis. Despite the expected smaller size of these preserves, preference should be given to areas that support more than one target species, and lend themselves to long-term viability based on a variety of factors including (but not limited to) surrounding land use and management opportunities.

While some of the text in the following guidelines may be repetitive, the redundancy is intentional. Much of the basic language is the same or similar for many species, but with specific variations tailored to the individual species. Most jurisdictions, with the exceptions of the county, will need to reference different subsets of these species guidelines, as a result of differing species' distributions. Therefore, inclusion of all pertinent guidelines for each species will facilitate referencing the complete guidelines for individual species or groups of species in different general plan documents or resource protection ordinances.

Table A-9-2
RESEARCH/ACTIVE MANAGEMENT PRIORITY LEVELS
FOR TARGET SPECIES

| Priority Level 1 | Priority Level 2 | Priority Level 3 |
|---|---|--|
| <u>Plants</u> | | |
| <i>Ambrosia pumila</i> ^H | <i>Acanthomintha ilicifolia</i> | <i>Arctostaphylos glandulosa</i> var. <i>crassifolia</i> ^H |
| <i>Aphanisma blitoides</i> | <i>Agave shawii</i> | <i>Arctostaphylos otayensis</i> |
| <i>Astragalus tener</i> var. <i>titi</i> ^{H/C} | <i>Astragalus deanei</i> | <i>Baccharis vanessae</i> ^H |
| <i>Chorizanthe orcuttiana</i> ^{H/C} | <i>Brodiaea filifolia</i> ^H | <i>Brodiaea orcuttii</i> ^H |
| <i>Cordylanthus maritimus</i> ssp. <i>maritimus</i> | <i>Cordylanthus orcuttianus</i> ^H | <i>Calochortus dunnii</i> |
| <i>Dudleya brevifolia</i> | <i>Corethrogyne filaginifolia</i> var. <i>linifolia</i> ^H | <i>Caulanthus stenocarpus</i> ^H |
| <i>Erysimum ammophilum</i> | <i>Dudleya variegata</i> | <i>Ceanothus cyaneus</i> |
| <i>Lotus nuttallianus</i> | <i>Eryngium aristulatum</i> var. <i>parishii</i> | <i>Ceanothus verrucosus</i> |
| <i>Monardella linooides</i> ssp. <i>viminea</i> ^H | <i>Githopsis diffusa</i> ssp. <i>filicaulis</i> ^H | <i>Cupressus forbesii</i> |
| <i>Myosurus minimus</i> var. <i>apus</i> | <i>Opuntia parryi</i> var. <i>serpentina</i> | <i>Dudleya viscida</i> |
| <i>Navarretia fossalis</i> | <i>Pinus torreyana</i> | <i>Ericameria palmeri</i> var. <i>palmeri</i> |
| <i>Orcuttia californica</i> | <i>Pogogyne abramsii</i> | <i>Ferocactus viridescens</i> |
| <i>Pogogyne nudiuscula</i> | | <i>Fremontodendron</i> <i>mexicanum</i> |
| | | <i>Hemizonia conjugens</i> ^H |
| | | <i>Hemizonia floribunda</i> |
| | | <i>Lepechinia cardiophylla</i> |
| | | <i>Lepechinia ganderi</i> |
| | | <i>Muilla clevelandii</i> ^H |
| | | <i>Nolina interrata</i> |
| | | <i>Rosa minutifolia</i> |
| | | <i>Senecio ganderi</i> |
| | | <i>Solanum tenuilobatum</i> ^H |
| | | <i>Tetracoccus dioicus</i> |
| <u>Animals</u> | | |
| arroyo southwestern toad ^H | Harbison's dun skipper ^H | Riverside fairy shrimp ^H |
| California red-legged frog ^{H/C} | salt marsh skipper | brown pelican |

Table A-9-2 (Continued)
RESEARCH/ACTIVE MANAGEMENT PRIORITY LEVELS
FOR TARGET SPECIES

| Priority Level 1 | Priority Level 2 | Priority Level 3 |
|-------------------------------------|--|----------------------------------|
| <u>Animals (Continued)</u> | | |
| southwestern pond turtle | Thorne's hairstreak butterfly ^H | reddish egret |
| golden eagle ^H | Hermes copper butterfly ^H | white-faced ibis ^H |
| northern harrier ^H | quino checkerspot butterfly ^H | Canada goose |
| western snowy plover | San Diego horned lizard | Cooper's hawk ^H |
| elegant tern | orange-throated whiptail | ferruginous hawk |
| burrowing owl ^H | peregrine falcon | Swainson's hawk |
| willow flycatcher ^H | light-footed clapper rail | bald eagle |
| coastal cactus wren ^H | California least tern | mountain plover |
| California gnatcatcher ^H | least Bell's vireo | long-billed curlew |
| tricolored blackbird | rufous-crowned sparrow | western bluebird |
| Pacific pocket mouse ^{H/C} | grasshopper sparrow ^H | large-billed Savannah sparrow |
| mountain lion ^H | Belding's Savannah sparrow | southern mule deer |
| | California mastiff bat ^H | |
| | Townsend's western big-eared bat ^H | |
| | American badger ^H | |

^H = Highest priority for research efforts within a given level, based on lack of existing data and imminent threats to species' survival. Species that receive some degree of protection through existing regulations and/or occur in existing preserves are not given the highest priority designation. This designation is *not* intended to imply that research/management efforts are not required for the other species, but only to provide some direction on the initial allocation of research funds. In general, all species in Priority Level 1 will have a higher research priority than species in levels 2 and 3.

^{H/C} = Highest priority for research efforts, subject to agency consultation. This designation is applied to species that may be extinct or extirpated within the MSCP area.

Priority Level:

1 = Vulnerable. Formerly occurred in large numbers and/or several populations but now occurs in only one or a few small populations.

2 = One or more populations may require enhancement to remain or become viable.

3 = Species that historically occurred in small populations; species that are relatively widespread, occurring in several (often large) populations with relatively stable population fluctuations; species of marginal occurrence within MSCP study area.

LITERATURE CITED

- ERC Environmental and Energy Services Co. (ERCE) (Ogden). 1989. Eastside Reservoir project, Riverside County, California. Sensitive and endangered plant studies: Interim report. Prepared for Metropolitan Water District of Southern California. October.
- ERC Environmental and Energy Services Co. (ERCE) (Ogden). 1990. Eastside Reservoir project, Riverside County, California. Sensitive and endangered plant studies: Draft report. Prepared for Metropolitan Water District of Southern California. December.
- ERC Environmental and Energy Services Co. (ERCE) (Ogden). 1991. Eastside Reservoir project, Riverside County, California. Sensitive and endangered plant studies: Final report. Prepared for Metropolitan Water District of Southern California. March.
- Holsinger, K.E. and L.D. Gottlieb. 1991. Conservation of rare and endangered plants: principles and prospects. Pages 195-208 *in* Falk, D.A. and K.E. Holsinger, eds., *Genetics and conservation of rare plants*. Oxford University Press, New York.
- Lande, R. and G.F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. Pages 87-123 *in* M.E. Soulé (ed.), *Viable populations for conservation*. Cambridge University Press, Cambridge.
- Meffe, G. 1992. Maintaining genetic diversity. Paper presented at Biodiversity in Managed Landscapes: Theory and Practice Symposium. Sacramento. July 14.
- Ogden Environmental and Energy Services Company (Ogden). 1992. Eastside Reservoir project, Riverside County, California. Seed collection studies. Unpublished data.
- Van Horne, B. 1982. Density as a misleading indicator of habitat quality. *Journal of Wildlife Management* 47: 893-901.

GOAL: Maintain and enhance biological diversity in the region and conserve viable populations of endangered, threatened, and key sensitive species and their habitats, thereby preventing local extirpation and ultimate extinction.

OBJECTIVE 1 **Maintain the full range of vegetation communities and successional phases in ecologically significant areas, with a focus on habitats considered sensitive, rare, or declining.**

POLICY 1.1 **Conserve southern foredunes.**

Present status Southern foredunes occupy 188 acres within the MSCP study area. The majority of this habitat is currently owned by the State of California and U.S. Navy. Southern foredunes habitat supports MSCP target species and is considered a sensitive and declining habitat by the CDFG and the City and County of San Diego.

Standard

Conserve all southern foredunes, as delineated on MSCP vegetation maps #7 (Del Mar), #11 (La Jolla), #16 (Point Loma), and #21 (Imperial Beach) and through subsequent surveys.

Implementation

- 1) For southern foredunes habitat currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.
- 2) For southern foredunes habitat currently in or proposed for open space, prepare individual management plans to restore disturbed portions of this habitat, including management and restoration plans for sensitive species occurring in this habitat.

POLICY 1.2 **Conserve southern coastal bluff scrub.**

Present status Southern coastal bluff scrub occupies 198 acres within the MSCP study area and is known from only a few localized sites along the coast in southern California. Approximately 93% of southern coastal bluff scrub in the MSCP study area is currently owned by the State of California and U.S. Navy. Southern coastal bluff scrub supports MSCP target species and is considered a sensitive and declining habitat by the CDFG and the City of San Diego.

Standard

Conserve all southern coastal bluff scrub, as delineated on MSCP vegetation maps #7 (Del Mar), #11 (La Jolla), and #16 (Point Loma) and through subsequent surveys.

Implementation

- 1) For southern coastal bluff scrub habitat currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.

- 2) For southern coastal bluff scrub habitat currently in or proposed for open space, prepare individual management plans to restore disturbed portions of this habitat, including management and restoration plans for sensitive species occurring in this habitat.

POLICY 1.3 **Conserve Torrey pine forest.**

Present status

Torrey pine forest occupies 169 acres within the MSCP study area. Approximately 94% of this habitat is currently owned by the State of California. Natural stands of Torrey pine forest occur in only one location within the MSCP study area (Torrey Pines State Reserve) and in only one location outside the MSCP study area (Santa Rosa Island). Torrey pine forest is considered a sensitive and declining habitat by the CDFG and the City and County of San Diego.

Standard

Conserve all Torrey pine forest, as delineated on MSCP vegetation map #7 (Del Mar) and through subsequent surveys. Refer to Policy 3.42 for a discussion of preservation standards for individual Torrey pine trees.

Implementation

- 1) For Torrey pine forest currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.
- 2) For Torrey pine forest currently in or proposed for open space, prepare individual management plans to restore disturbed portions of this habitat, including management and restoration plans for sensitive species occurring in this habitat.

POLICY 1.4 **Conserve southern maritime chaparral.**

Present status

As currently mapped, southern maritime chaparral occupies approximately 1777 acres within the MSCP study area. Approximately 56% of this habitat is currently preserved or in planned open space. Southern maritime chaparral supports MSCP target species and is considered a sensitive and declining habitat by the CDFG and the City and County of San Diego.

Standard

Conserve 100% of all southern maritime chaparral in ecologically viable areas, as delineated on MSCP vegetation maps #7 (Del Mar), #8 (Poway), and #11 (La Jolla) and through subsequent surveys. Ecologically viable patches of southern maritime chaparral are those areas that are contiguous with other habitats (i.e., not isolated by development). Southern maritime chaparral that is not ecologically viable may include those patches that are isolated by development, <50 acres, exhibit a large degree of disturbance, and do not support sensitive species.

Implementation

- 1) For southern maritime chaparral currently in or proposed for open space, prepare a management plan to insure maintenance and monitoring of this habitat and its species.
- 2) For southern maritime chaparral currently in or proposed for open space, prepare a management plan to restore disturbed portions of this habitat, including a management and restoration plan for sensitive species occurring in this habitat.

POLICY 1.5 Conserve maritime succulent scrub.

Present status

As currently mapped, maritime succulent scrub occupies approximately 1804 acres within the MSCP study area. Approximately 43% of this habitat is preserved or in planned open space. Maritime succulent scrub supports MSCP target species and is considered a sensitive and declining habitat by the CDFG and the City of San Diego.

Standard

Conserve 100% of all maritime succulent scrub in ecologically viable areas, as delineated on MSCP vegetation maps #7 (Del Mar), #11 (La Jolla), #16 (Point Loma), #17 (National City), #18 (Jamul Mountains), #21 (Imperial Beach), and #22 (Otay Mesa) and through subsequent surveys. Ecologically viable patches of maritime succulent scrub are those areas that are contiguous with other habitats (i.e., not isolated by development). Maritime succulent scrub that is not ecologically viable may include those patches that are isolated by development, <50 acres, exhibit a large degree of disturbance, and do not support sensitive species.

Implementation

- 1) For maritime succulent scrub currently in or proposed for open space, prepare a management plan to insure continued maintenance and monitoring of this habitat and its species.
- 2) For maritime succulent scrub currently in or proposed for open space, prepare a management plan to restore disturbed portions of this habitat, including a management and restoration plan for sensitive species occurring in this habitat.

POLICY 1.6 Conserve and enhance viable vernal pool habitat (vernal pools and their associated watershed and mima mounds) to ensure the long-term viability of the vernal pool habitat and the associated endemic, sensitive and State and Federally listed rare and endangered plant and animal species.

Present status

Vernal pools are a highly restricted, unique wetland habitat type that has been reduced by an estimated 97% in San Diego County. Vernal pools contain high numbers of endangered, sensitive, and endemic plant and animal species, including 1 federally listed endangered species and 4 proposed endangered species. As

currently mapped, intact vernal pool habitat occupies approximately 3230 acres within the MSCP study area, and is considered sensitive and declining by the U.S. Army Corps of Engineers (ACOE), USFWS, CDFG, and the City and County of San Diego. NAS Miramar owns and manages over half the vernal pool habitat in the MSCP area.

Standard

Include within dedicated managed preserves a minimum of 98% of the acreage of extant vernal pool habitat.

Implementation

- 1) The allowed 2% impacts to vernal pool habitat may not occur within large, or high value vernal pool complexes including A4, B, C, D1, D5-6, E, F, G1-2, H, I, J1-5, J7, J11-18, J-21, J23-26, J28-31, K3-6, L, M, N1-6, Q, R, S, T, U, V, W, X1-4, Z1-3, Z6-7, AA1-13, EE1-2, HH1-4, RR1-2, or vernal pools containing or associated with the following species: *Pogogyne abramsii*, *Pogogyne nudiuscula*, *Orcuttia californica*, *Eryngium aristulatum* var. *parishii*, *Myosurus minimus* ssp. *apus* and *M. m. filiformis*, *Navarretia fossalis*, *Downingia cuspidata*, *Brodiaea filifolia*, and the Riverside fairy shrimp. Occurrence of these species shall be determined by long-term monitoring (includes historical locations).
- 2) The allowed 2% impact may not occur within vernal pool habitat that occurs within a mosaic of other identified sensitive habitats or habitats supporting sensitive species such as intact native grassland, maritime chaparral, or coastal sage scrub.
- 3) The allowed 2% impacted vernal pools must be mitigated through restoration of damaged vernal pool habitat such that no net loss of vernal pool habitat value or area occurs. Mitigation must be consistent with the requirements of Section 404 of the Clean Water Act.
- 4) Acceptable restoration sites include vernal pools within the preserve boundary that have been damaged through alteration of vernal pool basins or drainage areas, grazing, off-road vehicles, soil compaction, invasive non-native plant species, or pollutants.
- 5) Develop a vernal pool management plan which will ensure that the preserved vernal pool habitat is stabilized and maintained.
- 6) Pools within the preserve system shall be interconnected to adjacent natural habitat to ensure the continuation of natural ecosystem functions. Buffers should be of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping, and collecting, and include sufficient resources to support appropriate pollinators and dispersal agents.
- 7) Reintroduction of greatly declining vernal pool species to suitable areas for recolonization should be considered. Acceptable species and locations for reintroductions will be determined by studies.
- 8) Surveys or studies should be included to fully define boundaries of vernal pool complexes.

Note: This criterion encompasses vernal pools beyond the boundary of the MSCP, specifically Ramona and San Marcos vernal pools.

POLICY 1.7 Conserve saltmarsh habitat.

Present status This habitat occupies approximately 1870 acres within the MSCP study area, supports several MSCP target species, and is considered a sensitive and declining resource by the USFWS, CDFG, ACOE, and the City and County of San Diego. Within the MSCP study area, approximately 72% of this habitat is currently preserved or in planned open space.

Standard

There shall be no net loss of saltmarsh habitat, as delineated on MSCP vegetation maps #7 (Del Mar), #11 (La Jolla), #16 (Point Loma), #17 (National City), and #21 (Imperial Beach), and through subsequent surveys.

Implementation

- 1) For saltmarsh currently in or proposed for open space, prepare a management plan to insure maintenance and monitoring of this habitat and its species.
- 2) For saltmarsh currently in or proposed for open space, prepare a management plan to restore disturbed portions of this habitat, including a management and restoration plan for sensitive species occurring in this habitat.
- 3) Where conditions are appropriate, create new saltmarsh habitat by converting disturbed upland habitat.

POLICY 1.8 Conserve all other wetland habitats, including freshwater marsh, riparian forest, riparian woodlands, oak riparian forest, riparian scrub, disturbed wetlands, open water, and natural flood channel.

Present status Wetland habitats occupy 5% of undeveloped lands within the MSCP study area and support MSCP target species. Open water occupies an additional 2% of the study area and also supports MSCP target species. Wetland habitat is considered a sensitive and declining resource by the USFWS, ACOE, CDFG, and the City and County of San Diego.

Standard

There shall be no net loss of wetlands habitats.

Implementation

- 1) For wetlands currently in or proposed for open space, prepare a management plan to insure maintenance and monitoring of this habitat and its species.

- 2) For wetlands currently in or proposed for open space, prepare a management plan to restore disturbed portions of these habitats, including a management and restoration plan for sensitive species occurring in these habitats.
- 3) Where conditions are appropriate, create new wetlands habitat by converting disturbed upland habitat.

POLICY 1.9 Conserve Tecate cypress forest.

Present status

Southern interior cypress forest (Tecate cypress forest) occupies 5696 acres in the San Ysidro Mountains within the MSCP study area. Approximately 89% of this habitat is currently on public lands (owned primarily by BLM). Tecate cypress forest occurs on only four peaks in the Peninsular Ranges of southwestern California (three in San Diego County, one in Orange County), with the greatest portion of its U.S. distribution (84%) on Otay Mountain within the MSCP study area. Tecate cypress also occurs in isolated groves 150 miles south into Baja California (Armstrong 1978) and is considered declining on Sierra Peak in Orange County and on Tecate Peak. Tecate cypress forest is considered a sensitive and declining habitat by the CDFG and the County of San Diego. Tecate cypress, which is the dominant canopy member in this habitat, is considered a sensitive species by the California Native Plant Society (Smith and Berg 1988).

Standard

Conserve Tecate cypress forest on Otay Mountain above 1500 feet elevation or that supports other sensitive species. (See Policy 3.20 for tecate cypress.) Tecate cypress forest is delineated on MSCP vegetation maps #18 (Jamul Mountains), #19 (Dulzura), #22 (Otay Mesa), and #23 (Otay Mountain).

Implementation

- 1) For Tecate cypress forest currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.
- 2) For Tecate cypress forest currently in or proposed for open space, prepare individual management plans to restore disturbed portions of this habitat, including management and restoration plans for sensitive species occurring in this habitat.
- 3) Develop a fire management plan for the conserved Tecate cypress forest on Otay Mountain that incorporates controlled burns (to insure succession of the closed-cone forest ecosystem) and fire prevention (to insure maintenance of large populations of Tecate cypress in various stages of succession/senescence). Maintain a minimum fire frequency cycle of 40 years.

POLICY 1.10 Conserve oak woodland.

Present status

Oak woodlands (including coast live oak woodland and Engelmann oak woodland) occupy approximately 5210 acres within the MSCP

study area. Oak woodlands are considered sensitive by the City and County of San Diego primarily due to their limited acreage, high wildlife value, gradual loss as a result of development, and lack of regeneration.

Standard

Conserve oak woodlands that are deemed important as wildlife value (food, cover, and nesting/breeding sites), habitat linkages, buffers, or as part of a mosaic of other conserved native habitat.

Implementation

- 1) For oak woodlands currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.
- 2) For oak woodlands currently in or proposed for open space, prepare individual management plans to restore disturbed portions of this habitat, including management and restoration plans for sensitive species occurring in this habitat.
- 3) Prohibit grazing in oak woodlands to be preserved in open space.

POLICY 1.11 Conserve coastal sage scrub and coastal sage scrub/chaparral.

Present status

Coastal sage scrub, including disturbed coastal sage scrub, occupies approximately 115,636 acres within the MSCP study area. Over half of the coastal sage scrub in the County is within the MSCP study area. Coastal sage scrub/chaparral, a transitional community between coastal sage scrub and chaparral, occupies approximately 3878 acres within the MSCP study area. Diegan coastal sage scrub is considered a sensitive habitat by the City and County of San Diego and is given the highest inventory priority by the California Natural Diversity Data Base. Coastal sage scrub was listed as the third most extensive vegetation community in the county over 25 years ago (CDFG 1965); however, Oberbauer (1979) and Oberbauer and Vanderwier (1991) suggested that approximately 70 to 72% of the county's original sage scrub habitat had been destroyed or modified, and this loss has continued throughout the last few years, primarily due to urban expansion. Additional evidence of the decline of this once common habitat is the growing number of declining plant and animal species dependent upon it, including the California gnatcatcher, cactus wren, rufous-crowned sparrow, San Diego horned lizard, orange-throated whiptail, and many of the MSCP target plant species.

Standards

- 1) Conserve coastal sage scrub according to the guidelines for individual species that depend on this habitat (see especially California gnatcatcher, Policy 4.32).

- 2) Conserve coastal sage scrub where it serves as a habitat linkage, wildlife movement corridor, riparian buffer, or as part of a mosaic of other conserved native habitat.

Implementation

- 1) For coastal sage scrub currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.
- 2) For coastal sage scrub currently in or proposed for open space, prepare individual management and monitoring plans to restore disturbed portions of this habitat, including management and restoration plans for sensitive species occurring in this habitat.

POLICY 1.12 Conserve chaparral.

Present status

Chaparral, including southern mixed, chamise, and disturbed chaparral, occupies approximately 110,191 acres within the MSCP study area; this represents approximately 12% of the chaparral in the County, based on Oberbauer and Vanderwier's (1991) estimate. Southern mixed and chamise chaparral are relatively widespread throughout the coastal foothills of San Diego County to the east of the MSCP study area. While chaparral supports many of the target species, it is not considered sensitive as a habitat unless sensitive species are present or use the habitat for foraging (e.g., raptors), or unless it serves as a habitat linkage or wildlife movement corridor.

Standards

- 1) Conserve chaparral according to the guidelines for individual species that depend on this habitat.
- 2) Conserve chaparral where it serves as a habitat linkage, wildlife movement corridor, riparian buffer, or as part of a mosaic of other conserved native habitat.

Implementation

- 1) For chaparral currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.
- 2) For chaparral currently in or proposed for open space, prepare individual management and monitoring plans to restore disturbed portions of this habitat, including management and restoration plans for sensitive species occurring in this habitat.

POLICY 1.13 Conserve grasslands.

Present status

Grasslands, both native and non-native, occupy approximately 28,400 acres within the MSCP study area. The large majority of this acreage is non-native grassland. Native grassland (*Stipa* grassland or valley needlegrass grassland) is considered a sensitive

habitat by the City and County of San Diego and the California Natural Diversity Data Base (CNDDDB), primarily due to its limited distribution, potential to support sensitive plant species, use as raptor foraging habitat, and gradual loss as a result of development and agricultural activities. Within the study area, this association generally occurs as small stands interspersed within scrub habitats. Oberbauer and Vanderwier (1991) estimated that almost 95% of the original acreage of native grassland in the County had been lost as of 1988, and that less than 7250 acres of native grassland remained. Grassland communities with 10% cover or greater of *Stipa pulchra* have been identified by CNDDDB as associations which need priority monitoring and restoration efforts. Native grasslands have also been identified by CNDDDB as significant communities that require special protection as remnants of a once widespread community (Keeley 1989). Non-native grassland is not considered sensitive as a habitat alone; however, it is considered a significant resource for raptor foraging, may support sensitive plant species, and may serve as a habitat linkage.

Standards

- 1) Conserve native and non-native grassland according to the guidelines for individual species that depend on this habitat, focusing on larger patches in locations that make them feasible to protect. This may be achieved through a combination of preservation and restoration of disturbed and/or non-native habitats. Restoration must result in habitat for threatened and endangered species that is of equal or greater value than that of the habitat disturbed.
- 2) Conserve native and non-native grassland where it serves as a habitat linkage, wildlife movement corridor, or as part of a mosaic of other conserved native habitat.

Implementation

- 1) For native and non-native grassland currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.
- 2) For native and non-native grassland currently in or proposed for open space, prepare individual management plans to restore disturbed portions of this habitat, including management and restoration plans for sensitive species occurring in this habitat.
- 3) Monitor restoration efforts. For native grasslands decreasing in cover, implement management prescriptions. For example, prescribed burning is recommended at a frequency of less than 7 years (3-4 years may be more ideal) (Kellogg and Kellogg 1990; Keeley 1989). Timing of burning (i.e., season) may also be critical in determining the proportion of native to non-native species.

POLICY 1.14 **Conserve beaches.**

Present status Beaches occupy approximately 1206 acres within the MSCP study area; this acreage probably varies yearly. The majority of this

acreage is in public ownership, although only 17% are currently preserved or in planned open space. Beaches are important foraging, breeding, and roosting habitat for least terns, snowy plovers, brown pelicans, and a variety of other shorebirds. Snowy plovers and least terns breed on The Strand at Imperial Beach.

Standards

- 1) Conserve beaches according to the guidelines for individual species that depend on this habitat, specifically, least terns, elegant terns, snowy plovers, and brown pelicans.

Implementation

- 1) For beach habitat currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.

POLICY 1.15

Conserve saltpan.

Present status

Saltpan occupies approximately 235 acres at the south end of San Diego Bay. The majority of this habitat is in private ownership, and 77% is in planned open space. Saltpan is considered under the jurisdiction of the U.S. Army Corps of Engineers. It is important breeding and roosting habitat for least terns, elegant terns, and snowy plovers and an important foraging habitat for snowy plovers.

Standards

- 1) Conserve saltpan habitat according to the guidelines for individual species that depend on this habitat, specifically, least terns, elegant terns, and snowy plovers.

Implementation

- 1) For saltpan habitat currently in or proposed for open space, prepare individual management plans to insure maintenance and monitoring of this habitat and its species.

REFERENCES

- Armstrong, W.P. 1978. Southern California's vanishing cypresses. *Fremontia* 6(2):24-29.
- California Department of Fish and Game (CDFG). 1965. California fish and wildlife plan. The Resources Agency, Vol 3(c):908.
- Keeley, J.E. 1989. The California Valley grassland. *In* Schoenherer, A.A., ed., *Endangered plant communities of southern California*. Proceedings of the 15th Annual Symposium. Southern California Botanists, Special Publication No. 3.
- Kellogg, E.M. and J.L. Kellogg. 1990. A study of the distribution and pattern of perennial grassland on the Camp Pendleton Marine Corps Base. Contract No. M00681-88-P-3161. 38 pp. + appendices.
- Oberbauer, T. 1979. Distribution and dynamics of San Diego County grasslands. Unpublished M.A. thesis, San Diego State University, San Diego, CA.
- Oberbauer, T.A. and J.M. Vanderwier. 1991. The vegetation and geologic substrate association and its effect on development in San Diego County. Pages 203-212 *in* Abbott, P.L. and W.J. Elliott, eds., *Environmental perils, San Diego region*. San Diego Association of Geologists, October 20.
- Smith, J.P., Jr. and K. Berg (eds.). 1988. *Inventory of rare and endangered vascular plants of California*. California Native Plant Society. 168 pp.

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OBJECTIVE 2 **Maintain functional wildlife corridors and habitat linkages between critical biological resource areas.**

POLICY 2.1 **Maintain landscape linkages to minimize habitat fragmentation, provide habitat for plants and animals in transit, maintain genetic and demographic interchange between populations, facilitate daily, annual, and seasonal movements, permit dispersal to breeding and foraging areas, and facilitate "rescue" of small peripheral populations from extinction.**

Standards

- 1) **Maintain regional habitat linkages (i.e., between regions and subregions) by preserving natural connections between large areas of conserved native habitat.**
- 2) **Maintain local habitat linkages (i.e., within subregions) by preserving natural connections to allow access to necessary resources which otherwise may be impeded by development.**
- 3) **Maintain adequate natural habitat linkages with conserved habitat patches outside the MSCP study area.**
- 4) **Where habitat linkages are not possible (e.g., constrained by existing development), maintain functional movement corridors between habitat patches.**

Implementation

- 1) **Functional wildlife corridors and habitat linkages should be determined by the dispersal characteristics of the target species (habitat preferences, dispersal distance, and movement rates), structural and spatial characteristics of the landscape, distance between patches of suitable habitat, presence of barriers to movement (e.g., roads, development), and interference from humans or predators (Noss et al. 1992). Conservation plans should identify which species the corridor or linkage is intended to address and how the corridor or linkage is intended to function. In general, will they be used only rarely, with their major function being to allow "rescue" of locally extinct populations? Or, will the corridor be used on a regular basis to migrate to feeding and/or breeding grounds?**

Habitat linkages are defined herein as natural areas that not only provide connectivity between habitat patches but also provide year-round foraging and reproduction habitat for resident plants and animals. Corridors are defined herein as narrower connections between habitat patches that allow for wildlife movement and dispersal. Habitat linkages, rather than movement corridors alone, should be conserved wherever possible (e.g., where not constrained by existing development).

- 2) **Maintain multiple linkages between habitats and resources where possible. Alternative movement corridors are especially important in areas subject to human disturbance or fire.**

- 3) Identify and maintain existing movement corridors. Corridors channel animals in the appropriate direction by means of topography (canyons and ridgelines), dirt paths, streambeds, or fences. Riparian habitats are commonly used because they provide structural diversity of vegetative cover, an available water source, an abundance of insects and plant food, and a microclimate with less intense temperature fluctuations than the surrounding upland habitats (Doyle 1990, Roberts et al. 1977).
- 4) Corridors should provide good vegetative and/or topographic cover (Noss 1983, Soule and Gilpin 1991).
- 5) Corridors can be combined with buffer zones to design a landscape that provides high quality wildlife habitat intermingled with low-intensity human land uses with a minimum of conflict (Noss 1983). This system involves having a core wildland area buffered by a zone of low-intensity land use. Beyond this would be an outer buffer zone of moderate-intensity land use providing an additional buffer from surrounding high-intensity land use areas.
- 6) Regional corridors should accommodate travel for a broad range of wildlife species as well as provide habitat for foraging and reproduction. Linkages that support resident populations of wildlife are more effective as corridors for those species (Bennett 1990). Regional corridors should have a year-round source of water.
- 7) The width of a corridor should be based on biological information for the target species (e.g., home range size and dispersal capabilities), the quality of the habitat within and adjacent to the corridor, topography, and edge effects of adjacent land uses. Where topography is lacking, the corridor must be well vegetated and development screened and well buffered from the center of the corridor. A corridor surrounded by natural vegetation may not need to be as wide to function as an appropriate travel corridor as it would need to be if the corridor were surrounded by development. If the corridor is relatively long, it must be wide enough for animals to hide in during the day.

As a general rule, wide linkages are better than narrow ones, and narrow linkages should be relatively short in length. Corridors should have a maximum length of less than 500 feet for sections with a minimum width of 400 feet. A typical width greater than 1000 feet is recommended for large mammals and birds (Ogden 1992a).

Corridors for bobcats, mountain lions, and deer should include the entire drainage (rim-to-rim), at least where the drainage is relatively steep (Ogden 1992a).

Well landscaped parking areas associated with commercial/industrial parks and the corridor may buffer the corridor on one side of an otherwise naturally vegetated corridor. Landscaped parks or golf courses can also contribute to the buffer of a corridor. Powerline easements may partially serve as movement corridors (Ogden 1992a).

- 8) A corridor should maintain visual stimuli (e.g., vegetative cover) along its entire length, or at least continually within sight, to keep animals moving through it. Developments along the rim of a canyon used as a corridor should be set back and visually screened with vegetation and/or fencing to minimize their visual impact.

- 9) Corridors should have a minimum amount of human disturbance, especially at night, and low ambient noise levels during the time (nighttime) that the target species are expected to use the corridor.
- 10) Minimize barriers such as roads. Roads that cross corridors should provide underpasses allowing large mammals and other animals to cross. Roads crossing the corridor should be fenced by at least a 10-foot fence that channels animals toward the wildlife underpass. Bridges are the preferred type of wildlife underpass; box and pipe culverts are infrequently used (Ogden 1992a). Corridors should be directed away from freeway interchanges.

The length-to-width ratio of wildlife underpasses is less than 2. This ratio is less restrictive if the height of the underpass is greater than 30 feet (Ogden 1992a).

Noise within underpasses should be less than 60 dBA during the time of day at which the animals use it. Corridors should be shielded from artificial lighting. Skylight openings within the underpass allow for vegetative cover within the underpass, and decrease the cave-like appearance, and thus will increase their success (Ogden 1992a).

- 11) Gnatcatchers likely prefer to disperse through coastal sage scrub, but will use riparian scrub, riparian woodland, and chaparral as well. Areas lacking sufficient shrub cover (e.g., extensive grassland) are probably avoided. Continuous corridors are probably more reliable than stepping-stone corridors, although disjunct patches of sage scrub do appear to be used if within short dispersal distances (1-2 miles, Ogden 1992b). Gnatcatchers probably do not disperse through high density development; however, they do use vegetated powerline and road easements that are mostly adjacent to low density development (Ogden unpubl. data, D. Bolger pers. comm.).
- 12) Establish a monitoring program to evaluate wildlife use of corridors. Develop a management program to improve corridor design and effectiveness by maintaining natural habitat structure, including removal of exotic plant and animal species, and limiting human access. Management programs may include active restoration of degraded habitats and agricultural areas, and retrofitting of existing roads (new underpasses) to allow wildlife to cross.

REFERENCES

- Bennett, A.F. 1990. Habitat corridors: their role in wildlife management and conservation. Arthur Rylah Institute for Environmental Research, Dept. of Conservation and Environment, Melbourne, Australia.
- Doyle, A.T. 1990. Use of riparian and upland habitats by small mammals. *Journal of Mammalogy* 71:14-23.
- Noss, R.F. 1983. A regional landscape approach to maintain diversity. *Bioscience* 33:700-706.
- Noss, R.F., D.D. Murphy, P.F. Brussard, M.S. Gilpin, and J.F. O'Leary. 1992. Connectivity as a component of conservation strategy for coastal sage scrub. Unpubl. report prepared for the Natural Community Conservation Planning program, California Resources Agency.

- Ogden Environmental and Energy Services Company, Inc. 1992a. Baldwin Otay Ranch wildlife corridor studies. Unpubl. report prepared for Otay Ranch Project Team, San Diego, CA.
- Ogden Environmental and Energy Services Company, Inc. 1992b. Population viability analysis for the California gnatcatcher within the MSCP study area. Unpubl report to Clean Water Program, City of San Diego, CA.
- Roberts, W.G., J.G. Howe, and F.J. Mayor. 1977. A survey of riparian forest flora and fauna in California. Pages 3-19 in A. Sands (ed.), Riparian forests in California: their ecology and conservation. Univ. California, Institute of Ecology Publ. 15:1-122.
- Soule, M.E. and M.E. Gilpin. 1991. The theory of wildlife corridor capability. Pages 3-8 in D.A. Saunders and R.J. Hubbs (eds.), The role of corridors in nature conservation. Surrey Beaty, Sydney, Australia.

Guidelines and Techniques for Delineating Wildlife Movement Corridors

A wildlife corridor is a route used by one or more species to move between two areas of habitat. A corridor can be defined by topographical features such as ridges or valleys, habitat types such as bands of riparian vegetation, areas of natural open space passing between man-made constraints, or even game trails used by many generations of animals. There are two main categories of wildlife movement corridors: regional corridors and local corridors. Regional corridors connect open space areas in a region and allow activities such as dispersal of young, genetic transfer between subpopulations, and seasonal migration. Local corridors are routes within a habitat used regularly by an animal to commute between resources such as denning sites, water sources, and hunting or foraging areas. Naturally occurring movement corridors through unconstrained habitat are usually more difficult to identify than corridors defined by urban development. Constraints are defined herein as any structure or presence which may repel or alter the path of an animal. Some examples of potential constraints are urbanized areas, areas without cover or resources, noise, lighting, domestic animals, dense vegetation, and steep or impassible topography.

It is useful to identify several "target species" for a corridor study. Based on the sizes of the open space areas being linked and habitat types occurring in the areas, the species most sensitive to the constraints of the potential corridors should be used as target species. Bobcats, mountain lions, and mule deer, for example, are much more sensitive to human presence and urbanization than are species such as coyotes, opossums, or skunks. Birds such as the California gnatcatcher are more sensitive to vegetation types and disturbance levels than other species. It can be assumed that if the target species can move through a corridor, then less sensitive species will be able to move through as well. This will help in determining the effectiveness of corridors, especially in high constraint situations.

The techniques for delineating corridors are listed below in order from general to specific. Studies on a site should proceed through the list until adequate data have been collected to determine the habitat linkage value of a site, regional corridors which pass through the site, and local corridors linking resources within the site.

- 1) Identify areas of natural open space in the region. Consider the size and habitat value of these areas for wildlife and species that inhabit the region. Identify existing man-

made or natural barriers in the area and/or adjacent land uses that may constrain linkages between the natural open space areas. Assess the importance of the area being studied as a linkage between habitats. Use recent large-scale aerial photographs.

- 2) Identify potential corridors within the site being studied. Use aerial photographs and topographic maps to identify large-scale vegetative, topographic, and development constraints and features. Features that act as natural corridors include drainages and ridgetops. Dirt roads, firebreaks, and trails are often utilized by large mammals.
- 3) Interview local naturalists, residents, ranchers, night watchmen, etc. Access data on roadkills at Caltrans and at city maintenance departments to locate road crossing sites. Long-term residents in rural areas may have anecdotal data on population trends and seasonal variability.
- 4) Search potential corridors for tracks, scat, game trails, or other sign. Other sign, depending on the species, can include scratching posts, burrows and dens, food caches, and fur. Local resources such as water sources, foraging areas, and shelter should also be noted.
- 5) Where substrate is not suitable for tracking, enhance or create tracking substrate in strategic potential movement areas such as "choke points" between existing constraints, under bridges, or along trails or narrow ravines. Several techniques have been used with varying success:
 - a. Smooth patches of dust or mud with branches or rakes. Till and smooth areas of hard soil. This is effective on bare dirt where soil is not too hard or rocky.
 - b. Bands of marking lime (gypsum powder) can be sifted across potential lines of travel. Bands should be deep enough to hold a track, wide enough that the largest species being tracked cannot easily step over, and should connect two constraining objects so that the animal cannot circumvent the band. Tracks must be read and smoothed every 1-3 days, especially in areas of high traffic or small rodent activity which will quickly obliterate tracks. Rain or repeated fogs harden the lime which must then be broken up and smoothed.
 - c. Sheets of posterboard coated with fine graphite powder or soot collect good quality tracks when laid across the path of travel and secured with long nails. The sheets are sensitive to moisture and work best in very dry climates or in sheltered areas such as under bridges and in culverts. Some species have avoided or been turned back by the cards.
 - d. Motion-sensing automatic cameras, field workers stationed with night vision scopes, or other direct viewing techniques may be useful where other techniques fail or specific data on species or individual animals are needed.
- 6) Where more specific information is needed, animals can be banded or radio-tagged and tracked over a longer period of time.

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OBJECTIVE 3 **Maintain viable populations of priority plant species.**

POLICY 3.1 **Preserve the long-term viability of San Diego thornmint (*Acanthomintha ilicifolia*).**

Present status Federal category 1 candidate (status review complete; decision pending on whether to propose for listing) and state-endangered. The San Diego thornmint is restricted to several localities in the MSCP area and is often associated with gabbro-derived or clay soils. It is threatened by urbanization and grazing.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within San Diego thornmint by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>1000 individuals), known populations (e.g., Sycamore Canyon, Poway, Black Mountain Road, Lake Hodges, El Capitan, Jamul Mountains), and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <1000 individuals).

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 5, below.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Develop and implement a fire management plan for each preserved area in order to protect populations from fires and disturbances associated with fire suppression. This plan should be developed in conjunction with the City of San Diego, County

of San Diego, California Department of Fish and Game, California Department of Forestry, and other affected agencies.

- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seedbank ecology, seedling mortality, specific habitat requirements, and management techniques for maintaining viable populations.
- 7) Establish a seed bank for San Diego thornmint as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.2 **Preserve the long-term viability of Shaw's agave (*Agave shawii*).**

Present status Federal category 2 candidate; only four small, disjunct populations of this species occur in the U.S., and all are restricted to coastal bluff scrub habitat in the MSCP area.

Standards

- 1) Include within the open space/preserve system 100% of existing populations at Torrey Pines State Reserve, Point Loma, Border Field State Park, and the mesas adjacent to Border Field State Park.
- 2) Stabilize and maintain existing populations.
- 3) Enhance existing populations that have a reduced probability for long-term viability (i.e., effective population size of <200 individuals).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat known to support this species in each of the designated areas.
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between

populations, introduced plant materials must be from the parental population or a population in proximity (e.g., Spooner's Mesa and Border Field State Park).

- 4) Develop and implement a fire management plan for each preserved area in order to protect populations from fires and disturbances associated with fire suppression. This plan should be developed in conjunction with the California Department of Parks and Recreation, California Department of Forestry, Immigration and Naturalization Service, National Park Service, U.S. Navy, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators (e.g., hummingbirds).

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive strategies, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.3 Preserve the long-term viability of San Diego ambrosia (*Ambrosia pumila*).

Present status Federal category 2 candidate; endemic to San Diego County and Baja California, Mexico; scattered throughout coastal San Diego County, including a few localities in the MSCP area. San Diego ambrosia is often associated with coastal sage scrub and disturbed habitats. A few extant populations occur in San Diego County, and many of these are threatened by urbanization.

Standards

- 1) Include within the open space/preserve system 100% of the known populations in Santee (including Mission Trails Regional Park, Old Mission Dam-KFMB Radio Towers area) and Otay Mesa (Spring Canyon) and an adequate amount (as determined by specific, subsequent studies) of any newly discovered, major populations (>500 individuals) and newly discovered or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <500 individuals).
- 4) Establish new populations of San Diego ambrosia in historic (re-introduction) and/or unoccupied but suitable habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat known to support extant stands of the species and an adequate amount (as determined by specific,

subsequent studies) of any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 6, below.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Establish the species in formerly occupied habitat (re-introduction) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >500 individuals).
- 5) Develop and implement a fire management plan for each preserved area in order to protect populations from fires and disturbances associated with fire suppression. This plan should be developed in conjunction with local jurisdictions, City of San Diego, County of San Diego, California Department of Forestry, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting.

Long-term Management Program

- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.
- 8) Establish a seed bank for San Diego ambrosia as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.4 **Preserve the long-term viability of aphanisma (*Aphanisma blitoides*).**

Present status Federal category 2 candidate (under status review); restricted to a few populations along the immediate coast in the MSCP area (not mapped); also occurs outside the MSCP area at San Onofre and possibly, in the desert at Carrizo Creek (this latter location may be an erroneous record). *Aphanisma* is a monotypic species that is widely distributed outside San Diego County; associated with coastal bluffs, coastal sage scrub, and coastal strand habitat. It has been reduced to only a few populations in San Diego County and extirpated in the northern end of its range. It is threatened by development.

Standard

- 1) Include within the open space/preserve system 100% of any extant populations at San Dieguito Creek, Silver Strand, and Imperial Beach and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <200 individuals).
- 4) Establish new populations of aphanisma in historic (re-introduction) and/or unoccupied but suitable habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat known to support extant stands of the species and an adequate amount (as determined by specific, subsequent studies) of any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 6, below.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.

- 4) Establish the species in formerly occupied habitat (re-introduction) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificial established populations) with a reasonable probability for long-term viability (i.e., effective population size of >200 individuals).
- 5) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the City of San Diego, California Department of Forestry, California Department of Parks and Recreation, U.S. Navy, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting.

Long-term Management Program

- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.
- 8) Establish a seed bank for aphanisma as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.5 Preserve the long-term viability of Del Mar manzanita (*Arctostaphylos glandulosa* ssp. *crassifolia*).

Present status Federal proposed endangered; restricted to coastal San Diego County, from the vicinity of Del Mar northward to Carlsbad. Four major populations occur in the MSCP area, associated with southern maritime chaparral and marine sandstones. This species is threatened primarily by agricultural, commercial, and residential development.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Del Mar manzanita by preserving an adequate amount (as determined by specific, subsequent studies) of the major, known populations (Del Mar-San Dieguito River Valley, Torrey Pines, Carmel Mountain-Carmel Valley, and Los Peñasquitos Canyon).
- 2) Stabilize and maintain preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations. Adequate habitat should be maintained between preserved populations to allow for gene flow via pollinators and/or dispersal agents.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop a fire management plan for the preserve areas that incorporates controlled burns, while limiting fire frequency and emergency access. This plan should be developed in conjunction with local jurisdictions, the California Department of Forestry, U.S. Fish and Wildlife Service, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on interpopulational genetic analyses, reproductive and pollinator studies, specific habitat requirements, and management techniques (e.g., controlled burning) for maintaining viable populations.

POLICY 3.6 **Preserve the long-term viability of Otay manzanita (*Arctostaphylos otayensis*).**

Present status Federal category 2 candidate; entire distribution restricted to four populations, three of which occur in the MSCP area (i.e., San Miguel Mountain, Jamul Mountain, and Otay Mountain; the fourth population on Guatay Mountain occurs on U.S. Forest Service land); associated with chaparral.

Standards

- 1) Include within the open space/preserve system an adequate amount (as determined by specific, subsequent studies) of all major (>500 individuals), known (San Miguel Mountain, Jamul Mountain, and Otay Mountain) populations and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. If genetic analyses indicate little interpopulational variation, adequate habitat should be maintained between preserved populations to allow for gene flow via pollinators and/or dispersal agents.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas that incorporates controlled burns, while limiting fire frequency and emergency access. The plan should be developed in conjunction with the County of San Diego, California Department of Forestry, Bureau of Land Management, Immigration and Naturalization Services, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on seedbank ecology, specific habitat requirements, and management techniques (including fire) for maintaining viable populations.

POLICY 3.7 **Preserve the long-term viability of Deane's milk-vetch (*Astragalus deanei*).**

Present status

Federal category 2 candidate; endemic to San Diego County; restricted to a few small populations within the MSCP area, primarily in the Sweetwater River Basin near Dehesa, and additional populations in the County unincorporated area to the east. This species is associated with coastal sage scrub, chaparral, and coast live oak woodland. There are few known localities with generally small populations, and the species is further threatened by loss of habitat.

Standards

- 1) Include within the open space/preserve system 100% of the known populations (e.g., Amber Ridge, Singing Hills (sharp bend in road), Sloan Canyon) and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

- 2) Stabilize and maintain all preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <200 individuals).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat known to support extant stands of the species and an adequate amount (as determined by specific, subsequent studies) of any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 5, below.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.
- 4) Develop and implement a fire management and emergency access plan for the preserve areas that incorporates controlled burns, while limiting fire frequency and emergency access. The plan should be developed in conjunction with the County of San Diego, California Department of Forestry, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques (including fire) for maintaining viable populations.
- 7) Establish a seed bank for Deane's milk-vetch as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.8

Preserve the long-term viability of coastal dunes milk vetch (*Astragalus tener* var. *titi*).

Present status

Federal category 1 candidate (under status review) and state-endangered; restricted to three historic localities: one extant population in Monterey County, extinct in Los Angeles County, and possibly extinct in San Diego County; if extant in the county, restricted to one or a few localities (not mapped) in the MSCP area; associated with southern foredunes.

Standards

- 1) Include within the open space/preserve system 100% of existing populations and 100% of any newly discovered populations.
- 2) Stabilize and maintain all existing and any newly discovered populations.
- 3) Enhance all populations that have a reduced probability for long-term viability (i.e., effective population size of <500 individuals).
- 4) Establish new populations of coastal dunes milk-vetch in historic (re-introduction) and/or unoccupied but suitable habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space 100% of all known, occupied habitat areas. Preserve all potential southern foredunes until they collectively have been determined to represent non-essential habitat for re-introduction purposes.

For all extant populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 5, below.

- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include the re-introduction of plant materials and/or specific management techniques.
- 4) Establish the species in formerly occupied habitat (re-introduction) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >1000 individuals).

If the species is determined to be extinct in the MSCP area, the potential for recovery through long-distance re-introduction (i.e., via the Monterey population) will need to be evaluated in conjunction with the California Department of Fish and Game (CDFG). In addition (or alternatively), a limited amount of seed may be

available from herbarium specimens and, if viable, may be used, in part, to propagate source material. As with the long-distance re-introduction, the implications and genetic consequences of propagating material from a small source will need to be evaluated in conjunction with the CDFG.

- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seed and pollen viability, germination requirements, specific habitat requirements, and management techniques for maintaining viable populations.
- 7) Establish a seed bank for coastal dunes milk vetch as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.9 Preserve the long-term viability of Encinitas baccharis (*Baccharis vanessae*).

Present status Federal proposed endangered and state-endangered; restricted to five or six "major" populations, and three of these occur in the MSCP area. Population size is often small and associated with chaparral. This species is threatened by development.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Encinitas baccharis by preserving an adequate amount (as determined by specific, subsequent studies) of all major (i.e., >100 individuals), known populations (4-S Ranch-Lake Hodges (above Del Dios Highway)) and any newly discovered populations or existing, smaller populations (Iron Mountain, Poway) that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. Preservation priorities should focus on populations that include both male and female plants.
- 2) Stabilize and maintain existing populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to,

trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.

- 3) Develop a fire management plan for the preserve areas that incorporates controlled burns, while limiting fire frequency and emergency access. This plan should be developed in conjunction with local jurisdictions, City of San Diego, California Department of Fish and Game, California Department of Forestry, U.S. Fish and Wildlife Service, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive, pollinator, and seed dispersal studies, specific habitat requirements, and management techniques (including fire) for maintaining viable populations.

POLICY 3.10 Preserve the long-term viability of thread-leaved brodiaea (*Brodiaea filifolia*).

Present status Federal proposed threatened and state-endangered; restricted to a few populations. Thread-leaved brodiaea is not recorded within the MSCP area, but is known from adjacent lands to the north of the MSCP area. This species is associated with clay soils in grasslands and vernal pool complexes and is threatened by residential development and off-road vehicles.

Standards

- 1) Include within the open space/preserve system 100% of the major (>500 individuals) populations in each of the jurisdictions where the taxon occurs (e.g., Carlsbad, Oceanside, Vista, and San Marcos), and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <500 individuals).

Implementation

- 1) Preserve and manage in natural open space 100% of all major populations and an adequate amount (as determined by specific, subsequent studies) of any other populations determined to add significantly to the genetic diversity or otherwise

contribute to the stability/survivability of the species. Preserved habitat must include the watershed necessary to support the occupied habitat.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.
- 4) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should incorporate management of watershed and water quality, and be developed in conjunction with the the local jurisdictions, County of San Diego, California Department of Fish and Game, California Department of Forestry, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive strategies (e.g., the importance of sexual versus asexual reproduction in maintaining or increasing population size) and management techniques for maintaining viable populations of a predominantly clonal species.
- 7) In order to determine the location of thread-leaved brodiaea populations, surveys must be conducted in years of adequate rainfall (i.e., at least two consecutive years of average or above-average precipitation). In order to further define extent and density of populations, sampling techniques (i.e., digging within suitable clay substrate) may be employed to identify viable but dormant corms, if such sampling can be conducted in a manner which is non-destructive to target species and sensitive habitats.

POLICY 3.11 Preserve the long-term viability of Orcutt's brodiaea (*Brodiaea orcuttii*).

Present status Federal category 2 candidate; endemic to southern California and Baja California, Mexico. Orcutt's brodiaea is found in numerous localities in San Diego County, including several populations in the MSCP area. It is associated with vernal pool complexes, grasslands, and seasonal streams, and is threatened by development.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Orcutt's brodiaea by preserving an adequate amount (as determined by specific, subsequent studies and vernal pool policy no. 1.6) of the major (>1000

individuals), known populations (Tierrasanta, Mira Mesa, Kearny Villa, Miramar, Montgomery Field, and Proctor Valley Creek) and any newly discovered populations or existing, smaller populations (e.g., Fernbrook, Poway, Los Peñasquitos Canyon, Carmel Mountain, La Mesa, O'Neal Canyon) that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space 100% of the vernal pool complexes (including watershed) that contain this taxon: A4, B5, B7-8, B11-12, C1, C9-16, C18, C22, D5-8, D16, E4, F1-28, H4, H6, H19-22, I1, I6-7, N1-4, N6, U1-13, V1-4, W1-4, X1-4, Z1-7, AA3-10, EE1-2, HH, LL, and Proctor Valley Creek, and an adequate amount (as determined by specific, subsequent studies) of any other populations (including watershed) determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should incorporate management of watershed and water quality, and be developed in conjunction with the City of San Diego, County of San Diego, California Department of Forestry, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive strategies (e.g., the importance of sexual versus asexual reproduction in maintaining or increasing population size) and management techniques for maintaining viable populations of a predominantly clonal species.
- 6) In order to determine the location of Orcutt's brodiaea populations, surveys in potential habitat must be conducted in years of adequate rainfall (i.e., at least two consecutive years of average or above-average precipitation). In order to further define extent and density of populations, sampling techniques (i.e., digging within suitable clay substrate) may be employed to identify viable but dormant corms, if such sampling can be conducted in a manner which is non-destructive to target species and sensitive habitats.

POLICY 3.12 **Preserve the long-term viability of Dunn's mariposa lily (*Calochortus dunnii*).**

Present status Federal category 2 candidate and state-rare. This lily is highly restricted in distribution; it is known from several localities in San Diego County, including three localities in the MSCP area, associated with gabbro-derived and metavolcanic soils.

Standards

- 1) Include within the open space/preserve system 100% of the extant populations on San Miguel Mountain, Otay Mountain, and Jamul Mountain, and an adequate amount (as determined by specific, subsequent studies) of any other known or newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain existing populations.

Implementation

- 1) Preserve and manage in natural open space 100% of the known populations on San Miguel Mountain, Otay Mountain, and the Jamul Mountains, and an adequate amount (as determined by specific, subsequent studies) of any other known or newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. Adequate habitat should be maintained between preserved populations to allow for gene flow via pollinators.
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the County of San Diego, California Department of Fish and Game, California Department of Forestry, Bureau of Land Management, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive strategies (e.g., the importance of sexual versus asexual reproduction in maintaining or increasing population size), specific habitat requirements, and management techniques for maintaining viable populations.

- 6) In order to determine the location of Dunn's mariposa lily populations, surveys in potential habitat must be conducted in years of adequate rainfall (i.e., at least two consecutive years of average or above-average precipitation). In order to further define extent and density of populations, sampling techniques (i.e., digging within suitable clay substrate) may be employed to identify viable but dormant corms, if such sampling can be conducted in a manner which is non-destructive to target species and sensitive habitats.

POLICY 3.13 **Preserve the long-term viability of slender-pod jewelflower [*Caulanthus stenocarpus* (= *C. heterophyllus* var. *heterophyllus*)].**

Present status Federal category 3B candidate and state-rare. This species has a widespread but sporadic distribution. It occurs in small populations in several locations in the MSCP area, associated with burned chaparral and gabbro-derived soils. A recent taxonomic revision has submerged *C. stenocarpus* into the more commonly occurring and nonsensitive taxon, *C. heterophyllus* var. *heterophyllus*. If this treatment is deemed valid by the regulatory agencies, then this taxon would not be considered sensitive.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within slender-pod caulanthus by preserving an adequate amount (as determined by specific, subsequent studies) of all major (>100 individuals), known populations (Poway, Fortuna Mountain, Dehesa-Harbrison Canyon (not mapped), Wildcat Canyon) and any newly discovered populations or existing, smaller populations (e.g., Lake Hodges, Jamul Mountains, Marron Valley) that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain existing populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in populations size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 4, below.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management plan for each preserved area that incorporates controlled burns, while limiting fire frequency and emergency access.

This plan should be developed in conjunction with the County of San Diego, California Department of Fish and Game, California Department of Forestry, Bureau of Land Management, and other affected agencies.

- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques (including fire) for maintaining viable populations.

POLICY 3.14 Preserve the long-term viability of Lakeside ceanothus (*Ceanothus cyaneus*).

Present status Federal category 2 candidate; restricted to four or five populations in San Diego County, and most occur within the MSCP area; associated with chaparral.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Lakeside ceanothus by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>200 individuals), known populations (Barona Valley-Wildcat Canyon, Ramona, El Cajon Mountain, Crest-Harbison Canyon), and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management plan for the preserve areas that incorporates controlled burns, while limiting fire frequency and emergency access.

This plan should be developed in conjunction with local jurisdictions, the County of San Diego, California Department of Forestry, and other affected agencies.

- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seedbank ecology, specific habitat requirements, and management techniques (including fire) for maintaining viable populations.

POLICY 3.15 Preserve the long-term viability of wart-stemmed ceanothus (*Ceanothus verrucosus*).

Present status Federal category 2 candidate; occurs in several populations in San Diego County, including at least seven in the MSCP area. Wart-stemmed ceanothus is associated with chaparral (including southern maritime chaparral) and is threatened by development.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within wart-stemmed ceanothus by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>1000 individuals), known populations (e.g., Torrey Pines State Reserve-Carmel Valley, Carmel Mountain, Lake Hodges, Point Loma), and any newly discovered populations or existing, smaller populations (e.g., Kearny Mesa-Clairemont Mesa-Miramar, Soledad Mountain, Spooner's Mesa) that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. Adequate habitat should be maintained between preserved populations to allow for gene flow via pollinators.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas that incorporates controlled burns, while limiting fire frequency and

emergency access. The plan should be developed in conjunction with the local jurisdictions, City of San Diego, County of San Diego, California Department of Forestry, California Department of Parks and Recreation, Immigration and Naturalization Services, U.S. Navy, and other affected agencies.

- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seedbank ecology, and management techniques (including fire) for maintaining viable populations.

POLICY 3.16 **Preserve the long-term viability of Orcutt's spineflower (*Chorizanthe orcuttiana*).**

Present status

Federal proposed endangered and state-endangered. Orcutt's spineflower is known historically from the MSCP area and is now restricted to one extant population which is in the MHCP area. It is associated with southern maritime chaparral and marine sandstones. Attempts to rediscover this population in the last few years have been unsuccessful, as most historic habitat has been urbanized.

Standards

- 1) Include within the open space/preserve system 100% of existing population(s) (Oak Crest County Park in Encinitas) and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations.
- 2) Stabilize and maintain all existing and any newly discovered populations.
- 3) Enhance all populations that have a reduced probability for long-term viability (i.e., effective population size of <1000 individuals).
- 4) Establish new populations of Orcutt's spineflower in historic (re-introduction) and/or suitable but unoccupied habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat known to support extant stands of this species and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations. Preserve potential but unoccupied habitat areas until these have been surveyed adequately and determined to neither support this taxon nor represent essential habitat for re-introduction purposes.

For all extant populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 6, below.

- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.
- 4) Establish the species in formerly occupied habitat (e.g., re-introduction in Torrey Pines State Reserve and Point Loma) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >1000 individuals).
- 5) Develop and implement a fire management and emergency access plan for the preserve areas that incorporates controlled burns, while limiting fire frequency and emergency access. The plan should be developed in conjunction with the local jurisdictions, City of San Diego, California Department of Fish and Game, California Department of Forestry, California Department of Parks and Recreation, U.S. Fish and Wildlife Service, U.S. Navy, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 7) Conduct studies that determine the life history of this species, monitor the status of populations, and determine their ecological and management requirements. Studies should include complete surveys of all potential habitat areas (including marine sandstone terraces and other potential habitats).
- 8) Establish a seed bank for Orcutt's spineflower as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.17 **Preserve the long-term viability of salt marsh bird's beak (*Cordylanthus maritimus* ssp. *maritimus*).**

Present status

Federally and state-endangered; restricted to three extant populations in San Diego County, and all occur in the MSCP area. Salt marsh bird's beak is associated with coastal saltmarsh and is threatened by loss of habitat.

Standards

- 1) Include within the open space/preserve system 100% of existing populations (Sweetwater Marsh, Tijuana Estuary, mouth of Otay River) and 100% of any newly discovered populations.
- 2) Stabilize and maintain all existing and any newly discovered populations.
- 3) Enhance all populations that have a reduced probability for long-term viability (i.e., effective population size of <1000 individuals).
- 4) Establish new populations of salt marsh bird's beak in historic (re-introduction) and/or suitable but unoccupied habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space all of the coastal salt marsh habitat (refer to policy no. 1.4) which supports or has historically supported this species, or which is determined to be potential habitat.

For all extant populations, preserve an additional 25% of suitable but presumably unoccupied habitat to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 5, below.

- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.
- 4) Establish the species in formerly occupied habitat (re-introduction) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >1000 individuals). If possible, establish populations in marshes other than Tijuana and Sweetwater.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 6) Develop and implement a watershed management plan for each of the affected coastal estuaries.
- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements.

- 8) Establish a seed bank for salt marsh bird's beak as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.18 **Preserve the long-term viability of Orcutt's bird's-beak (*Cordylanthus orcuttianus*).**

Present status Federal category 2 candidate; endemic to San Diego County and Baja California, Mexico. In San Diego County, this species is restricted to a few locations in the southwestern portion of the MSCP area. It is associated with maritime succulent scrub and riparian scrub/disturbed floodplains and is threatened by urbanization.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Orcutt's bird's-beak by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>1000 individuals), known populations (Otay River Valley, between I-5 and I-805) and any newly discovered populations or existing, smaller populations (e.g., Chula Vista (extant?), Dennery Canyon, and Spooner's Mesa area) that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance all populations that have a reduced probability for long-term viability (i.e., effective population size of <1000 individuals).

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 5, below.

- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include the re-introduction of plant materials and/or specific management techniques.

- 4) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should be developed in conjunction with local jurisdictions, the City of San Diego, County of San Diego, California Department of Forestry, Immigration and Naturalization Service, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, seedling mortality, specific habitat requirements, and management techniques for maintaining viable populations.
- 7) Establish a seed bank for Orcutt's bird's-beak as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.19 **Preserve the long-term viability of Del Mar Mesa sand-aster (*Corethrogyne filaginifolia* var. *linifolia*).**

Present status Federal proposed threatened. Del Mar Mesa sand-aster is endemic to San Diego County, where it is restricted to a few disjunct populations near the coast between Los Peñasquitos Canyon and Encinitas (and possibly, to Carlsbad). It is associated with sandstone substrate and is threatened by development.

Standard

- 1) Include within the open space/preserve system the range of genetic diversity within Del Mar Mesa sand-aster by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>1000 individuals), known populations (Carmel Mountain-Del Mar Mesa, Torrey Pines State Park) and any newly discovered populations or existing, smaller populations (San Dieguito River Valley) that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance all populations that have a reduced probability for long-term viability (i.e., effective population size of <1000 individuals).

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations

determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 5, below.

- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include the re-introduction of plant materials and/or specific management techniques.
- 4) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should be developed in conjunction with local jurisdictions, the City of San Diego, County of San Diego, California Department of Forestry, U.S. Fish and Wildlife Service, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, seedling mortality, specific habitat requirements, and management techniques for maintaining viable populations.
- 7) Establish a seed bank for Del Mar Mesa sand-aster as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.20 Preserve the long-term viability of Tecate cypress (*Cupressus forbesii*).

Present status

Federal category 2 candidate. Tecate cypress is restricted to three major locations in San Diego County, and the largest of these occurs in the MSCP area. It has been estimated that over 80% of this population lies within the boundaries of federal land holding. This species is threatened by frequent wildfires.

Standards

- 1) Include within the open space/preserve system 100% of the existing population on Otay Mountain that lies above 1500 feet elevation or that supports other sensitive species and an adequate amount (as determined by specific, subsequent studies) of any smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space 100% of all known occupied habitat on Otay Mountain that lies above 1500 feet elevation or that supports other sensitive species and an adequate amount (as determined by specific, subsequent studies) of any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. This implementation guideline is compatible with the standards for southern interior cypress forest (refer to policy no. 1.9).
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 5, below.
- 3) Develop and implement a fire management plan for each preserved area that incorporates controlled burns, while limiting fire frequency to a minimum 40-year cycle. This plan should be developed in conjunction with the County of San Diego, California Department of Forestry, Bureau of Land Management, Immigration and Naturalization Services, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on interpopulational genetic analyses and management techniques (including fire) for maintaining viable populations.

POLICY 3.21 **Preserve the long-term viability of short-leaved dudleya (*Dudleya brevifolia* [*D. blochmaniae* ssp. *brevifolia*]).**

Present status

Federal proposed endangered and state-endangered. Short-leaved dudleya is restricted to four or five extant populations, and all occur in the MSCP area. It is associated with reddish sandstone in openings in chaparral on coastal mesas and is threatened by urbanization and off-road vehicles.

Standards

- 1) Include within the open space/preserve system 100% of existing populations (Torrey Pines State Reserve, Torrey Pines Extension, Crest Canyon, Del Mar Heights Road, and Carmel Mountain) and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance all populations that have a reduced probability for long-term viability (i.e., effective population size of <500 individuals).
- 4) Establish new populations of short-leaved dudleya in historic (re-introduction) and/or suitable but unoccupied habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat known to support extant stands of this species in each of the designated areas and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations. Preserve potential but unoccupied habitat areas until these have been surveyed adequately and determined to neither support this taxon nor represent essential habitat for re-introduction purposes.
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.
- 4) Establish the species in formerly occupied habitat (re-introduction) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >500 individuals).
- 5) Develop and implement a fire management plan for each preserved area in order to protect populations from fires and disturbances associated with fire suppression. This plan should be developed in conjunction with the City of San Diego, California Department of Fish and Game, California Department of Forestry, California Department of Parks and Recreation, U.S. Fish and Wildlife Service, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 7) Conduct studies that determine the life history of this species, monitor the status of populations, and determine their ecological and management requirements. Studies should include complete surveys of all potential habitat areas (including marine sandstone terraces and other potential habitats).
- 8) Establish a seed bank for short-leaved dudleya as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.22 Preserve the long-term viability of variegated dudleya (*Dudleya variegata*).

Present status Federal category 2 candidate; known from several locations in the MSCP area. Variegated dudleya is associated with coastal sage scrub and clay soils and is threatened by loss of habitat.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within variegated dudleya by preserving an adequate amount (as determined by specific, subsequent studies) of the major (i.e., >500 individuals), known populations (e.g., Lake Hodges, Poway, Santee (Sycamore Canyon-Fortuna Mountain), Dehesa, Naval Radio Receiving Facility at Imperial Beach, San Miguel Mountain, Proctor Valley Road, Otay Lakes, Otay River Valley, Otay Mesa, Marron Valley) and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <500 individuals).

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.

- 4) Develop and implement a fire management plan for each preserved area in order to protect populations from fires and disturbances associated with fire suppression. This plan should be developed in conjunction with local jurisdictions, City of San Diego, County of San Diego, California Department of Forestry, Immigration and Naturalization Service, U.S. Navy, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that determine the life history of this species, monitor the status of populations, and determine their ecological and management requirements. Specific studies might focus on reproductive and pollination strategies, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.23 Preserve the long-term viability of sticky dudleya (*Dudleya viscida*).

Present status Federal category 1 candidate (under status review); restricted to four major populations in San Diego County (none of which is in the MSCP study area). Sticky dudleya is associated with chaparral or coastal sage scrub, and often found on cliffs. This species is threatened by development, particularly road-widening projects.

Standards

- 1) Include within the open space/preserve system 100% of the Santa Fe Valley population and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space all occupied habitat and any adjacent habitat that constitutes the watershed necessary to support this species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management plan for each preserved area in order to protect populations from fires. This plan should be developed in conjunction with the County of San Diego, California Department of Forestry, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping, and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive and pollination strategies, and management techniques for maintaining viable populations.

POLICY 3.24 **Preserve the long-term viability of Palmer's ericameria (*Ericameria palmeri* ssp. *palmeri*).**

Present status Federal category 2 candidate; restricted to several populations in the MSCP area. This species is associated with coastal sage scrub and floodplains and is threatened by habitat loss due to urbanization.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Palmer's ericameria by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>50 individuals), known populations (e.g., Wild Animal Park, Poway (Thompson Creek), Sweetwater River (McGinty Mountain, Amber Ridge, Willow Glen, Singing Hills), Steele Canyon Creek, and Dulzura Creek), and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the County of San Diego, California Department of Forestry, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.25 **Preserve the long-term viability of San Diego button-celery (*Eryngium aristulatum* var. *parishii*).**

Present status Federally and state-endangered. San Diego button-celery occurs in several extant populations in the MSCP area and elsewhere in the County of San Diego. It is associated with clay soils in vernal pools and grasslands and is threatened by agriculture, urbanization, road maintenance, and off-road vehicles.

Standards

- 1) Include within the open space/preserve system the range of diversity within San Diego button-celery by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>200 individuals), known populations (Otay River Valley, Otay Lakes, Proctor Valley, Miramar, Tierrasanta, and Del Mar Mesa) and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance all preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <200 individuals).

Implementation

- 1) Preserve and manage in natural open space 100% of the vernal pool complexes (including watershed) (e.g., D5-8, E4, F1-16, F20-26, H1-7, H9, H11-12, H18-20, H31-33, I1, I6-7, J1-2, J5, J12, J13, J15, J22-26, J28-30, K3-5, O, U1-14, U18, V1-4, W1-3, X1-4, X6, Z1-7, and AA, EE1-2, GG, HH) and grassland habitat that contain major populations of this species, and an adequate amount (as determined by specific, subsequent studies) of the habitat and watershed of other preserved populations. This implementation guideline is compatible with the standards for vernal pool preservation (refer to policy no. 1.6).
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.

- 4) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the City of San Diego, County of San Diego, California Department of Fish and Game, California Department of Forestry, Immigration and Naturalization Services, U.S. Fish and Wildlife Service, U.S. Navy, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that determine the life history of this species, monitor the status of populations, and determine their ecological and management requirements. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, and management techniques for maintaining viable populations.
- 7) Establish a seed bank for San Diego button-celery as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.26 Preserve the long-term viability of coast wallflower (*Erysimum ammophilum*).

Present status

Federal category 2 candidate; restricted to a few populations along the immediate coast, mostly within the MSCP area. Coast wallflower is associated with sandstone substrates and is threatened by coastal development. Taxonomic revisions may invalidate this species in the MSCP area.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within coast wallflower by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>50 individuals), known populations (Point Loma) and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance all populations that have a reduced probability of long-term viability (i.e., effective population size of <50 individuals).
- 4) Establish new populations of coast wallflower in historic and/or unoccupied but suitable habitat.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 6, below.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.
- 4) Establish the species in formerly occupied habitat (re-introduction) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >1000 individuals).
- 5) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the City of San Diego, California Department of Forestry, California Department of Parks and Recreation, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.
- 8) Establish a seed bank for coast wallflower as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.27 **Preserve the long-term viability of San Diego barrel cactus (*Ferocactus viridescens*).**

Present status Federal category 2 candidate. Formerly widespread throughout coastal areas of San Diego County, this species persists in numerous, fragmented populations in the MSCP area, where it is associated with coastal sage scrub. It is threatened by urbanization, off-road vehicles, and horticultural collecting.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within San Diego barrel cactus by preserving an adequate amount (as determined by specific, subsequent studies) of major (>200 individuals), known populations (e.g., Carmel Mountain, Santee (Oak Canyon-Little Sycamore Canyon-Sycamore Canyon), Mission Trails Regional Park, Point Loma, Sweetwater Reservoir, Otay River Valley, Otay Mesa, Marron Valley) and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. Adequate habitat should be maintained between preserved populations to allow for gene flow via pollinators and/or dispersal agents.
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the local jurisdictions, City of San Diego, County of San Diego, California Department of Forestry, Bureau of Land Management, Immigration and Naturalization Services, U.S. Navy, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures.

POLICY 3.28 **Preserve the long-term viability of Mexican flannelbush (*Fremontodendron mexicanum*).**

Present status Federal category 2 candidate (under status review) and state-rare. This species is restricted to two or three locations in San Diego County, and all occur within the MSCP area, associated with chaparral, southern interior cypress forest, and drainages. It is potentially threatened by development.

Standards

- 1) Include within the open space/preserve system 100% of the major, known populations (Jamul Mountains (if verified), Otay Mountain) and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space all major populations and an adequate amount (as determined by specific, subsequent studies) of any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the County of San Diego, California Department of Forestry, Bureau of Land Management, Immigration and Naturalization Services, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on pollination and seed dispersal strategies, and management techniques for maintaining viable populations.

POLICY 3.29 **Preserve the long-term viability of Mission Canyon bluecup (*Githopsis diffusa* ssp. *filicaulis*).**

Present status Federal category 2 candidate. This species is restricted to very few populations in the MSCP area, and one or more may be extinct. It is associated with chaparral or coastal sage scrub and is potentially threatened by loss of habitat.

Standards

- 1) Include within the open space/preserve system 100% of the known population at Silverwood Wildlife Sanctuary and an adequate amount (as determined by specific, subsequent studies) of any other known populations (e.g., Harbison Canyon, Barona Valley, El Cajon Mountain) that are verified to be extant or any newly discovered populations.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <100 individuals).

Implementation

- 1) Preserve and manage in natural open space 100% of the population at Silverwood Wildlife Sanctuary (including the watershed necessary to support this species) and an adequate amount (as determined by specific, subsequent studies) of any other populations.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 5, below.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques.
- 4) Develop and implement a fire management and emergency access plan for each preserved area in order to protect populations from unwanted fires and disturbances associated with fire suppression. This plan should be developed in conjunction with the County of San Diego, California Department of Forestry, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping, and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that determine the life history of this species, monitor the status of populations, and determine their ecological and management requirements. Specific studies might focus on pollination and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.30 Preserve the long-term viability of Otay tarplant (*Hemizonia conjugens*).

Present status Federal category 2 candidate (status review complete; decision pending on whether to propose for listing) and state-endangered; restricted to several localities in the MSCP area, associated with clay soils. This species is threatened by residential development and illegal dumping.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Otay tarplant by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>1000 individuals), known populations (e.g., Dennery Canyon, Otay River Valley, Wolf Canyon, Poggi Canyon, Salt Creek, Proctor Valley, and San Miguel Mountain), and any newly discovered populations or existing, smaller populations (e.g., Sweetwater Reservoir, Spring Valley Creek) that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. Adequate habitat should be maintained between preserved populations to allow for gene flow via pollinators.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 3, below.

Otay tarplant apparently occurred as one large, contiguous population in the Otay area. Although it is highly restricted in its overall distribution, it occurs naturally in larger populations than most annual rare plants. Where large populations exist, larger, effective population sizes (e.g., 10,000-50,000 individuals or larger, unless otherwise determined by specific, subsequent studies) should be preserved.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.

- 3) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 4) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.
- 5) Establish a seed bank for Otay tarplant as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.31 Preserve the long-term viability of Tecate tarplant (*Hemizonia floribunda*).

Present status Federal category 2 candidate; endemic to San Diego County and northwestern Baja California. This species has a restricted distribution, generally occurring east of the MSCP area (e.g., Dulzura, Potrero, Tecate, McCain Valley, Bankhead Springs, Live Oak Springs, Jacumba). There are no mapped localities of this species within the MSCP area, although suitable habitat occurs in the eastern portion of the MSCP area. Tecate tarplant is associated primarily with drainages in chaparral.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Tecate tarplant by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>500 individuals), known populations and any newly discovered populations or existing, smaller populations that are determined to add to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to,

trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.

- 3) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the County of San Diego, California Department of Forestry, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.32 Preserve the long-term viability of heart-leaved pitcher sage (*Lepechinia cardiophylla*).

Present status Federal category 2 candidate; restricted in San Diego County to one location within the MSCP area; associated with chaparral.

Standards

- 1) Include within the open space/preserve system 100% of the known population (vicinity of Iron Mountain) and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations that are determined to contribute significantly to the genetic diversity of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space the Iron Mountain population and an adequate amount (as determined by specific, subsequent studies) of any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management plan for the preserved area that incorporates controlled burns (if determined necessary to maintain the species), while limiting fire frequency and emergency access. This plan should be developed

in conjunction with the City of Poway, California Department of Forestry, and other affected agencies.

- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on pollination and seed dispersal strategies, germination requirements, seedbank ecology, specific habitat requirements, and management techniques (including fire) for maintaining viable populations.

POLICY 3.33 Preserve the long-term viability of Gander's pitcher sage (*Lepechinia ganderi*).

Present status Federal category 2 candidate; restricted to three locations, all of which occur in the MSCP area; associated with chaparral. This species is potentially threatened by development and/or an increase in the frequency of fires.

Standards

- 1) Include within the open space/preserve system an adequate amount (as determined by specific, subsequent studies) of the major (>200 individuals), known (e.g., Jamul Mountains, San Miguel Mountain, and Otay Mountain) populations and any newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all known populations and any newly discovered populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management plan for the preserved areas that incorporates controlled burns (if determined necessary to maintain the populations), while limiting fire frequency. This plan should be developed in conjunction with the County of San Diego, California Department of Forestry, Bureau of Land Management, and other affected agencies.

- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on pollination and seed dispersal strategies, germination requirements, seedbank ecology, specific habitat requirements, and management techniques (including fire) for maintaining viable populations.

POLICY 3.34 **Preserve the long-term viability of Nuttall's lotus (*Lotus nuttallianus*).**

Present status Federal category 2 candidate (under status review); endemic to San Diego County and Baja California. Nuttall's lotus is restricted to several populations along the immediate coast in the MSCP area, where it is associated with coastal dunes and coastal scrub habitat. It is threatened by loss of habitat and highway "beautification" plans.

Standards

- 1) Include within the open space/preserve system 100% of any extant populations along the San Diego River Flood Control Channel (intersection between Seaworld Drive and Friars Road), or in the D Street Fill and Marisma de Nacion, Naval Radio Receiving Facility at Imperial Beach, Silver Strand, and Border Field State Park, and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <500 individuals).
- 4) Establish new populations of Nuttall's lotus in historic (re-introduction) and/or unoccupied but suitable habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat known to support extant stands of the species and an adequate amount (as determined by specific, subsequent studies) of any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.

For all preserved populations, include an additional 25% of suitable but presumably unoccupied habitat in the preserve to allow for yearly fluctuations in population size. This additional acreage should be adjacent to the occupied habitat area, and is considered separate from buffer requirements described in no. 5, below.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Establish the species in formerly occupied habitat (re-introduction) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >500 individuals).
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.
- 7) Establish a seed bank for Nuttall's lotus as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.35 Preserve the long-term viability of willow monardella (*Monardella linoides* ssp. *viminea*).

Present status Federal category 2 candidate (under status review) and state-endangered. Only three to four disjunct populations occur in the U.S., and all are restricted to drainages in the MSCP study area. Willow monardella is threatened by highway improvements, off-road vehicles, and urbanization.

Standards

- 1) Include within the open space/preserve system 100% of existing populations on Otay Mountain and Marron Valley, and an adequate amount (as determined by specific, subsequent studies) of the Santee-Sycamore Canyon and Miramar populations and any newly discovered populations.

- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <200 individuals).
- 4) Establish new populations of willow monardella in historic (re-introduction) and/or unoccupied but suitable habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat and watershed known to support this species on Otay Mountain and in Marron Valley, and an adequate amount (as determined by specific, subsequent studies) of the habitat and watershed of the Santee-Sycamore Canyon and Miramar populations and any newly discovered populations.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Establish the species in formerly occupied habitat (re-introduction) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >200 individuals).
- 5) Develop and implement a fire management plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should incorporate management of watershed and water quality, and be developed in conjunction with the California Department of Fish and Game, California Department of Forestry, Immigration and Naturalization Service, U.S. Navy, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.36

Preserve the long-term viability of San Diego goldenstar (*Muilla clevelandii*).

Present status

Federal category 2 candidate. San Diego goldenstar is restricted to several populations on the coastal mesas within the MSCP area; it also rarely occurs outside the MSCP area (e.g., Carlsbad). This species is associated with clay soils in grasslands and coastal sage scrub and is threatened by illegal dumping, off-road vehicles, and urbanization.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within San Diego goldenstar by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>1000 individuals), known populations (4-S Ranch, Del Mar Mesa, Carmel Mountain, Fernbrook, NAS Miramar (several localities), Mira Mesa, Tierrasanta, Santee (Oak Canyon-Little Sycamore Canyon-Sycamore Canyon), Dehesa Mountain, Proctor Valley (City of San Diego lands), Otay Mesa (vernal pool areas J23-25, J29-30), and Marron Valley) and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the City of San Diego, County of San Diego, California Department of Forestry, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies

might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.37 **Preserve the long-term viability of little mousetail (*Myosurus minimus* ssp. *apus*).**

Present status Federal category 2 candidate. Most extant populations of this species in San Diego County occur in the MSCP area and are restricted to several vernal pools complexes on the mesas north of San Diego and on Otay Mesa. Little mousetail is threatened by loss of vernal pool habitat.

Standards

- 1) Include within the open space/preserve system 100% of existing populations and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance existing populations that have a reduced probability for long-term viability (Because populations vary tremendously in size, effective population size will be determined through specific, subsequent studies).
- 4) Establish new populations of little mousetail in historic habitat (re-introduction) and/or suitable but unoccupied habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space all of the vernal pool complexes (including watershed) that contain this taxon: G1-2, J5, J11, J13, J26. This implementation guideline is compatible with the standards for vernal pool preservation (refer to policy no. 1.6).
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Establish the species in formerly occupied habitat (e.g., re-introduction in vernal pool series H, K, M 1-4, R) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term

viability (effective population size will be determined through specific, subsequent studies).

- 5) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should incorporate management of watershed and water quality, and be developed in conjunction with the City of San Diego, County of San Diego, California Department of Forestry, Bureau of Land Management, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollination, and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, and management techniques for maintaining viable populations.
- 8) Establish a seed bank for little mousetail as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.38 Preserve the long-term viability of prostrate navarretia (*Navarretia fossalis*).

Present status Federal proposed threatened. This species is historically known from several vernal pools complexes on the mesas north of San Diego and on Otay Mesa, but is currently restricted to several extant populations on Otay Mesa. It is threatened by loss of vernal pool habitat from agriculture and urbanization.

Standards

- 1) Include within the open space/preserve system 100% of existing populations and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance existing populations that have a reduced probability for long-term viability (Because populations vary tremendously in size, effective population size will be determined through specific, subsequent studies).
- 4) Establish new populations of prostrate navarretia in historic (re-introduction) and/or unoccupied but suitable habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space all of the vernal pool complexes (including watershed) that contain this taxon: J1-3, J5, J13, J22, J28-29, K3-5, S1-3. This implementation guideline is compatible with the standards for vernal pool preservation (refer to policy no. 1.6).
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Establish the species in formerly occupied habitat (e.g., re-introduction in complexes J19 and N6) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (effective population size will be determined through specific, subsequent studies).
- 5) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should incorporate management of watershed and water quality, and be developed in conjunction with the the City of San Diego, County of San Diego, California Department of Forestry, Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Navy, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting.

Long-term Management Program

- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, and management techniques for maintaining viable populations.
- 8) Establish a seed bank for prostrate navarretia as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.39 **Preserve the long-term viability of Dehesa beargrass (*Nolina interrata*).**

Present status Federal category 1 candidate (under status review) and state-endangered. Dehesa beargrass is restricted to three major populations and is endemic to gabbro-derived or peridotite soils. It is threatened by residential development and horticultural collecting.

Standards

- 1) Include within the open space/preserve system a minimum of 90% of the major, known populations (Dehesa, McGinty Mountain, and Sequan Peak).
- 2) Stabilize and maintain existing populations.

Implementation

- 1) Preserve and manage in natural open space 90% of the habitat known to support extant stands of this species in each of the designated areas.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management plan for the preserve areas that incorporates controlled burns in order to stimulate sexual reproduction (i.e., flowering). This plan should be prepared in conjunction with the County of San Diego, Bureau of Land Management, California Department of Forestry, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on the reproductive strategies of Dehesa beargrass (e.g., the importance of sexual versus asexual reproduction in maintaining or increasing population size) and management techniques for maintaining viable populations of a clonal species.

POLICY 3.40 **Preserve the long-term viability of snake cholla (*Opuntia parryi* var. *serpentina*).**

Present status Federal category 2 candidate (status review complete; decision pending on whether to propose for listing); endemic to southwestern San Diego County and northwestern Baja California. In San Diego County, snake cholla is restricted to the MSCP area, where it occurs

in a few locations near the immediate coast and in coastal canyons and valleys; it is associated with maritime succulent scrub and coastal sage scrub. Population numbers are not well-known and key taxonomic characters used to distinguish this variety are confusing. Snake cholla is threatened by loss of habitat.

Standards

- 1) Include within the open space/preserve system 100% of the known populations at Border Field State Park (not mapped), Sweetwater Marsh, Florida Canyon, Chollas Canyon, and Point Loma, and an adequate amount (as determined by specific, subsequent studies) of the populations at Jamacha, Wolf Canyon, Poggi Canyon, Salt Creek, and Denney Canyon and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance all preserved populations that have a reduced probability of long-term viability (effective population size should be determined through specific, subsequent studies).

Implementation

- 1) Preserve and manage in natural open space 100% of the known populations at Border Field State Park, Sweetwater Marsh, Florida Canyon, Chollas Canyon, Point Loma, and Jamacha and an adequate amount (as determined by specific, subsequent studies) of any other known or newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the County of San Diego, California Department of Forestry, California Department of Parks and Recreation, Immigration and Naturalization Service, U.S. Navy, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.41 Preserve the long-term viability of California Orcutt grass (*Orcuttia californica*).

Present status Federally and state-endangered. Only a few extant populations of this species occur in San Diego County, and all are within the MSCP area. This species is associated with vernal pools and is threatened by loss of vernal pool habitat from agriculture and overgrazing.

Standards

- 1) Include within the open space/preserve system 100% of existing populations and 100% of any newly discovered populations.
- 2) Stabilize and maintain all existing populations and any newly discovered populations.
- 3) Enhance existing populations that have a reduced probability for long-term viability (i.e., effective population size of <200 individuals).
- 4) Establish new populations of California Orcutt grass in historic habitat (re-introduction) and/or unoccupied but suitable habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space all of the vernal pool complexes (including watershed) that contain this taxon: J11-13. This implementation guideline is compatible with the standards for vernal pool preservation (refer to policy no. 1.6).
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from local populations.
- 4) Establish the species in formerly occupied habitat (i.e., re-introduction in complexes HH, J28-29, J15-18, U4) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-

occurring and artificially established populations) with a reasonable probability for long-term viability (i.e., effective population size of >200 individuals).

- 5) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should incorporate management of watershed and water quality, and be developed in conjunction with the County of San Diego, Bureau of Land Management, California Department of Fish and Game, California Department of Forestry, U.S. Fish and Wildlife Service, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting.

Long-term Management Program

- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements.
- 8) Establish a seed bank for California Orcutt grass as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.42 **Preserve the long-term viability of Torrey pine (*Pinus torreyana* ssp. *torreyana*).**

Present status Federal category 2 candidate; known from only two localities, and one occurs within the MSCP area, in the vicinity of Del Mar. The Torrey pine is threatened by development.

Standards

- 1) Include within the open space/preserve system 100% of the major, known population (Torrey Pines State Reserve, including the extension) and an adequate amount (as determined by specific, subsequent studies) of any other stands (e.g., Carmel Mountain, Del Mar, San Dieguito Valley) that are determined to constitute viable "subpopulations."
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability (i.e., effective population size of <200 individuals).

Implementation

- 1) Preserve and manage in natural open space 100% of the habitat known to support this species in Torrey Pines State Park and an adequate amount of habitat (as determined by specific, subsequent studies) to support any other preserved populations.

- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. The San Diego population of Torrey pine shows virtually no intrapopulation genetic variability (Ledig and Conkle 1983), so any of the local, naturally-occurring stands can be used as source material for introduction purposes. However, introduced material should not be derived from the Santa Rosa Island population or from horticultural stock.
- 4) Develop and implement a fire management plan for each preserved area that incorporates controlled burns (if determined necessary to maintain the population), while limiting fire frequency and emergency access. This plan should be developed in conjunction with the City of San Diego, California Department of Parks and Recreation, California Department of Forestry, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on management techniques (including controlled burns) for maintaining viable populations.

POLICY 3.43 Preserve the long-term viability of San Diego mesa mint (*Pogogyne abramsii*).

Present status Federally listed as endangered and state-endangered. All extant populations occur in the MSCP area, restricted to vernal pool complexes on the mesas north of San Diego (e.g., Miramar, Tierrasanta, Kearny Mesa). This species is seriously threatened by urbanization of San Diego mesas.

Standards

- 1) Include within the open space/preserve system 100% of existing, major populations and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. In this case, a major population will likely comprise more than one pool; the actual number of individuals per major population should be determined through specific, subsequent studies.
- 2) Stabilize and maintain existing populations.
- 3) Enhance existing populations that have a reduced probability for long-term viability (effective population size will be determined through specific, subsequent studies).

Implementation

- 1) Preserve and manage in natural open space all of the vernal pool complexes (including watershed) that contain this taxon: A4, B5, B7-8, B11-12, C1, C9-16, C18, C22, D5-8, D16, E4, F1-28, G1-2, H4-6, H18-22, I1, I6, N1-4, N6, U1-14, U18, V1-4, W1-3, X1-3, Z1-5, AA3-10, EE1-2, GG, HH. This implementation guideline is largely compatible with the standards for vernal pool preservation (refer to policy no. 1.6).
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 6, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 6, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should incorporate management of watershed and water quality, and be developed in conjunction with the City of San Diego, County of San Diego, California Department of Fish and Game, California Department of Forestry, U.S. Fish and Wildlife Service, U.S. Navy, Federal Aviation Administration, and other affected agencies.
- 5) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 6) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollinator, and seed dispersal strategies, seedbank ecology, and management techniques for maintaining viable populations.
- 7) Establish a seed bank for San Diego mesa mint as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.44 Preserve the long-term viability of Otay Mesa mint (*Pogogyne nudiuscula*).

Present status

Federally and state-endangered. All extant populations of this species occur in the MSCP area, restricted to 3-5 vernal pools complexes on Otay Mesa. Otay Mesa mint is seriously threatened by urbanization of San Diego mesas.

Standards

- 1) Include within the open space/preserve system 100% of existing populations and 100% of any newly discovered populations.
- 2) Stabilize and maintain existing populations.
- 3) Enhance existing populations that have a reduced probability for long-term viability (effective population size will be determined through specific, subsequent studies).
- 4) Establish new populations of Otay Mesa mint in historic (re-introduction) and/or unoccupied but suitable habitat (introduction).

Implementation

- 1) Preserve and manage in natural open space all of the vernal pool complexes that contain this taxon: J14, J23-26, J28-30. This implementation guideline is compatible with the standards for vernal pool preservation (refer to policy no. 1.6).
- 2) Stabilize populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restore damaged habitat, based on information obtained in no. 7, below.
- 3) Enhance declining populations and populations that are stable but below an effective population size, based on information obtained in no. 7, below. Enhancement may include re-introduction of plant materials and/or specific management techniques. Unless analyses determine that there is no significant genetic variation between populations, introduced plant materials must be from the parental population or a population in proximity.
- 4) Establish the species in formerly occupied habitat (e.g., re-introduction in complexes J2 and J28) and/or suitable but unoccupied habitat (introduction). Establishment must occur within the historic range of the taxon. The overall goal should be a minimum of five populations (including both naturally-occurring and artificially established populations) with a reasonable probability for long-term viability (effective population size will be determined through specific, subsequent studies).
- 5) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. This plan should incorporate management of watershed and water quality, and be developed in conjunction with the the County of San Diego, California Department of Forestry, Bureau of Land Management, and other affected agencies.
- 6) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

Long-term Management Program

- 7) Conduct studies that monitor the status of populations and determine their ecological and management requirements. Specific studies might focus on reproductive, pollinator, and seed dispersal strategies, seedbank ecology, and management techniques for maintaining viable populations.
- 8) Establish a seed bank for Otay Mesa mint as a guarantee against extinction. Collections should be based on established guidelines (Center for Plant Conservation 1991; Brown and Briggs 1991) and subject to seed availability. Collected seed should be stored at an established seed bank facility (e.g., Rancho Santa Ana Botanic Garden).

POLICY 3.45 **Preserve the long-term viability of small-leaved rose (*Rosa minutifolia*).**

Present status State-endangered. The U.S. distribution is restricted to one small population (clonal, possibly one individual) on western Otay Mesa near Dennery Canyon. It is associated with disturbed mesa top habitat and adjacent canyons and is threatened by off-road vehicles and development.

Standards

- 1) Include within the open space/preserve system 100% of the existing "population" on Otay Mesa.
- 2) Stabilize and maintain the existing "population" and surrounding habitat necessary to support it.

Implementation

- 1) Preserve and manage in natural open space all of the habitat supporting the single, known population.
- 2) Stabilize the preserved population by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of adjacent habitat would increase the stability and long-term viability of small-leaved rose.
- 3) Develop a fire management plan for the preserve that limits fire frequency and emergency access, thereby preventing accidental disturbance to the population. This plan should be developed in conjunction with the landowner and all affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators and dispersal agents.

POLICY 3.46

Preserve the long-term viability of Gander's butterweed (*Senecio ganderi*).

Present status

Federal category 2 candidate and state-rare; endemic to southwestern San Diego County, including two populations in the MSCP area and several populations to the north and east (e.g., Magee Road, El Cajon Mountain, Lawson Peak, and Cuyamaca Peak (unverified)). The rarity of this species is due to edaphic endemism rather than human-related factors, and it has not suffered significant population declines. It is associated with gabbro-derived soils in chaparral.

Standards

- 1) Include within the open space/preserve system 100% of the known populations on McGinty Mountain and Sequan Peak (not mapped), and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species. Note: the population on McGinty Mountain is on land owned and managed by the California Department of Fish and Game and/or The Nature Conservancy.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space 100% of the known populations on McGinty Mountain and Sequan Peak and an adequate amount (as determined by specific, subsequent studies) of any newly discovered populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the County of San Diego, California Department of Fish and Game, California Department of Forestry, The Nature Conservancy, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability,

germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.47 Preserve the long-term viability of narrow-leaved nightshade (*Solanum tenuilobatum*).

Present status Federal category 2 candidate; restricted to several populations in southern San Diego County. Most occurrences of this species are within the MSCP area, but it may also occur outside the MSCP area to the east and north (unverified record in Carlsbad, in the MHCP area). It is associated with chaparral and is potentially threatened by loss of habitat.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within narrow-leaved nightshade by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>1000 individuals), known populations (e.g., Jamul Mountains, Otay Mountain) and any newly discovered, major populations or existing, smaller populations (e.g., Fernbrook, Silverwood Wildlife Sanctuary (not mapped), Dehesa, Jamul, San Miguel Mountain, Marron Valley, and Bee Canyon) that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major, known populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, dumping, and collecting. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management and emergency access plan for the preserve areas in order to protect populations from fires and disturbances associated with fire suppression. The plan should be developed in conjunction with the County of San Diego, California Department of Forestry, Bureau of Land Management, Immigration and Naturalization Services, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of trampling, vehicles, dumping and collecting, and that include sufficient resources to support appropriate pollinators.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species.

Based on results of these studies, implement remedial measures. Specific studies might focus on reproductive and seed dispersal strategies, seed and pollen viability, germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.

POLICY 3.48 Preserve the long-term viability of Parry's tetracoccus (*Tetracoccus dioicus*).

Present status Federal category 2 candidate. Parry's tetracoccus is scattered throughout San Diego County and is restricted to several populations in the MSCP area. It is associated with gabbro soils and is potentially threatened by loss of habitat due to development.

Standards

- 1) Include within the open space/preserve system the range of genetic diversity within Parry's tetracoccus by preserving an adequate amount (as determined by specific, subsequent studies) of the major (>1000 individuals), known populations (e.g., Ramona/Barona Valley (not mapped), McGinty Mountain, Dehesa) and any newly discovered populations or existing, smaller populations that are determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize and maintain existing populations.

Implementation

- 1) Preserve and manage in natural open space an adequate amount (as determined by specific, subsequent studies) of all major populations and any other populations determined to add significantly to the genetic diversity or otherwise contribute to the stability/survivability of the species.
- 2) Stabilize preserved populations by removing impacts or threat of impacts: exclude all adverse activities within the preserve areas including, but not limited to, trampling, vehicular traffic, and dumping. Restoration of damaged habitat would increase the stability and long-term viability of preserved populations.
- 3) Develop and implement a fire management plan for each preserved area that incorporates controlled burns, while limiting fire frequency and emergency access. This plan should be developed in conjunction with the local jurisdictions, County of San Diego, California Department of Forestry, Bureau of Land Management, and other affected agencies.
- 4) Provide buffers that are of adequate size and configuration to eliminate adverse effects of drainage, trampling, vehicles, dumping and collecting.

Long-term Management Program

- 5) Monitor the status of populations. If populations are declining (and decline cannot be correlated to natural events, such as climatic fluctuations or drought), conduct studies to determine the ecological and management requirements of the species. Based on results of these studies, implement remedial measures. Specific studies might focus on the reproductive, pollination, and seed dispersal strategies,

germination requirements, seedbank ecology, specific habitat requirements, and management techniques for maintaining viable populations.

REFERENCES

- Brown, A.H.D. and J.D. Briggs. 1991. Sampling strategies for genetic variation in *ex situ* collections of endangered plant species. Pages 99-122 in Falk, D.A. and K.E. Holsinger, eds., Genetics and conservation of rare plants. Oxford University Press, New York.
- Center for Plant Conservation. 1991. Genetic sampling guidelines for conservation collections of endangered plants (appendix). Pages 225-238 in Falk, D.A. and K.E. Holsinger, eds., Genetics and conservation of rare plants. Oxford University Press, New York.
- Ledig, F.T. and M.T. Conkle. 1983. Gene diversity and genetic structure in a narrow endemic, Torrey pine (*Pinus torreyana* Parry ex Carr.). *Evolution* 37:79-85.

OBJECTIVE 4 **Maintain viable populations of priority animal species.**

POLICY 4.1 **Preserve the long-term viability of the Harbison's dun skipper butterfly (*Euphyes vestris harbisoni*).**

Present status Federal proposed endangered species known only from western San Diego and Orange Counties; seldom occurs within 10 miles of the immediate coast. The largest known populations are in the Ramona-Escondido area. This species is restricted to riparian areas and intermittent streams, particularly beneath oak woodlands, where the larval host San Diego sedge (*Carex spissa*) grows. Its decline is attributed to habitat loss, encroachment by development, introduction of pollutants into riparian systems, and elimination of the host plant through competition with invasive non-native plants (Brown and McGuire 1983 and Brown 1991).

Standards

- 1) Include within the open space preserve sufficient Harbison's dun skipper populations and potential habitat to maintain a viable metapopulation.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve in open space a) southern coast live oak riparian woodland, b) known extant localities for Harbison's dun skipper, and c) known extant localities for *Carex spissa* (Cyperaceae). These areas are likely to be considered "waters of the U.S." under the jurisdiction of the U.S. Army Corps of Engineers and "wetlands" under the jurisdiction of the California Department of Fish and Game. Hence, they are already constrained from development.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade Harbison's dun skipper habitat. These activities include but are not limited to construction of dams or other structures that result in considerable modification of stream flow in preserved areas, detrimental reductions in water quality and quantity, the introduction of non-native plants into native riparian systems, and the introduction of pollutants, pesticides and/or herbicides into the watershed of preserved habitat.

Long-term Management Program

- 3) Prepare a management program to ensure adequate water quality and quantity and to prevent the invasion of exotic plants into preserved Harbison's dun skipper habitat.

POLICY 4.2 **Preserve the long-term viability of the salt marsh skipper butterfly (*Panoquina errans*).**

Present status Federal category 2 candidate, restricted to coastal salt marshes and coastal estuaries from Los Angeles County south to the southern tip of Baja California, Mexico; occurs in salt marsh habitat associated with nearly every coastal lagoon in San Diego County. This

species' decline is attributed to loss and alteration of salt marsh habitat in southern California and Baja California (Brown 1991).

Standards

- 1) Include within the open space preserve no net loss of existing occupied coastal salt marsh habitat to maintain a viable metapopulation of the salt marsh skipper. This likely will result in preservation of approximately 100% of known salt marsh skipper populations in San Diego County.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Include within the open space preserve all existing occupied coastal salt marsh habitat and all alkali marsh habitat within 1 mile of the immediate coast.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade salt marsh skipper habitat. These activities include but are not limited to the introduction of pollutants, pesticides and/or herbicides into preserved habitat and adverse changes in water quality or quantity in alkali marshes, coastal salt marshes, and lagoons.

Long-term Management Program

- 3) Prepare a water management program to maintain and enhance where necessary the existing water quality and quantity in preserved alkali marshes, coastal salt marshes, and lagoons.

POLICY 4.3 **Preserve the long-term viability of the Hermes copper butterfly (*Lycaena hermes*).**

Present status

Federal candidate species, restricted to western San Diego County and a small portion of northern Baja California. Within San Diego County this species has been recorded from Otay Ranch north to Fallbrook, and from Mission Gorge east to Guatay; it occurs in coastal sage scrub and southern mixed chaparral in which its larval host plant redberry (*Rhamnus crocea*) constitutes at least 5% of the shrub cover. The decline of the Hermes copper is attributed to loss of habitat from urban development and destruction of colonies by wildfire (Brown 1991).

Standards

- 1) Include within the open space preserve sufficient extant localities of Hermes copper to maintain a viable metapopulation. Impacts to populations would require mitigation (e.g., purchase of identified preserve areas).
- 2) Stabilize and maintain all preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Preserve and manage in natural open space the known extant localities of Hermes copper (based on museum collection records).
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade Hermes copper habitat. Off-road vehicle activity, illegal campfires, and gun shooting should be prohibited within the preserve as these activities have the potential to start wildfires which could degrade Hermes copper habitat.
- 3) Enhance declining populations through appropriate management techniques. Following ecological catastrophes (such as fire) in isolated habitat patches supporting Hermes copper, it is unlikely that this species will recolonize the recovering habitat owing to the low vagility of the animal. Hence, females of Hermes copper should be re-introduced (translocated) to these sites, from the nearest population, starting approximately five years following perturbations that result in local population extinctions. Such efforts should be coordinated by the USFWS with the assistance of qualified entomological specialists.

POLICY 4.4 Preserve the long-term viability of the Thorne's hairstreak butterfly (*Mitoura thornei*).

Present status Federal proposed endangered species, confined to southern interior cypress forest (Tecate cypress woodland) in the San Ysidro Mountains. Most of this habitat type occurs on the BLM property south of Otay Ranch, with limited distribution on the Ranch. This species is vulnerable to extirpation because of its extremely limited geographic distribution.

Standards

- 1) Include within the open space preserve sufficient potential habitat in the Otay Mountains/Otay Lakes region to maintain a viable metapopulation of Thorne's hairstreak.
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space sufficient southern interior cypress forest in the Otay Mountains/Otay Lakes region of southern California (see Policy 3.20).
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade Thorne's hairstreak habitat. Prohibiting off-road vehicle activity, illegal campfires, and gun shooting within the preserve would decrease the potential for wildfires which can degrade Thorne's hairstreak habitat.

Long-term Management Program

- 1) Develop a fire management plan for the Otay Mountain region that incorporates controlled burns (to insure succession of the closed-cone forest ecosystem) and fire prevention (to insure maintenance of large populations of Tecate cypress in various stages of succession/senescence).

POLICY 4.5 **Preserve the long-term viability of the quino checkerspot (*Euphydryas editha quino*).**

Present status

Federal category 1 candidate; formerly occurred in western portions of Riverside, Orange, and San Diego counties extending south into northern Baja Mexico. The quino checkerspot is likely to be locally extirpated from the MSCP area. It formerly occurred in small meadow-like flower fields within open coastal sage scrub, native grassland, and vernal pool habitat from Otay Ranch north to Rancho Bernardo. Fifty years ago this may have been one of the most abundant butterfly species in southern California (Murphy 1990); the decline of this species is attributed to loss of habitat to development, habitat degradation, complex metapopulation dynamics, and pressures resulting from the recent prolonged drought in California (Murphy 1990, Brown 1991).

Standards

- 1) Include within the open space preserve sufficient potential habitat to maintain the re-introduction of this species into the MSCP area. Include within the regional open space system a minimum of six undisturbed localities (if that many remain) known to formerly have supported this species.
- 2) Stabilize and maintain all preserved populations.
- 3) Re-establish quino checkerspot in localities that formerly supported the insect.

Implementation

- 1) Preserve and manage in natural open space sufficient potential habitat to support at least six populations of quino checkerspot. Because this species occurs in several habitat types that are considered highly sensitive (e.g., vernal pool, native grassland, and coastal sage scrub), considerable potential habitat for quino checkerspot will be preserved as a consequence of planning for other sensitive species. For example, open space in Del Mar Mesa proposed as part of the City of San Diego Environmental Tier (which includes the Caltrans vernal pool preserve) includes considerable potential habitat for quino checkerspot, although this species was not included in the planning process.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade quino checkerspot habitat.
- 3) Develop and implement if determined to be feasible, a translocation project to re-establish the quino checkerspot in San Diego County. Such a plan should be coordinated by the U.S. Fish and Wildlife Service with the assistance of the Entomology Department of the San Diego Natural History Museum.

POLICY 4.6 **Preserve the long-term viability of the Riverside fairy shrimp (*Streptocephalus woottoni*).**

Present status Federal endangered species, known from only three general localities in southern California: five pools in the vicinity of Temecula and Rancho California, Riverside County (Eng, Belk, and Erikson 1990), pools on NAS Miramar (Simovich and Fugate 1992), and a pool on Otay Ranch (Simovich and Fugate 1992). It also has been collected in Baja California, Mexico (Brown, Wier, and Belk, in press). According to Eng, Belk, and Erikson (1990) it occupies pools in which the water persists into April or May and reaches a minimum depth of 30 cm (about 1 foot) at filling. This species is vulnerable to extinction because it is known from so few localities.

Standards

- 1) Include within the open space preserve sufficient potential habitat to maintain a viable metapopulation of the Riverside fairy shrimp (see Policy 1.6).
- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Preserve and manage in natural open space all known populations of Riverside fairy shrimp in San Diego County (see Simovich and Fugate 1992) and all those populations discovered in the future.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade Riverside fairy shrimp habitat. These activities include, but are not limited to, the introduction of herbicides, pesticides, and other pollutants into preserved watersheds, modification of watersheds causing changes in run-off patterns which can affect the formation and chemistry of vernal pools, the restriction of gene flow because of habitat fragmentation, competition with other more successful species (e.g., *Branchinecta lindahli*), and off-road vehicle activity which can crush eggs and destroy vernal pools (Michael Brandman and Associates 1991).

POLICY 4.7 **Preserve the long-term viability of the arroyo southwestern toad (*Bufo microscaphus californicus*).**

Present status Federal endangered species and California Department of Fish and Game Species of Special Concern; distributed along the coastal slope from San Luis Obispo County south to northwestern Baja California. The arroyo toad occurs along sandy washes, arroyos, and streambeds in arid regions of the MSCP area; eggs and tadpoles require clear, slow-moving streams or ponds to develop (Stebbins 1966). This species may be declining because of destruction, degradation, and alteration of its habitat.

Standards

- 1) Include within the open space/preserve system remaining populations and potential habitat (as determined by specific, subsequent studies) to maintain a viable metapopulation of the arroyo southwestern toad.
- 2) Provide for genetic exchange between preserved populations of the arroyo southwestern toad within and adjacent to the MSCP area.
- 3) Stabilize and maintain all preserved populations.
- 4) Enhance preserved populations that may have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys to identify populations of arroyo southwestern toads and potential habitat within the MSCP area. Preserve and manage in natural open space large populations, and any other smaller populations or potential habitat determined necessary to maintain a viable metapopulation (see number 6 below). Preserved areas should include all burrowing, foraging, and breeding habitats utilized by the arroyo toad. Sufficient unoccupied but suitable habitat should also be preserved adjacent to occupied habitat to allow for population expansion and fluctuation.
- 2) Identify habitat linkages or corridors between existing populations as well as potential habitat areas. Preserve those habitat corridors or linkages identified as necessary in number 6 below. If linkages do not exist or are not appropriate for preservation, translocation of individuals may be required to maintain/enhance genetic diversity of the metapopulation.
- 3) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade southwestern arroyo toad habitat. These activities include, but are not limited to, livestock grazing, land use practices that favor introduced predator populations, adverse alteration or channelization of streambeds, vehicular traffic, dumping of trash, specimen collecting, detrimental reductions in water quantity and quality, and the introduction of pesticides or other contaminants and pollutants into the watershed. Restore degraded habitat based on information obtained from number 1 above and number 7 below.
- 4) Enhance declining populations, as identified in number 7 below through habitat enhancement/restoration and management techniques. Enhancement could include creation of artificial sandy or gravelly beaches and shallows, predator control, and translocation of individuals to maintain/enhance genetic diversity.
- 5) Provide biological and planning buffers around preserved populations and preserved potential habitat that are of sufficient size and configuration to minimize the threat of habitat degradation and predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and on the available cover within the habitat.

Long-term Management Program

- 6) Little is known about the distribution and habits of the southwestern arroyo toad; therefore, studies are needed to determine its range and distribution (see number 1

in the implementation section, above) and to define more precisely this species' resource and habitat requirements. Collect data to support a population viability analysis which would be used to determine minimum viable population size. The data required for such an analysis would include variation in juvenile and adult survivorship, fecundity, and habitat carrying capacity. A study of this species' population genetics is also needed. Use this information to determine the populations, linkages between populations, and potential habitat which should be preserved and to identify where translocation of individuals would be required to maintain the metapopulation.

- 7) Develop a standardized protocol for habitat evaluation and a standard censusing method for the southwestern arroyo toad. Conduct periodic studies that monitor the status of the metapopulation and determine management requirements. Management activities may include, but would not be limited to, predator control, habitat enhancement, translocation of individuals to maintain/enhance genetic diversity, and restriction of activities within the preserve that are identified as impactive to the southwestern arroyo toad.
- 8) Maintain an ongoing predator control program to remove bullfrogs, bass, sunfish, and other introduced aquatic predators from the water systems inhabited by the toads.

POLICY 4.8 **Preserve the long-term viability of the California red-legged frog (*Rana aurora draytoni*).**

Present status Federal proposed endangered species and California Department of Fish and Game species of special concern; historical range is from Humboldt County south along the coast to northern Baja California. This species may be extirpated from large areas of its range, including San Diego County. It occurs in permanent water sources and associated wooded or grassland habitats, and requires cover from predators. The decline of the California red-legged frog is attributed to loss and alteration of aquatic habitats (San Diego Herpetological Society 1980a), competition with and predation by introduced aquatic species (e.g., bullfrogs and large fish), acid rain, pathogens, parasites, catastrophic events, and frequent local extinctions of small populations (Hayes and Jennings 1986; Hayes pers. comm., Storm 1960).

Standards

- 1) Include within the open space preserve existing populations and an adequate amount of potential habitat (as determined by specific, subsequent studies) to allow for population expansion and fluctuation.
- 2) Stabilize and maintain any existing populations.
- 3) Provide for genetic exchange between preserved populations of California red-legged frogs within and adjacent to the MSCP area.
- 4) Enhance preserved populations that have a reduced probability for long-term viability.

- 5) Establish new populations of California red-legged frogs in suitable, unoccupied habitat, including historically occupied or newly created or restored habitats.

Implementation

- 1) Conduct surveys to identify occupied and potential habitat within the MSCP area. Preserve and manage in natural open space all occupied habitat. Preserve potential habitat (including historically occupied habitat) as determined in number 7, below. Sufficient unoccupied habitat adjacent to occupied habitat should be preserved to accommodate fluctuations in population size.
- 2) Stabilize populations by removing impacts or threat of impacts. Restrict activities within the preserve that could adversely affect red-legged frog populations. Negative impacts include, but are not restricted to, the presence of introduced predators (e.g., bullfrogs and large-mouth bass), removal of riparian vegetation, alteration or channelization of streambeds, adverse changes in water temperature, water levels, and quality. Restore degraded habitat based on information from numbers 7 and 8 below.
- 3) Identify habitat linkages or corridors between red-legged frog populations within and adjacent to the MSCP area. Where feasible, preserve linkages between populations. If linkages do not exist, are not appropriate for dispersal, or are not appropriate for preservation, translocation of individuals may be required to maintain/enhance genetic diversity of the metapopulation.
- 4) Enhance declining populations (as identified in number 8 below) through habitat enhancement/restoration and appropriate management. Specific enhancement techniques could include restoration or creation of small pond habitat with natural riparian vegetation, with rocks and logs for cover. A program to remove introduced predators may also be necessary. Population enhancement could also require translocation of individuals from another population to maintain/enhance genetic diversity.
- 5) Introduce red-legged frogs into suitable areas of historic occurrence or into other appropriate but unoccupied habitat. A number of populations should be introduced to different areas to diminish the effects of localized extinctions and to enhance genetic diversity. Areas for introduction should be determined from information obtained in number 7 below.
- 6) Provide biological and planning buffers around preserved populations and preserved potential habitat, that are of sufficient size and configuration to minimize the threat of habitat degradation or predation by domestic predators. Buffer distances depend on the type of land use bordering the preserve areas and on the available cover within the habitat.

Long-term Management Program

- 7) Conduct studies to more precisely define habitat and resource requirements of the California red-legged frog. Based on information from these studies determine which potential habitats (as identified in number 1 above) should be preserved for introduction of this species in the MSCP area. Introduction areas should provide the necessary resources for foraging, reproduction, cover, and juvenile dispersal. Prior to introduction, introduced predators (e.g., bullfrogs and bass) should be

removed and any habitat enhancement, restoration, or creation should be implemented.

- 8) Develop a standardized protocol for censusing and evaluating habitat for the species. Conduct periodic studies to monitor the status of populations within the MSCP area and use the results to refine management requirements. A program for predator control would be necessary to assure the continued viability of the populations. Other management activities might include, but would not be limited to, habitat enhancement/restoration, introduction of individuals into unoccupied habitat, translocation of individuals to maintain/enhance genetic diversity, and restriction of activities within the preserve which negatively impact the California red-legged frog.
- 9) Maintain an ongoing predator control program to remove bullfrogs, bass, sunfish, and other introduced aquatic predators from the water systems inhabited by the frogs.

POLICY 4.9 Preserve the long-term viability of the southwestern pond turtle (*Clemmys marmorata pallida*).

Present status Federal category 2 candidate and California Department of Fish and Game species of special concern; occurs in southern California and northern Baja California. Within the MSCP area, pond turtles are documented in Lusardi Creek, Sweetwater River, and Otay River Valley; inhabits slow-moving rivers, ponds, and small lakes. Southwestern pond turtle populations have declined because of the loss and alteration of aquatic habitats, predation on young by introduced aquatic species (e.g., bullfrogs, bass, and catfish), collection for pets, predation (e.g., dogs, raccoons, skunks), and competition with exotic turtles (Holland 1991, San Diego Herpetological Society 1980b).

Standards

- 1) Include within the open space preserve sufficient populations and potential habitat for southwestern pond turtles (as determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Provide for genetic exchange between preserved populations of southwestern pond turtles within and adjacent to the MSCP area.
- 3) Stabilize and maintain all preserved populations.
- 4) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys to refine subspecies range and distribution within the MSCP area. Preserve and manage in natural open space those populations and potential habitats determined necessary to maintain a viable metapopulation (see number 6 below). Sufficient, unoccupied habitat immediately adjacent to occupied habitat should be preserved to accommodate fluctuations in population size. Preserved areas should

contain all foraging and nesting habitat, including upland habitats within a minimum of 500 meters from the water.

- 2) Identify habitat linkages or corridors between pond turtle populations within and adjacent to the MSCP area. Where feasible, preserve linkages between populations. If linkages do not exist or are not appropriate for preservation, translocation of individuals may be required to maintain/enhance genetic diversity of the metapopulation.
- 3) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could adversely affect southwestern pond turtle populations. Negative impacts may include, but are not restricted to, vehicular traffic, the presence of introduced aquatic predators (e.g., bullfrogs, large-mouth bass, and catfish), competition with introduced turtles, collection of pond turtles for pets, predation by feral and domestic dogs, removal of riparian vegetation, alteration or channelization of streambeds, reductions in water flow and quality, and the introduction of pesticides or other pollutants and contaminants into the watershed. Construction of roads or off-road vehicle trails in preserve areas or across corridor linkages should be restricted and existing trails removed, to avoid roadkills during overland migration and nesting. Restore damaged habitat, based on information obtained from number 1 above and numbers 6 and 7 below.
- 4) Enhance declining populations identified in number 7, below, through habitat enhancement or restoration and appropriate management. Specific enhancement techniques could include restoration or creation of small pond habitat with natural riparian vegetation along the shore for cover, rocks and logs protruding from the water for protected basking, and earthen banks and adjacent upland habitat for nest building and egg laying. Habitat restoration should be combined with the removal of introduced aquatic predators and competitors and possibly with the translocation of individuals to maintain/enhance genetic diversity.
- 5) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize habitat degradation from adjacent land uses and predation by domestic animals. Buffer distances depend on the type of land use bordering the preserve areas and the available cover within the habitat.

Long-term Management Program

- 6) Conduct studies to more precisely define habitat and resource requirements of the southwestern pond turtle. Incorporate data on behavior and nesting habitat requirements currently being gathered on turtle populations at Camp Pendleton. A study of this species' population genetics is also needed. Use this information to determine which populations and potential habitats should be preserved.
- 7) Develop a standardized protocol for censusing and evaluating habitat for the species. Conduct periodic studies to monitor the status of populations within the MSCP area and use the results, along with information obtained from number 6 above, to refine management requirements. A program for predator control would be necessary to assure the continued viability of the different populations. Other management activities might include, but would not be limited to, habitat enhancement and restoration, translocation of individuals to maintain/enhance genetic diversity, and restriction of activities within the preserve which negatively impact the southwestern pond turtle.

- 8) Maintain an ongoing predator control program to remove bullfrogs, bass, sunfish, and other introduced aquatic predators from the water systems inhabited by the turtles.

POLICY 4.10 **Preserve the long-term viability of the San Diego horned lizard (*Phrynosoma coronatum blainvillei*).**

Present status Federal category 2 candidate and California Department of Fish and Game Species of Special Concern; occurs along the coastal slope of southern California at elevations below 8000 feet. This species is found in a variety of habitats ranging from open, sandy areas to dense chaparral, including coastal sage scrub, grasslands, and coniferous forests; distribution of the species is limited by the availability of its primary food item, harvester ants. The San Diego horned lizard is vulnerable to habitat loss and degradation, collection for the pet trade, elimination of ant colonies by pesticides, off-road vehicle activity, habitat fragmentation, and human disturbance (San Diego Herpetological Society 1980b).

Standards

- 1) Include within the open space preserve sufficient San Diego horned lizard populations and potential habitat (determined from specific, subsequent studies) to maintain a viable metapopulation.
- 2) Provide for genetic exchange between preserved populations of San Diego horned lizards within and adjacent to the MSCP area.
- 3) Stabilize and maintain all preserved populations.
- 4) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys to refine species range and distribution within the MSCP area. Preserve and manage in natural open space large populations, and any other smaller populations or potential habitat determined necessary to maintain a viable metapopulation (see number 6 below). Sufficient unoccupied but suitable habitat should also be preserved adjacent to occupied habitat to allow for population expansion and fluctuation. Preserve habitat that provides basking, foraging, burrowing, and dispersal areas.
- 2) Identify habitat linkages or corridors between existing populations as well as potential habitat areas. Preserve those habitat corridors or linkages identified as necessary in number 6 below. If linkages do not exist or are not appropriate for preservation, translocation of individuals may be required to maintain/enhance genetic diversity of the metapopulation.
- 3) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade San Diego horned lizard habitat. These activities include, but are not limited to, livestock over-grazing, predation by

introduced predators (including feral and domestic pets), specimen collecting, and use of insecticides which might impact ant populations. Restore damaged habitat, based on information obtained in numbers 6 and 7 below.

- 4) Enhance declining populations as identified in number 7 below through habitat enhancement/restoration and management. Enhancement techniques could include maintenance of basking and foraging areas, translocation of individuals to maintain/enhance genetic diversity, and predator control.
- 5) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize the threat of habitat degradation from adjacent land uses and predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and the available cover within the habitat.

Long-term Management Program

- 6) Conduct studies to refine subspecies range and distribution (see number 1 in implementation section above) and to more precisely define habitat and resource requirements. Collect data to support a population viability analysis which would be used to determine minimum viable population size. The data required for such an analysis would include juvenile and adult survivorship, fecundity, and habitat carrying capacity. A study of this species' population genetics is also needed. Use this information to determine the populations, linkages between populations, and potential habitats which should be preserved and to identify where translocation of individuals would be required to maintain the metapopulation over a 200-year planning horizon.
- 7) Develop a standardized protocol for habitat evaluation and a standard censusing method for the San Diego horned lizard. Conduct studies that periodically monitor the status of the metapopulation and determine management requirements. Management activities may include, but would not be limited to, predator control, habitat enhancement, translocation of individuals to maintain/enhance genetic diversity, and restriction of activities within the preserve that are identified as impactive to the horned lizard.

POLICY 4.11 Preserve the long-term viability of the orange-throated whiptail (*Cnemidophorus hyperythrus beldingi*).

Present status

Federal category 2 candidate and a California Department of Fish and Game species of special concern; locally common within its range in the extreme southwest corner of California, which includes parts of Orange, Riverside, and San Diego counties, and northern Baja California at elevations below 2800 feet. Large concentrations of orange-throated whiptails are known from near Jamul, Santee, Alpine, Otay Mesa, Rancho San Diego, Miramar NAS, and Escondido. They are most often associated with open sage scrub habitats with a vegetative cover of about 50% (Horchar pers. comm.), but are also found in open, ruderal areas, chaparral and riparian scrub, and around oak woodlands. The principal threat to the orange-throated whiptail is loss and degradation of habitat (San Diego Herpetological Society 1980b); this species can also be

impacted by off-road vehicle activity, over-grazing by livestock, and predation by introduced predators (e.g., cats and dogs).

Standards

- 1) Include within the open space preserve sufficient orange-throated whiptail populations and potential habitat (determined from specific, subsequent studies) to maintain a viable metapopulation.
- 2) Provide for genetic exchange between preserved populations of orange-throated whiptails within and adjacent to the MSCP area.
- 3) Stabilize and maintain all preserved populations.
- 4) Enhance preserved populations that have a reduced probability for long-term viability.
- 5) If future studies indicate the necessity, establish new populations of orange-throated whiptails in suitable but unoccupied habitat, including historically occupied and restored or newly created habitats.

Implementation

- 1) Conduct surveys to refine subspecies range and distribution within the MSCP area. Preserve and manage in natural open space sufficient populations and potential habitat determined necessary to maintain a viable metapopulation (see number 7 below). Sufficient unoccupied habitat should be preserved adjacent to occupied habitat to allow for population expansion and fluctuation. Preserved habitat should provide basking, foraging, hibernation, and dispersal habitats.
- 2) Identify habitat linkages or corridors between existing populations as well as potential habitat areas. Preserve those habitat corridors or linkages identified as necessary in number 7 below. If linkages do not exist or are not appropriate for preservation, translocation of individuals may be required to maintain/enhance genetic diversity of the metapopulation.
- 3) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade orange-throated whiptail habitat. These activities include, but are not limited to, off-road vehicle activity, livestock over-grazing, and predation by introduced predators (e.g., cats and dogs). Restore degraded habitat, based on information obtained in numbers 7 and 8 below.
- 4) Enhance declining populations as identified in number 8 below through habitat enhancement or restoration and management techniques. Enhancement techniques could include maintenance of open basking and foraging areas, creation of small earthen berms for hibernation (Bostic 1965), translocation of individuals to maintain/enhance genetic diversity, and predator control.
- 5) A program of introducing individuals into formerly occupied, potential, or newly created habitat to initiate new populations within the preserve system may be necessary to enhance/maintain the genetic diversity of the metapopulation. Information from numbers 7 and 8 below would determine the necessity of establishing new populations within the MSCP area.

- 6) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize habitat degradation from adjacent land uses and predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and the available cover within the habitat.

Long-term Management Program

- 7) Conduct studies to precisely define habitat affinities. Collect data to support a population viability analysis (PVA) which would be used to determine minimum viable population size. The information required for a PVA would include variation in adult survivorship, fecundity, juvenile recruitment, and habitat carrying capacity. These studies should include an ecological study of the termite *Reticulitermes hesperus*, the primary prey of this lizard species. Evaluate the potential for initiating a translocation program for suitable unoccupied habitat areas within the preserve network and between occupied preserved habitats to maintain long-term genetic diversity. Use information from these studies and from information obtained from numbers 1 and 2 above to determine the populations, habitat linkages, and potential habitats that should be preserved, and identify where translocations of individuals into existing populations, or the introduction of new populations into unoccupied habitat, would be required to maintain a metapopulation.
- 8) Develop a standardized protocol for habitat evaluation and censusing for this lizard species. Conduct studies to periodically monitor the status of the metapopulation and to determine management requirements. Management activities may include, but would not be limited to, predator control, habitat enhancement, translocation of individuals to maintain/enhance genetic diversity, and restriction of activities within the preserve that are identified as impactive to the orange-throated whiptail.

POLICY 4.12 Preserve the long-term viability of the California brown pelican (*Pelecanus occidentalis californicus*).

Present status

Federal and state endangered species. Brown pelicans occur throughout the year as non-breeders in San Diego County. Coronado Islands is the closest breeding location of the local resident population associated with the Southern California Bight. Post-breeding and winter influx of pelicans from the Gulf of California into San Diego County considerably augments the resident population. Within the MSCP area, the brown pelican is restricted to open ocean, coastal shorelines, bays, and estuaries. This species declined sharply in the 1960s because of contamination of the food chain with DDT, dieldrin, and other chlorinated hydrocarbons (Anderson et al. 1975, Zeiner et al. 1990); brown pelicans may also be impacted by oil spills, commercial harvesting of anchovies, a favored food resource, and human disturbance and persecution.

Standards

- 1) Include within the open space preserve sufficient roosting and foraging habitat to maintain the resident and wintering populations. Impacts to brown pelican

populations or habitat would require mitigation (e.g., purchase of identified preserve areas).

- 2) Stabilize and maintain all preserved populations.

Implementation

- 1) Conduct a study to identify foraging and roosting habitat for the brown pelican within the MSCP area. Preserve and manage in natural open space all existing brown pelican foraging and roosting habitat.
- 2) Stabilize and maintain preserved populations by removing impacts or threats of impacts. Minimize contamination of pelican roosting and foraging areas with pesticides, oil, and other pollutants. Reduce human disturbance at important foraging and roosting areas.
- 3) Enhance populations as identified by information from number 4 below through habitat enhancement/restoration and appropriate management.

Long-term Management Program

- 4) Periodically monitor the resident brown pelican population and levels of pesticides, oil, and other contaminants in foraging and roosting habitats. Use information obtained from the monitoring studies to determine management requirements. Management activities may include but would not be limited to, controlling pollution and contamination of roosting and foraging habitats, enhancing preserved habitat, and increased patrolling and enforcement of laws protecting brown pelicans from physical harm and harassment.
- 5) Conduct an environmental education program to educate fishermen and the public about the role of the brown pelican in the coastal ecosystem and the regulatory protection of endangered species.

POLICY 4.13 Preserve wintering habitat for the reddish egret (*Egretta rufescens*).

Present status Federal category 2 candidate; subtropical species reaching regular northern distributional limit at 30° north latitude in Baja California (Palmer 1962, Cogswell 1977, Wilbur 1987). A few reddish egrets (1 to 4 individuals) are typically found along the south county coastal areas from the mouth of the Tijuana River to Del Mar; most birds occur in fall and winter, but there are records for all months of the year (Unitt 1984, McCaskie 1987, 1989, 1990, 1991). There are no breeding records for the county.

Standards and Implementation

The small number of birds in the county utilize areas that presently receive regulatory protection. No special management procedures are warranted.

POLICY 4.14 **Preserve the long term viability of breeding and wintering populations of the white-faced ibis (*Plegadis chihi*).**

Present status

Federal category 2 candidate and California Department of Fish and Game Species of Special Concern. San Diego County represents the southern extreme of the west coast distribution. This species occurs regularly in small numbers in lower river valleys in San Diego County (Unitt 1984); it is uncommon and localized in winter and a sporadic breeder on the coastal slope. Recent breeding colonies include Buena Vista Lagoon and Guajome Lake. The consistent occurrence of a small flock along the eastern end of Lake Hodges in the summer of 1992 suggests the potential for breeding in the vicinity (Ogden unpub. data). The decline of the white-faced ibis is attributed to the loss of extensive marsh habitats, seasonal drying of wetlands for mosquito and cattail control, and nesting failures caused by pesticides (e.g., dieldrin; Remsen 1978, Terres 1980).

Standards

- 1) Include within the open space preserve all documented breeding and foraging habitat (Buena Vista Lagoon and Guajome Lake in the MHCP area and the eastern edge of Lake Hodges in the MSCP area), and breeding colonies and potential breeding or foraging habitat found during subsequent study.
- 2) Preserve connections between inland riparian habitats (e.g., eastern end of Lake Hodges) and coastal lagoons to allow for seasonal movement.
- 3) Stabilize and maintain all preserved populations.
- 4) Enhance and restore preserved habitat, as necessary, to promote use by breeding and wintering white-faced ibis.

Implementation

- 1) Conduct surveys to assess known and potential breeding colonies, potential breeding habitat and foraging habitats. Preserve and manage in natural open space all documented breeding and foraging habitat. Preserve potential breeding and foraging habitat identified as necessary in number 6 below to maintain long-term viability of white-faced ibis in the MSCP area.
- 2) Identify and preserve corridors connecting preserved habitat at inland locations to coastal lagoons.
- 3) Stabilize and maintain breeding and wintering populations by removing impacts or threats of impacts. Restrict activities within the preserve which could degrade white-faced ibis habitat. These impacts include, but are not limited to, livestock grazing, removal of native wetland vegetation, sand mining, human disturbance, adverse changes in water flow and quality, and the introduction of pesticides and other contaminants into preserved wetlands. Restore damaged habitat, based on information obtained from numbers 1 and 2 above and number 6 below.

- 4) Enhance the breeding and wintering population of white-faced ibis in the MSCP area through appropriate management and habitat enhancement techniques identified as necessary in number 6 below. Specific enhancement activities may include changes in land use practices and restoration of wetland habitats to provide breeding habitat (e.g., the eastern end of Lake Hodges).
- 5) Provide biological and planning buffers around preserved breeding and foraging habitat and preserved potential habitat sufficient in size and configuration to minimize habitat degradation and predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and on the available cover within the habitat. Human activity should be restricted at potential breeding colonies and associated foraging habitat during the early breeding period when courtship and nest building occur (approximately March to June). If breeding colonies are active, human activity should be restricted in the vicinity until the completion of breeding. Information obtained from number 6 below, may refine buffer distances and the timing and extent of limitations on human activity near breeding colonies.

Long-term Management Program

- 6) Study known breeding colonies to determine ecological and management requirements for the coastal San Diego white-faced ibis population. Measure the extent and habitat characteristics of colonies and describe nest sites and nesting phenology. Potential impacts to foraging habitat and nesting colonies from land use practices and human activity should be evaluated. Based on these studies and information obtained from numbers 1 and 2 above, determine which potential habitats within the MSCP study area should be preserved.
- 7) Monitor the ibis population and refine management requirements. Management activities may include, but would not be limited to, predator control, habitat enhancement, and restriction of activities within the preserve which negatively impact white-faced ibis.

POLICY 4.15 Preserve the long-term viability of the wintering population of Canada geese (*Branta canadensis*).

Present status

Canada geese that winter in the MSCP study area have no official sensitivity listing; however, local agencies are concerned over recent declines. Canada geese occur along coastal and inland water bodies and forage in marshes and upland agricultural fields; within the MSCP area, Canada geese regularly occur at the eastern and western ends of the San Dieguito River Valley, Tijuana River Valley, Lake Hodges, Sweetwater Reservoir, and coastal marshes (Unitt 1984 and Ogden unpub. data). Wintering populations of Canada geese have declined in San Diego County because of the loss of wetland habitats (Unitt 1984).

Standards

- 1) Include within the open space preserve sufficient roosting and foraging areas (as determined from specific, subsequent studies) to maintain a viable wintering population.

- 2) Stabilize and maintain preserved wintering populations.

Implementation

- 1) Conduct surveys to identify important Canada geese foraging and roosting areas as well as potential areas of use. Preserve and manage in natural open space all important roosting and foraging habitat and sufficient potential habitat to maintain the long-term viability of this species.
- 2) Stabilize preserved populations by removing impacts or threats of impacts. Restrict activities within the preserve that could degrade Canada goose habitat. These activities include, but are not limited to, reductions in water quantity and quality, introduction of pesticides and other contaminants into the watershed, over-grazing by livestock, and unregulated hunting.

POLICY 4.16 Preserve wintering habitat for the bald eagle (*Haliaeetus leucocephalus*).

Present status

Federal threatened species, California Department of Fish and Game endangered species; breeds throughout much of North America and southern Canada; uncommon winter visitor to San Diego County (Unitt 1984); one nesting record has been reported for this species in the county at Little Tecate Peak in 1936; outside of the MSCP area, bald eagles have been observed regularly during winter at Lake Henshaw, Whalen Lake, and Lake Cuyamaca (Unitt 1984 and Bloom pers. comm.); within the MSCP area, bald eagle sighting localities include Sweetwater and San Vicente reservoirs, Point Loma, Tijuana River Valley, and Torrey Pines State Reserve (Unitt 1984, Ogden unpub. data); wintering bald eagles require large bodies of open water for foraging and large trees for roosting; this species has declined because of shooting, human disturbance at nest sites, loss of nesting trees, loss of open water habitat due to human activities, power line electrocution, and reproductive failure caused by DDT (Anderson and Hickey 1970, Buehler et al. 1992, Caton et al. 1992, Terres 1980).

Standards

- 1) Include within the open space preserve occupied habitat and sufficient potential habitat to maintain the wintering bald eagle population.
- 2) Stabilize and maintain the wintering population of bald eagle.
- 3) Enhance the preserved wintering population if it has a reduced probability for long-term viability.

Implementation

- 1) Evaluate maps of reservoirs and lakes, vegetation and development, topography, and sighting records to determine the conservation potential of documented and potential bald eagle wintering habitat. Conduct field verification of documented and potential habitat.

- 2) Stabilize the preserved wintering population by removing impacts or threat of impact. Restrict activities within the preserve that could degrade bald eagle wintering habitat. These activities include, but are not limited to, removal of large trees and snags used for roosting and foraging near lakes and reservoirs, adverse changes in water quantity or quality, the introduction of pesticides or other contaminants into preserved watersheds and bodies of water, and human disturbance at foraging and roosting areas.
- 3) If information from number 4 below indicates a decline in wintering bald eagles, enhance the population through management techniques and enhancement of preserved habitat.

Long-term Management Program

- 4) Conduct periodic studies to monitor the preserved wintering bald eagle population to gather information on variation in population size, particularly in response to land use practices, development, pesticide contamination and pollution, and human disturbance factors. Establish management plans for preserved bald eagle habitat occurring within acquired preserve areas. The management plan should include guidelines for acceptable land use practices, visitor densities, permissible activities, and control of access to roosting and foraging sites. Conduct management studies to evaluate the enhancement potential of unoccupied potential wintering habitat within preserved areas.

POLICY 4.17 Preserve the long-term viability of breeding and wintering populations of northern harriers (*Circus cyaneus*).

Present status

California Department of Fish and Game species of special concern; breeds from Canada south into the northern United States, but is somewhat nomadic with respect to breeding locations; winters south into Central America. San Diego County is at the southwest edge of this species' breeding range. The northern harrier is disappearing as a breeding resident from the coastal lowlands of San Diego County (Unitt 1984, Bloom pers. comm.). Since the mid-1970s, some documented nesting locations in San Diego County include Camp Pendleton and Sweetwater River Estuary (Bloom pers. comm.), Otay River (Ogden 1992a), and Proctor Valley (Unitt 1984); nesting suspected at Otay Mesa (Ogden 1992a), Tijuana River Estuary, Sorrento Valley, northeast Lake Hodges, and south of San Marcos (Unitt 1984). The harrier breeds in marshes and grasslands and forages in grasslands, agricultural fields, wetlands and open coastal sage scrub. Northern harrier populations have declined because of destruction and alteration of nesting and foraging habitats, livestock over-grazing (reduces nest cover), detrimental agricultural practices (e.g., plowing and burning of fields during the breeding season), and increases in reproductive failure from environmental contaminants (Remsen 1978, Hamerstrom 1986, Zeiner et al. 1990).

Standards

- 1) Include within the open space preserve the breeding population of northern harriers (as determined by specific, subsequent studies) in existing and potential nesting and foraging habitats to maintain a viable metapopulation. Maintain important wintering areas for northern harriers. The breeding northern harrier population should be preserved within large blocks of open space (minimum area of one square mile [640 acres] of breeding/foraging habitat per pair).
- 2) Stabilize and maintain preserved breeding and foraging populations.
- 3) Enhance preserved breeding or wintering populations that have a reduced probability for long-term viability.

Implementation

- 1) Evaluate maps of vegetation and development, species sightings, and nesting locations to determine the conservation potential of northern harrier breeding habitat. Conduct field verifications of documented and potential nesting habitats. Identify northern harrier foraging habitat requirements in San Diego County through radio-telemetry studies of representative individuals. Conduct an analysis of potential foraging habitat associated with preserved and potential breeding habitat. Evaluate maps of vegetation, existing development, topography, nest site locations, and harrier sighting data to determine which areas meet the habitat requirements identified in the radio-telemetry study. Conduct field studies to verify and prioritize potential foraging habitats. Use the information from the breeding and foraging habitat analyses to preserve and manage in natural open space all documented nesting habitat, other potential and historic nesting habitat, and associated foraging habitats required to maintain and enhance the breeding population. Adequate foraging habitat, as identified by subsequent studies, must be preserved in contiguous blocks connected to breeding habitats. Identify important wintering areas for northern harrier through an analysis of topography, vegetation, and species sighting locations. Conduct field verification of potential and documented wintering habitat. Preserve those areas identified as important for maintaining the wintering population of northern harriers.
- 2) Stabilize the preserved breeding and wintering populations by removing impacts or threats of impact. Restrict activities within the preserve that could degrade northern harrier habitat. These activities include, but are not limited to, overgrazing by livestock, human disturbance, clearing of vegetation used for nesting, building roads or trails through breeding habitat, reductions in the water available to wetlands, introduction of pesticides or other contaminants into the preserve, and the presence of introduced predators (e.g., domestic dogs). Restore degraded habitat within the preserve, based on information obtained in number 1 above and number 5 below.
- 3) If information obtained from number 5 below indicates a declining breeding or wintering population, enhance the population through management techniques and enhancement/restoration of preserved habitat.
- 4) Establish protective buffer zones within a 300-foot radius around preserved breeding habitat (Bloom pers. comm.). Prohibit new housing development, building of structures, and construction of roads and trails within the buffer zone. New below-ground infrastructure projects (e.g., pipelines and utility lines) which

are determined not to have a significant impact on northern harrier nesting habitat may be built in the buffer zone during the non-breeding season. Restrict human activity (e.g., hiking, biking, vehicle activity, picnicking) during the breeding season (January 15 through July 31). Restrict public information about northern harrier nest sites to avoid human disturbance of the nests.

Long-term Management Program

- 5) Conduct periodic population monitoring of the conserved northern harrier population to gather information on variation in breeding and wintering population size, reproductive success, mortality, and juvenile dispersal, particularly in response to development, land use practices, environmental contaminants, prey availability, and human disturbance. Use this information to establish management plans for preserved nesting and foraging habitats within acquired preserve areas. Management goals should include maintaining and enhancing the existing breeding population and maintaining the wintering population. The management plan should include guidelines for land use practices, visitor densities, permissible activities near nest sites, and control of access to nesting habitat during the breeding season. Conduct studies to evaluate the enhancement potential of occupied and potential nesting and foraging habitats.

POLICY 4.18 Preserve the long-term viability of breeding and wintering populations of Cooper's hawks (*Accipiter cooperii*).

Present status

California Department of Fish and Game species of special concern; distributed throughout much of the United States from southern Canada to northern Mexico. A partial listing of recent breeding locations within the MSCP area includes Lake Hodges, San Diego Wild Animal Park, Balboa Park, Sweetwater River, Dulzura Creek, and San Ysidro Mountains (Unitt 1984, Ogden 1992a, Ogden unpub. data). Breeding is restricted to oak and riparian woodlands. The decrease in the breeding population of Cooper's hawks in California is attributed to destruction of riparian and oak woodlands, human disturbance, egg shell thinning from pesticide contamination, and illegal take of nestlings for falconry (Remsen 1978, Anderson and Hickey 1970).

Standards

- 1) Include within the open space preserve sufficient occupied and potential habitat (as determined by specific, subsequent studies) to maintain a viable population of breeding and wintering Cooper's hawks.
- 2) Stabilize and maintain preserved breeding and wintering populations.
- 3) Enhance preserved breeding or wintering populations that have a reduced probability for long-term viability.

Implementation

- 1) Evaluate vegetation maps, sighting records, and nesting locations to determine the conservation potential of Cooper's hawk nesting and foraging habitat. Nesting and

foraging habitat must be conserved as a contiguous unit. Larger stands of dense oak woodland should be prioritized for preservation as Cooper's hawk habitat. Conduct field verifications of documented and potential habitat. Preserve and manage in natural open space occupied and potential habitat determined necessary to maintain a viable population.

- 2) Stabilize the preserved resident and wintering populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade Cooper's hawk habitat. These activities may include, but are not limited to, human disturbance, livestock grazing, removal of oak trees and riparian vegetation, the invasion of non-native tree species into breeding habitat, building of trails or roads adjacent to or through breeding habitat, the introduction of pesticides or other contaminants into the preserve, and collection of individuals from the wild for falconry. Restore damaged habitat based on information obtained from number 1 above and numbers 5 and 6 below.
- 3) If information obtained from number 5 below indicates a declining breeding or wintering population, enhance the population through management techniques and enhancement/restoration of preserved habitat.
- 4) Establish protective buffer zones within a 300-foot radius around documented nesting trees (Bloom pers. comm.). Prohibit new housing development, building of structures, and construction of roads and trails within the buffer zone. New infrastructure projects (e.g., pipelines and utility lines) which are determined not to have a significant impact on Cooper's hawk nesting habitat may be built in the buffer zone during the non-breeding season. Restrict human activity (e.g., hiking, biking, vehicle activity, picnicking) from March 1 through July 31 within the buffer zone. Restrict public information about Cooper's hawk nest sites to avoid human disturbance of the nests.

Long-term Management Program

- 5) Conduct studies to monitor the preserved Cooper's hawk populations by gathering information on variation in breeding and wintering population size, reproductive success, mortality, and juvenile dispersal, particularly in response to land use practices, development, and human disturbance. Use this information to establish a management plan for Cooper's hawks within the preserve. The management plan should include guidelines for acceptable land use practices, visitor densities, permissible activities, and controlled access to nest sites. Periodic monitoring of the breeding and wintering populations should provide information regarding the refinement of management techniques, the necessity for preserving additional habitat, or enhancing/restoring unoccupied habitat within the preserve to maintain a viable Cooper's hawk population.

POLICY 4.19 **Preserve habitat for migrating Swainson's hawks (*Buteo swainsoni*).**

Present status

California Department of Fish and Game threatened species. This species was considered the most common breeding hawk in San Diego County at the turn of the century, but has been extirpated as a breeding resident since the 1930s (Unitt 1984); it is still observed as an uncommon spring migrant and a rare fall migrant in the western portion of the county at the Tijuana River Valley, Point Loma, and

Presidio Park (Unitt 1984), Salt Creek and Proctor Valley (Ogden unpub. data), Camp Pendleton (Bloom pers. comm.), and Sweetwater River (Lovio pers. comm.). It forages in grasslands and agricultural fields. Swainson's hawks have declined because of loss of breeding habitat, human persecution (illegal shooting), pesticide contamination, human disturbance, and deterioration of wintering habitat in South America (Remsen 1978).

Standard

- 1) Include within the open space preserve habitat for migrating Swainson's hawks in conjunction with habitat preservation for other sensitive raptor species.

Implementation

- 1) Evaluate maps of vegetation, development, and sighting records to determine the conservation potential of Swainson's hawk foraging habitat. Conduct field verification of documented and potential habitat. Preserve and manage in natural open space migration stopover areas for Swainson's hawk that are also identified for preservation for other sensitive raptor species.

POLICY 4.20 **Preserve the long-term viability of the wintering population of ferruginous hawks (*Buteo regalis*).**

Present status Federal category 2 candidate and California Department of Fish and Game species of special concern. Some locations within the MSCP area where this species occurs are Proctor Valley, Otay River Valley, Otay Mesa, San Dieguito River Valley, and San Diego Wild Animal Park (Ogden 1992a, Ogden unpub. data). Ferruginous hawks require grassland and agricultural fields for foraging; they have declined because of loss of large tracts of nesting and winter foraging habitat, human persecution (illegal shooting), and human disturbance at the nest.

Standard

- 1) Include within the open space preserve foraging habitat for wintering ferruginous hawks in conjunction with preservation of large blocks of grassland habitat for other sensitive raptor species.

Implementation

- 1) Evaluate maps of vegetation, development, and sighting records to identify important ferruginous hawk foraging habitat. Conduct field verification of documented and potential habitat. Preserve and manage in natural open space important wintering areas which are also identified for preservation of other sensitive raptor species.

POLICY 4.21 **Preserve the long-term viability of the golden eagle (*Aquila chrysaetos*).**

Present status California Department of Fish and Game species of special concern and protected under the federal Bald Eagle Protection Act. As of

1981, the number of breeding golden eagle pairs (38 pairs) within the western half of San Diego County had decreased by 33% from 1928 levels (Scott 1985). Active nesting pairs within the MSCP area occur near Ramona, Lake Hodges, tributary canyons of eastern San Pasqual Valley, San Vicente Reservoir, El Capitan Reservoir, San Miguel Mountains, San Ysidro Mountains, and Marron Valley (Colton pers. comm., Ogden unpub. data, Preston pers. comm., Scott unpub. data, USFS unpublished data, and Woychak pers. comm.). There is no current information available on eagle activity at other historic and potential nesting locations within the MSCP area. Golden eagles forage in grassland and open scrub habitats and nest primarily on cliffs with secondary use of large trees (e.g., oak and sycamore); this species has declined because of loss of foraging and nesting habitat, human persecution (illegal shooting), incidental poisoning, egg collecting, power line electrocution, and human disturbance at the nest (Snow 1973, Johnsgard 1990, Scott 1985).

Standards

- 1) Include within the open space preserve viable nesting pairs of golden eagles (as determined from specific, subsequent study) in existing nesting locations with sufficient foraging habitat to maintain a viable population. The preserved eagle population should be distributed within large blocks of open space, away from urbanized areas of the county, with the majority of the preserved population directly adjacent to existing publicly-owned lands (e.g., federal lands managed by the U.S. Forest Service and Bureau of Land Management).
- 2) Stabilize and maintain the preserved population.
- 3) Enhance the preserved population if specific, subsequent studies indicate a reduced probability for long-term viability.

Implementation

- 1) Conduct aerial surveys of active or potentially active golden eagle nesting locations to determine the status and vulnerability to human disturbance of each nest site. Evaluate maps of vegetation, topography, documented nest locations, and eagle sighting locations to determine the conservation potential of known golden eagle nest sites. Determine foraging habitat requirements of golden eagles in San Diego County through a radio-telemetry study of representative eagle pairs. Conduct an analysis of potential foraging habitat associated with each active nest site. Evaluate maps of vegetation, development, topography, nest site locations, and eagle sighting data to determine which areas meet the foraging habitat requirements identified in the radio-telemetry study. Conduct field studies to verify and prioritize foraging habitat. Use the information obtained from nesting and foraging studies to determine which eagle territories are viable over the long-term. Preserve and manage in natural open space, the nesting and foraging habitat for all viable pairs. Preserved nesting habitat for each viable pair should consist of preserving the documented primary nest site and at least two alternative nest sites. Sufficient and appropriate foraging habitat must be preserved to meet the requirements identified in the analysis of foraging habitat.
- 2) Stabilize the breeding population by removing impacts or threat of impact. Restrict activities within the preserve that could degrade golden eagle habitat. These

activities include but are not limited to conversion of grassland foraging habitat, rock climbing, hiking, and other human activity near nesting areas, poisoning of ground squirrels and other rodents in foraging habitat, building of trails, roads, or structures adjacent to nesting areas, and introduction of pesticides or other contaminants into the preserve. Restore degraded habitat within the preserve, based on information obtained in number 1 above and number 5 below.

- 3) If information obtained from number 5 below indicates a continued decline in the breeding population, enhance the population through management techniques and enhancement/restoration of preserved habitat.
- 4) Establish protective buffer zones with a 4,000-foot radius around preserved primary and alternate nest sites (Bloom pers. comm.). Prohibit new housing development, building of structures, and construction of roads and trails within the buffer zone. New infrastructure projects (e.g., pipelines, and utility lines) which are determined not to have a significant impact on the golden eagle nest site may be built in the buffer zone during the non-breeding season. Human activity (e.g., hiking, bicycling, vehicular activity, rock climbing) should be restricted within the buffer zones during the sensitive portion of the breeding season (January 15 through July 1). Throughout the year, preserved golden eagle nests should be protected from human disturbance (e.g., rock climbing, unauthorized visits, vandalism). Restrict public information about golden eagle nest sites to avoid human disturbance of the nests.

Long-term Management Program

- 5) Conduct periodic studies to monitor the preserved golden eagle population by gathering information on variation in population size, reproductive success, juvenile recruitment, dispersal, and mortality, particularly in response to development, land use practices, and human disturbance. Use this information to establish a management plan for the golden eagle population within acquired preserve areas. Include in management goals the long-term maintenance of preserved golden eagle pairs and, when feasible, the incorporation of new pairs into preserve areas. Utilize information acquired from the population monitoring to effectively manage golden eagle nesting and foraging habitat. Within the management plan, include guidelines for land use practices, fire control, visitor densities and allowable activities, control of access to nest areas, and modification of utility poles that have the potential to electrocute eagles. Conduct management studies to evaluate the enhancement potential of unoccupied eagle nesting sites and foraging habitat within preserve areas.

POLICY 4.22 **Preserve the long-term viability of wintering and breeding American peregrine falcon (*Falco peregrinus anatum*).**

Present status

Federal threatened and state endangered species which has been extirpated from much of its former breeding range in North America. Only one pair has bred in San Diego County since the 1950s (Pavelka 1991); this pair has been nesting at the Coronado Bridge since 1989. During winter, peregrine falcons occur along coastal areas and at reservoirs in the county; within the MSCP area some of the locations where this species has been detected include Tijuana River Valley, San Diego Bay, San Diego River Valley,

Mission Bay Park, Batiquitos Lagoon, Lake Hodges, San Pasqual River Valley, San Vicente Reservoir, and Sweetwater Reservoir (Konecny pers. comm., Ogden unpub. data, Patton pers. comm., Preston pers. comm., Unitt 1984). -Peregrine falcons suffered a large decline in the 1960s and 1970s because of dramatic reproductive failure from pesticide contamination (Johnsgard 1990); this species continues to be threatened by pesticide poisoning on the winter grounds, low breeding densities and reproductive isolation, lack of gene flow between populations, and reduced availability of foraging habitats and avian prey (Finch 1992).

Standards

- 1) Include within the open space preserve documented foraging habitat and sufficient potential and historical nesting and foraging habitat to maintain and achieve a net increase in the number of breeding and wintering peregrine falcons. Preserved habitat should be prioritized towards areas with steep topography and cliffs for roosting and nesting.
- 2) Stabilize and maintain the preserved wintering and breeding populations.
- 3) Enhance the preserved breeding populations. Establish new pairs of potentially breeding peregrine falcon into preserved historically occupied or potential habitats.

Implementation

- 1) Evaluate maps of vegetation and development, topography, sighting records, and historical nesting locations to determine the conservation potential of documented and potential peregrine falcon nesting and foraging habitat. Conduct field verification of documented and potential habitat. Preserve and manage in natural open space occupied and potential nesting and foraging habitat necessary to maintain and enhance breeding and wintering populations.
- 2) Stabilize the preserved breeding and wintering populations by removing impacts or threats of impact. Restrict activities within the preserve that could degrade peregrine falcon habitat. These activities include, but are not limited to, building of roads or trails adjacent to breeding habitat, human disturbance, the introduction of pesticides or other contaminants into preserved habitat, and illegal collection of birds from the wild by falconers.
- 3) Enhance declining breeding and wintering populations, identified in number 6 below through management techniques and restoration/enhancement of preserved habitat.
- 4) If determined feasible in number 6 below, introduce pairs of peregrine falcons into suitable areas of historic nesting occurrence or other appropriate unoccupied breeding habitat. Areas of introduction should be determined from information obtained from number 1 above and number 6 below.
- 5) Establish biological and planning buffers around preserved nests in natural habitats. Buffers should be of sufficient size and configuration to minimize human disturbance. Buffer distances would depend on the type of land use bordering the nest area and on the topography and physical features of the nesting habitat. Prohibit new housing development, building of structures, and construction of

roads and trails within the buffer zone. New infrastructure projects (e.g., pipelines, and utility lines) which are determined not to have a significant impact on the peregrine falcon nest site may be built in the buffer zone during the non-breeding season. Restrict human activity (e.g., hiking, biking, vehicle activity, picnicking) from January 15 through July 31 within the buffer zone. Restrict public information about peregrine falcon nest sites to avoid human disturbance of the nests.

Long-term Management Program

- 6) Monitor breeding and wintering populations of preserved peregrine falcons to gather information on variation in breeding and wintering population size, reproductive success, mortality, and dispersal, particularly in response to land use practices, development, and human disturbance. Establish management plans for peregrine falcons occurring within acquired preserve areas. Management goals should include the enhancement or creation of potential nesting habitat to encourage an increase in nesting peregrine falcons. The management plan should include guidelines for acceptable land use practices, visitor densities, permissible activities, and control of access to nest sites. Conduct management studies to evaluate the enhancement potential of unoccupied historical peregrine falcon nest sites or potential nesting habitat within reserve areas. Assess the feasibility of introducing peregrine falcons into appropriate breeding habitats within preserved areas.

POLICY 4.23 Preserve the long-term viability of the light-footed clapper rail (*Rallus longirostris levipes*).

Present status

Federal and state endangered species, restricted to coastal marshes. The total California population of light-footed clapper rails was estimated to be 235 pairs in 1991 (Zembal 1992). Breeding pairs have been found at 22 marshes in California since 1980, but the number of marshes with breeding populations is declining; in 1991 clapper rails were found in only 11 marshes statewide; the second largest rail population is at the Tijuana National Wildlife Refuge. Rails occur in the marshes of south San Diego Bay, San Diego River Flood Control Channel, and Kendall-Frost marsh in Mission Bay within the MSCP area, representing 28% of the total state population. The light-footed clapper rail is endangered because of the loss, degradation, and alteration of coastal marsh habitat. This species is also vulnerable to human disturbance, predation (e.g., dogs, cats, red fox (*Vulpes vulpes*), raptors, gulls, raccoons, skunks, etc.) and chemical contamination of the habitat (Jorgensen 1975, USFWS 1986).

Standards

- 1) Include within the open space preserve the existing light-footed clapper rail habitat and sufficient potential habitat (as determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

- 4) Establish new populations of light-footed clapper rails into suitable, unoccupied marsh habitats, including historically occupied and newly created marsh habitats.

Implementation

- 1) Preserve and manage in natural open space occupied saltmarsh habitat and sufficient potential habitat (including historically occupied and newly created habitat) determined in number 6 below, as necessary to maintain the long-term viability of the light-footed clapper rail population.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade light-footed clapper rail habitat. These activities include, but are not limited to, human disturbance, filling and diking of wetland habitat, predation of adults and nests by domestic animals (e.g., dogs and cats), introduced predators (e.g., red fox), or artificially enhanced populations of natural predators (e.g., raptors, gulls, coyotes, raccoons, and skunks), adverse changes in water quality, and the introduction of pesticides and other contaminants into preserve wetlands. Restore degraded habitat based on information obtained from number 6 below.
- 3) Enhance preserved populations identified in number 7 below through management techniques and habitat enhancement/restoration of preserved areas.
- 4) Introduce light-footed clapper rails into suitable areas of historic occurrence or into other appropriate unoccupied habitat such as enhanced or newly created coastal marsh. Areas for introduction should be determined from information gathered in number 6 below.
- 5) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize the threat of habitat degradation and predation by domestic animals. Buffer distances depend on the type of land use bordering the preserve areas.

Long-term Management Program

- 6) Evaluate areas of disturbed coastal marsh habitat for potential enhancement or revegetation with cordgrass and pickleweed. Determine where introductions of clapper rails into historical, enhanced/restored, and newly created habitats could occur. Use this information to determine areas of potential habitat that should be preserved to maintain the long-term viability of the clapper rail population. Develop captive breeding techniques for rails. If necessary, captive breeding could be used to augment the wild population through introduction of captive bred individuals into the wild.
- 7) Monitor rail population levels in occupied habitat. Prepare a management plan for this species including a protocol for introduction into new habitats. Specific management guidelines could include a predator control program and creation of nesting substrates (e.g., nesting platforms).

POLICY 4.24 **Preserve the long-term viability of wintering and breeding populations of western snowy plovers (*Charadrius alexandrinus nivosus*).**

Present status

Federal threatened species and California species of special concern. The breeding and winter distribution in California is along sandy beaches and estuarine habitat. The western snowy plover is a common migrant and winter visitor and localized breeding resident in San Diego County (Unitt 1984); breeding localities within the MSCP area include Los Torrey Pines State Beach, Silver Strand Beach, San Diego Bay saltworks, Sweetwater River mouth, and Tijuana River mouth. Western snowy plover populations are declining because of human disturbance, vehicular destruction of nests, loss and degradation of foraging and nesting habitats, and predation by introduced animals and artificially enhanced populations of native predators (Remsen 1978, Page et al. 1983).

Standards

- 1) Include within the open space preserve the existing western snowy plover breeding and foraging habitat, sufficient potential nesting and foraging habitat, and principal wintering localities (as determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys to identify occupied, historic, and potential nesting and foraging habitats within the MSCP area. Preserve and manage in natural open space all occupied nesting and foraging habitat, principal wintering habitat, and potential breeding habitats necessary to maintain a viable population over the long-term.
- 2) Stabilize populations by removing impacts or threat of impacts. Restrict activities within the preserve that could adversely impact the western snowy plover population. Negative impacts include, but are not limited to, human disturbance, off-road vehicular activity, and predation of adults and nests by domestic animals (e.g., dogs and cats), introduced predators (e.g., red fox), or artificially enhanced populations of natural predators (e.g., raptors, gulls, raccoons, and skunks). Restore degraded habitat as determined from number 5 below.
- 3) Enhance declining populations identified in number 5 below through formulation and implementation of appropriate management techniques.
- 4) Provide biological and planning buffers around preserved nesting habitat and preserved potential habitat, that are of sufficient size and configuration to minimize the threat of human disturbance, habitat degradation, and predation by domestic animals. Buffer distances depend on the results of studies conducted in number 5 below. Human activity should be restricted within the nesting habitat and associated buffer zone during the breeding season (April 1 through August 31).

Long-term Management Program

- 5) Conduct periodic studies to monitor breeding and wintering snowy plover populations. Gather information on population size, reproductive success, mortality, and habitat use for foraging, particularly in response to predation, human disturbance, and adjacent land use practices. Use this information to formulate and refine on an ongoing basis, management requirements. Management activities could include, but would not be limited to, predator control, restriction of human activities in nesting areas during the breeding season from April 1 through August 31, implementation of an education program for local pet owners to reduce disturbance and predation at nesting colonies by domestic animals, avoiding placement of above ground utility poles and other man made structures near nesting areas potentially utilized by raptors, and restriction of vehicular activity at breeding colonies.

POLICY 4.25 Preserve wintering habitat of the mountain plover (*Charadrius montanus*).

Present status

Federal category 2 candidate species and California species of special concern. California supports a majority of wintering mountain plovers, although systematic surveys have not been conducted to assess the status of this species. Analysis of Christmas Bird Counts in southern California suggests that mountain plovers may have declined by 89% (Leachman and Osmundson 1990). Within the MSCP area, mountain plovers have been detected in the Tijuana River Valley; wintering flocks are found mostly in agricultural fields and grassland habitats. Mountain plover populations have declined primarily due to conversion of nesting habitat to agriculture and market hunting in the early 1900s (Terres 1980); this species is also vulnerable to chemical spraying and roadkill by automobiles (Leachman and Osmundson 1990).

Standard

- 1) Include within the open space preserve habitat that supports mountain plover (as identified during specific subsequent surveys) to maintain a viable wintering population.
- 2) Stabilize and maintain the wintering population.
- 3) Enhance the preserved wintering population if it has a reduced probability of long-term viability.

Implementation

- 1) Conduct systematic winter surveys to determine distribution, population size, and habitat use by mountain plovers in the MSCP area. Preserve and manage occupied and potential habitat necessary to maintain a viable wintering population.
- 2) Stabilize the preserved wintering population by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade mountain plover

habitat. These activities include the conversion of grassland and agricultural fields to other habitat types and the use of pesticides in foraging habitat.

- 3) If number 4 below shows a decline in the wintering mountain plover population, enhance the population through management techniques and enhancement of preserved habitat.

Long-term Management Program

- 4) Conduct periodic monitoring of the preserved wintering mountain plover population. Evaluate agricultural practices that might enhance productivity of fields as plover foraging habitat. Use the monitoring and enhancement information to develop a management plan for the preserved mountain plover population.

POLICY 4.26 Preserve the long-term viability of the wintering population of long-billed curlews (*Numenius americanus*).

Present status

Federal category 3C candidate and California species of special concern; common migrant and winter visitor to San Diego County, no breeding records for the County. Within San Diego County, curlews prefer tidal mudflats, saltmarshes, fallow agricultural fields, and grasslands along the coast. Within the MSCP area, San Diego Bay, Silver Strand, San Dieguito River mouth, Los Peñasquitos Marsh, Mission Bay, San Diego River mouth and Flood Control Channel, Tijuana River mouth, and Tijuana River Valley are some localities consistently utilized by curlews (Unitt 1984). The long-billed curlew has declined principally because of large-scale conversion of grasslands to agriculture; in the early 1900s it was extirpated from much of the Atlantic Coast by over-hunting (Terres 1980).

Standards

- 1) Include within the open space preserve sufficient habitat that supports long-billed curlew (as identified during specific subsequent surveys) to maintain a viable wintering metapopulation.
- 2) Stabilize and maintain the wintering population.
- 3) Enhance the preserved wintering population if it has a reduced probability of long-term viability.

Implementation

- 1) Conduct systematic winter surveys to determine distribution, population size, and habitat use by long-billed curlews in the MSCP area. Identify important wintering areas. Preserve and manage in natural open space all important wintering areas determined necessary to maintain the long-term viability of this species within the MSCP area.
- 2) Stabilize the preserved wintering population by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade long-billed

curlew habitat. These activities include, but are not limited to, disturbance from human activities.

- 3) If number 4 below shows a decline in the wintering-long-billed curlew population, enhance the population through management techniques and enhancement of preserved habitat.

Long-term Management Program

- 4) Conduct periodic monitoring of the preserved wintering long-billed curlew population. Use the results of monitoring to develop a management plan for the preserved long-billed curlew population. Management activities could include restricting human activities at important wintering habitats.

POLICY 4.27 **Preserve the long-term viability of the breeding and post-breeding populations of elegant tern (*Sterna elegans*).**

Present status

Federal category 2 candidate and California species of special concern; an abundant summer resident in San Diego County, arrives in early March and leaves by late December. Elegant terns first bred north of Baja California in 1959 on the dikes at the Western Salt Works in south San Diego Bay; this is the only known colony in the County and has steadily grown in size since discovery (Unitt 1984). This northern expansion was probably due to destruction of all but one known colony on Isla Rasa, Gulf of California; one additional colony has formed at the Bolsa Chica wetlands in Orange County. Large numbers of post-breeding birds augment the local breeding population beginning in late June. Elegant terns are restricted to coastal habitats (ocean, lagoons, bays, beaches, and mudflats) in the MSCP area. They are vulnerable to factors such as human disturbance, predation, catastrophic events, nest destruction from off-road vehicle activity, and loss of habitat at their limited number of nesting colonies (Remsen 1978).

Standards

- 1) Include within the open space preserve the occupied elegant tern breeding habitat and sufficient foraging habitat (as determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Stabilize and maintain the preserved breeding population.
- 3) Enhance the preserved population if it has a reduced probability for long-term viability.

Implementation

- 1) Preserve and manage in natural open space all occupied breeding habitat and sufficient foraging habitat for preserving the long-term viability of the breeding population of elegant terns within the MSCP area (see number 5 below).

- 2) Stabilize the breeding population by removing impacts or threat of impacts. Restrict activities within the preserve that could adversely impact the elegant tern population. Adverse activities include, but are not limited to, human disturbance, off-road vehicle and pedestrian activity, changes in nesting substrates and vegetative structure at nesting sites, and predation of adults and nests by domestic animals (e.g., dogs and cats), introduced predators (e.g., red fox), or artificially enhanced populations of natural predators (e.g., raptors, gulls, raccoons, and skunks). Restore damaged habitat identified in number 5 below.
- 3) Enhance declining colonies through habitat enhancement and appropriate management. Enhancement may include, but would not be limited to, managing vegetation at breeding colonies to optimize nesting success, controlling access by vehicles and people to nesting areas, and predator control.
- 4) Provide biological and planning buffers around preserved occupied elegant tern nesting habitat sufficient in size and configuration to minimize the threat of human disturbance, habitat degradation, and predation by domestic animals. Human activity should be restricted within the nesting habitat and associated buffer zone upon arrival of this species in the spring and through the breeding season (April 1 through September 15).

Long-term Management Program

- 5) Conduct a study to identify important elegant tern foraging habitats within the MSCP area. Use the results to determine foraging areas which should be preserved to maintain the long-term viability of the elegant tern population in the MSCP area.
- 6) Monitor the breeding population and reproductive success. Information from population monitoring should be used to formulate and refine management requirements as needed. Management activities could include, but would not be limited to, predator control, enhancement of nesting substrates, restriction of human activities in nesting areas during the breeding season from April through September 15, implementation of an education program for local pet owners to reduce disturbance and predation at nesting colonies by domestic animals, avoiding construction of above ground utility poles and other man-made structures near nesting areas potentially utilized by raptors, and restriction of vehicular activity at breeding colonies. Vegetation should be managed at nesting areas as necessary to maintain optimal conditions for elegant tern breeding.

POLICY 4.28 Preserve the long-term viability of breeding populations of the California least tern (*Sterna antillarum browni*).

Present status

Federal and state endangered species. This species historically nested in California in colonies of up to thousands of birds, but the state population declined to only about 600 nesting pairs in the mid-1970s; the population has increased steadily since being protected, with only a moderate decline in the mid-1980s due to the effects of adverse oceanographic conditions (El Niño). The state population peaked at about 1700 nesting pairs in 1990, with about 20 colonies supporting 20 or more pairs (Fancher 1992); the number of nesting pairs in San Diego County was 800 in 1990 and 500 in 1991. The MSCP area supports the majority of the County's nesting population; all established nesting sites in San Diego County have

received protection and are monitored each year. The California least tern is endangered because of loss of suitable nesting habitat to development (Unitt 1984); this species is also vulnerable to predation and human disturbance (Garrett and Dunn 1981).

Standards

- 1) Include within the open space preserve the occupied least tern breeding habitat and sufficient foraging and potential nesting habitat (as determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Stabilize and maintain the preserved breeding population.
- 3) Enhance the preserved population if it has a reduced probability for long-term viability.
- 4) Establish new nesting colonies of least tern in suitable, unoccupied habitat, including historically occupied and newly created sites.

Implementation

- 1) Preserve and manage in natural open space all occupied breeding and foraging habitat and potential nesting habitat determined necessary for preserving the long-term viability of least terns within the MSCP area (see number 6 below).
- 2) Stabilize the breeding population by removing impacts or threat of impacts. Restrict activities within the preserve that could adversely impact the least tern population. Adverse activities include, but are not limited to, human disturbance, off-road vehicle and pedestrian activity, changes in nesting substrates and vegetative structure at nesting sites, inundation of colonies by high tides or fresh water, and predation of adults and nests by domestic animals (e.g., dogs and cats), introduced predators (e.g., red fox), or artificially enhanced populations of natural predators (e.g., raptors, gulls, raccoons, and skunks). Restore degraded habitat as identified in number 7 below.
- 3) Enhance declining colonies, identified in number 7 below through habitat enhancement and appropriate management. Enhancement may include, but not limited to, managing vegetation at breeding colonies to provide islands of vegetation to protect and shelter the chicks while preventing overgrowth of vegetation, controlling access by vehicles and people to nesting areas, predator control, and enhancement of nesting substrate.
- 4) Establish new breeding colonies of least terns in suitable areas of historic occurrence or in other areas of appropriate unoccupied habitat. If necessary, create new habitat to facilitate the establishment of new breeding colonies. Encourage establishment of new breeding colonies at designated nesting areas by placement of tern decoys and chick shelters in the nesting area before the start of the breeding season.
- 5) Provide biological and planning buffers around preserved occupied nesting habitat and preserved potential habitat sufficient in size and configuration to minimize the threat of human disturbance, habitat degradation, and predation by domestic animals. Human activity should be restricted within the nesting habitat and associated buffer zone during the breeding season (April 1 through September 15).

Long-term Management Program

- 6) Identify unoccupied but suitable nesting habitat for least terns which should be preserved in conjunction with existing nesting colonies to maintain the breeding population. Determine if creation of new nesting habitat is necessary for the long term viability of the breeding population. Conduct a foraging study to identify primary and secondary least tern foraging areas within 3 miles of nesting habitat. The foraging study should also determine potential seasonal changes in foraging habitat utilization and effects of weather and boating activity on foraging behavior. Use the results from the foraging study and analysis of potential nesting habitat to determine foraging and nesting habitats that should be preserved to maintain the long-term viability of the least tern population in the MSCP area.
- 7) Conduct periodic studies to monitor the breeding population and reproductive success. Information from the foraging and population monitoring studies should be used to formulate and refine management requirements as needed. Management activities could include, but would not be limited to, predator control, enhancement of nesting substrates, restriction of human activities in nesting areas during the breeding season from April 1 through September 15, implementation of an education program for local pet owners to reduce disturbance and predation at nesting colonies by domestic animals, avoiding construction of above ground utility poles and other man-made structures near nesting areas potentially utilized by raptors, and restriction of vehicular activity at breeding colonies. Vegetation should be managed at nesting areas as necessary to maintain optimal conditions for tern breeding. Islands of vegetation should be left to provide shelter for chicks. Tern decoys and chick shelters can also be effective management tools.

POLICY 4.29 **Preserve the long-term viability of breeding and wintering populations of burrowing owls (*Speotyto cunicularia hypugaea*).**

Present status

Federal Category 2 candidate and California Department of Fish and Game species of special concern. Burrowing owls are uncommon and rapidly declining in California and in San Diego County (Remsen 1978, Unitt 1984 and Bloom pers. comm.). An incomplete listing of burrowing owl locations within San Diego County includes San Marcos, Camp Pendleton, Palomar Airport, Mission Bay, Lower Otay Lake, North Island Naval Air Station, Otay Mesa, and the Tijuana River Valley (Unitt 1984). Recent observations suggest the loss of a substantial number of these colonies and a reduction in the number of individuals at the remaining colonies (Bloom pers. comm.). Recent surveys have detected burrowing owls on east Otay Mesa and Brown Air Field, on the southern flank of Jamul Peak (Ogden 1992), east of Fairbanks Ranch (City of San Diego 1992), and San Marcos (Ogden unpublished data); the resident population is augmented by migratory individuals from the north during winter. Burrowing owls are usually found in open habitats such as grasslands, pastures, and the edges of agricultural fields and utilize California ground squirrel (*Spermophilus beecheyi*) burrows for cover and nesting. Burrowing owl populations are declining because of habitat loss, incidental poisoning of burrowing owls and destruction

of their burrows during eradication campaigns aimed at rodent colonies, human persecution (e.g., illegal shooting), roadkill by automobiles, human disturbance, and the introduction of non-native predators into burrowing owl habitat along with the artificial enhancement of certain native predator populations (Bloom pers. comm., Collins 1979, Remsen 1978, Zarn 1974).

Standards

- 1) Include within the open space preserve occupied burrowing owl breeding and foraging habitat and sufficient potential habitat (as determined by specific, subsequent studies) to maintain and enhance a viable metapopulation.
- 2) Stabilize and maintain the preserved breeding population.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.
- 4) Establish new burrowing owl colonies in suitable, unoccupied habitat, including historically occupied and newly created habitats.

Implementation

- 1) Evaluate maps of vegetation, development, locations of current and historic burrowing owl colonies, sighting records, and California ground squirrel colonies to determine the conservation potential of burrowing owl habitat. Verify occupied and potential nesting habitat. Evaluate suitability of unoccupied habitat adjacent to existing populations for enhancement as nesting habitat. Determine foraging habitat requirements through analysis of available literature and discussions with experts. Identify foraging habitat associated with colonies through analysis of topography, vegetation, and burrowing owl sightings. Conduct field verification of potential and documented foraging habitat. Preserve and manage in natural open space occupied nesting habitat, all associated foraging habitat, and potential habitat required to preserve the long-term viability of burrowing owls within the MSCP area. Foraging habitat should be contiguous with the burrows in nesting habitats.
- 2) Stabilize the preserved breeding and wintering populations by removing impacts or threat of impacts. Restrict activities that degrade burrowing owl habitat. These activities include, but are not limited to, rodent poisoning campaigns, human disturbance, vehicular activity, and predation of adults and nests by domestic animals (e.g., dogs and cats) or artificially enhanced populations of natural predators (e.g., raccoons, and skunks). Restore damaged habitat as identified in number 1 above and number 6 below.
- 3) Enhance declining colonies identified in number 6 below through habitat enhancement and appropriate management. Enhancement may include, but would not be limited to, creating artificial burrows, managing vegetation at breeding colonies to optimize nesting and foraging habitat, controlling access by vehicles and people to nesting areas, and predator control.
- 4) Provide biological and planning buffers a minimum of 300 feet in width (Bloom pers. comm.) around preserved burrowing owl colonies to minimize threat of human disturbance, habitat degradation, and predation by domestic animals. Prohibit new development and roads, trails, or infrastructure within the buffer

zone. Restrict human activity (e.g., hiking, biking, picnicking, etc.) throughout the year within the buffer zone.

- 5) Conduct a population viability analysis to determine if it is necessary to establish new colonies of burrowing owls in suitable, unoccupied habitat in order to maintain the long-term viability of this species.

Long-term Management Program

- 6) Monitor preserved burrowing owl populations and gather information on variation in breeding and wintering population size, reproductive success, mortality, and juvenile dispersal, particularly in response to land use practices, development, predation, and human disturbance. Establish management plans for preserved burrowing owl populations and habitat within acquired preserve areas. Habitat management goals should be to maintain existing populations and increase burrowing owl populations where feasible. The management plan should include guidelines for acceptable land use practices, visitor densities, permissible activities near breeding habitat, control of access to breeding colonies, and predator control near breeding colonies. Conduct management studies to evaluate the potential for enhancement of suitable, but unoccupied habitat and the introduction of individuals into unoccupied habitat.

POLICY 4.30 **Preserve the long-term viability of the breeding population of southwestern willow flycatchers (*Empidonax traillii extimus*)**

Present status

Federal proposed endangered and state endangered. Within the last 10 years willow flycatchers have reappeared sporadically in disjunct riparian systems in southwestern California; current numbers remain significantly reduced from historical levels. In San Diego County, small breeding populations of willow flycatchers persist in major river valleys including the Santa Margarita and San Luis Rey rivers; within the MSCP area, singing birds appeared sporadically on the Sweetwater and Tijuana rivers and on Jamul Creek in the 1980s (Unitt 1987), and probable breeding occurred in 1992 in the San Dieguito River Valley east of Lake Hodges (Ogden unpub. data). This species is restricted to willow-dominated riparian habitats; the willow flycatcher has declined primarily because of loss, alteration, and degradation of riparian habitat (Remsen 1978); this species is also impacted by brown-headed cowbird (*Molothrus ater*) nest parasitism and livestock grazing in riparian habitats (Remsen 1978, Taylor and Littlefield 1986, Sanders and Flett 1989).

Standards

- 1) Include within the open space preserve any documented breeding habitat and sufficient potential habitat (as determined by specific, subsequent studies) to maintain and enhance a viable willow flycatcher metapopulation.
- 2) Stabilize and maintain preserved breeding populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys of appropriate willow flycatcher habitat to identify occupied and potential breeding habitat and determine population size and distribution within the MSCP area. Preserve and manage in natural open space occupied breeding habitat and any potential habitat, as identified in number 5 below, as necessary to maintain and enhance a viable long-term breeding population of willow flycatchers.
- 2) Stabilize the preserved breeding populations by removing impacts or threat of impacts. Restrict activities that could degrade willow flycatcher habitat. These factors include, but are not limited to, livestock grazing, excessive noise, clearing of riparian vegetation, alteration or channelization of riverbeds, invasion of exotic plants and trees into the riparian system, human disturbance, brown-headed cowbird parasitism, insufficient water levels leading to loss of riparian habitat, and predation of adults and nests by domestic animals (e.g., dogs and cats). Restore degraded habitat as identified in number 1 above and numbers 5 and 6 below.
- 3) Enhance any declining breeding population identified in number 6 below through habitat enhancement and appropriate management. Enhancement may include, but would not be limited to, providing sufficient water flow to ensure sustained and increasing willow growth, restriction of human activities during the breeding season, removal of invasive plant species which degrade habitat, and predator/cowbird control.
- 4) Provide biological and planning buffers around preserved willow flycatcher nesting habitat, that are of sufficient size and configuration to minimize the threat of human disturbance, noise impacts, habitat degradation, and predation by domestic animals.

Long-term Management Program

- 5) Conduct studies to more precisely define the ecology and habitat requirements of breeding willow flycatchers. Document habitat characteristics such as height, extent, and patchiness of willow thickets, nature of surrounding habitats, and vertical heterogeneity in areas of known occurrence. Conduct a study of banded birds to assess population parameters such as breeding success, philopatry, survivorship, and dispersal rate between major drainages. Use information obtained from these and other studies to perform a population viability analysis to determine potential breeding areas which should be preserved to enhance and maintain the long-term viability of the breeding southwestern willow flycatcher population in the MSCP area.
- 6) Monitor the status of the breeding population within the MSCP area and use the results to refine management requirements. Management activities could include, but would not be limited to, predator/cowbird control, restriction of human activities in nesting areas during the breeding season, ensuring sufficient water flow to support and enhance the willow riparian habitat, shielding or buffering excessive noise, removing invasive non-native vegetation from the riparian system, and restricting activities that may degrade willow flycatcher habitat.

POLICY 4.31

Preserve the long-term viability of the breeding population of the coastal cactus wren (*Campylorhynchus brunneicapillus couesi*).

Present status

Federal category 3B species and California Department of Fish and Game species of special concern. There is a highly disjunct distribution of this species within San Diego County, with very small, fragmented populations in five primary subregions (Camp Pendleton, Lake Hodges/Wild Animal Park, Santee/Lake Jennings, Sweetwater River, and Otay River/Otay Mesa). The San Diego County population is estimated to be less than 300 pairs and is restricted to coastal sage scrub with patches of tall cactus. The coastal cactus wren is declining because of the loss, degradation, and fragmentation of coastal sage scrub habitat containing cactus (Rea and Weaver 1990; Ogden 1993a).

Standard

- 1) Include within the open space preserve viable habitat and populations of coastal cactus wrens (as determined from specific, subsequent studies) with sufficient foraging habitat to maintain a viable metapopulation.
- 2) Stabilize and maintain the preserved breeding populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.
- 4) Achieve a net increase in number of populations and total number of coastal cactus wrens by translocation of individuals into unoccupied or newly created habitat that is adjacent and connected to an established population.

Implementation

- 1) Evaluate vegetation and species distribution maps to identify viable populations and assess relative suitability for cactus wren habitat enhancement/creation in disturbed habitat areas adjacent and connected to conserved coastal cactus wren-occupied habitat.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict any activities or factors within the preserve that could degrade cactus wren habitat. These factors and activities include, but are not limited to, livestock overgrazing, presence of brown-headed cowbirds, and the presence of predators (e.g., domestic dogs and cats). Restore damaged habitat based on information obtained from number 1 above and number 5 below.
- 3) Enhance declining populations through habitat enhancement/restoration and management techniques.
- 4) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize the threat of habitat degradation or predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and on the available cover within the habitat.

Long-term Management Program

- 5) Conduct long-term population studies of the coastal cactus wren to monitor the status of the existing cactus wren population and its habitat. These studies should gather information on variation in population size/density, reproductive success, annual survival, juvenile recruitment, and dispersal capability, particularly in response to adjacent development and variation in predation and weather. This information will be used to refine population viability models developed for the coastal cactus wren. Information on the population genetics of the coastal cactus wren is also needed.
- 6) Capture any cactus wren individuals from populations deemed not viable and relocate them to the nearest viable population to retain maximum genetic diversity within the conserved population.
- 7) Conduct a management program to "seed" newly created habitat with juvenile cactus wrens of known genetic origin.

POLICY 4.32 **Preserve the long-term viability of the breeding population of the coastal California gnatcatcher (*Polioptila californica californica*).**

Present status

Federally threatened species, California Department of Fish and Game species of special concern; closely associated with coastal sage scrub habitat, especially below 950-foot elevation and on slopes less than 40%. Significant concentrations within the MSCP study area are known at Lake Hodges, Black Mountain, Escondido/San Pasqual Valley, Los Peñasquitos Canyon, Poway, Mission Trails Park/East Elliot/Miramar/Santee, Lake Jennings, Dehesa/Sweetwater River/San Miguel Mountains, Jamul Mountains, and San Ysidro Mountains/Otay River/Otay Mesa. The gnatcatcher population within the MSCP study area is estimated to exceed 900 pairs (Ogden 1993b); it is threatened primarily by loss, degradation, and fragmentation of coastal sage scrub habitat (USFWS 1991); it is also impacted by predation by human subsidized predators (e.g., cats) and brown-headed cowbird parasitism (USFWS 1991, ERCE 1990).

Standards

- 1) Maintain sufficient viable habitat and core populations of coastal California gnatcatchers that constitute a viable metapopulation.
- 2) Stabilize and maintain the preserved breeding populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.
- 4) Provide for genetic exchange between preserved populations of California gnatcatchers within and adjacent to the MSCP area.

Implementation

- 1) Species distribution, vegetation, and gnatcatcher habitat value maps were evaluated by the Biological Task Force. At least twelve (12) "core" reserves of very large blocks of gnatcatcher-occupied coastal sage scrub should be conserved (Ogden 1993b). These core reserves are Lake Hodges area, Black Mountain, Escondido/San Pasqual Valley, Los Peñasquitos Canyon, North Poway, South Poway (including Van Damm Peak), Mission Trails/East Elliot/Miramar/Santee (including Rattlesnake Mountain), South San Vicente/Lake Jennings, Dehesa/Upper Sweetwater River (including McGinty Mountain), Lower Sweetwater River/San Miguel Mountains (including Dictionary Hill), Jamul Mountains, San Ysidro Mountains/Otay River/Otay Mesa. These core reserves must be supplemented with a sufficient number of smaller "satellite" (steppingstone) reserves in between to enhance connectivity between core reserves and achieve a minimum viable metapopulation size. Satellite reserves should support at least 20 pairs within areas of high productivity and at least 50 pairs within areas of relatively low productivity (Ogden 1993b). Total metapopulation size needed to be conserved and alternative reserve network configurations shall be "tested" with a spatially explicit metapopulation simulation model.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict any activities or factors within the preserve that could degrade gnatcatcher habitat. These factors and activities include, but are not limited to, livestock overgrazing, presence of brown-headed cowbirds, and the presence of predators (e.g., domestic dogs and cats). Restore damaged habitat based on information obtained from number 6 below.
- 3) Enhance declining populations through habitat enhancement/restoration and management techniques.
- 4) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize the threat of habitat degradation or predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and on the available cover within the habitat.
- 5) Distance between gnatcatcher reserves shall average 1.5 to 2.0 miles with a maximum less than 6 miles (Ogden 1993b). Reserves shall be connected by corridors of native shrubland vegetation composed primarily of coastal sage scrub. Movement corridor width shall average more than 1000 feet and be a minimum of 500 feet wide (Ogden 1992b). Topography, vegetation, and existing/proposed adjacent land use shall be used to assess the adequacy of the movement corridor. Corridors deemed critical to the gnatcatcher metapopulation (e.g., I-8 crossing at Lakeside; Sweetwater River area between Rancho San Diego and McGinty Mesa) shall be enhanced or restored.

Long-term Management Program

- 6) Monitor the status of the conserved California gnatcatcher populations and their habitat. These studies would gather information on variation in population size/density, reproductive success, annual survival, juvenile recruitment, and dispersal capability, particularly in response to adjacent development, and variation in predation and weather. This information will be used to refine population viability models developed for the coastal California gnatcatcher. Habitat

management should include fire management, revegetation, and cowbird/meso-predator control programs where deemed appropriate.

POLICY 4.33 **Preserve the long-term viability of the breeding population of western bluebirds (*Sialia mexicana*).**

Present status

The local population of this species has no official status, but is being watched by wildlife agencies because of a decline in oak woodlands, the species' breeding habitat in coastal areas of the county. Western bluebirds occur throughout the year in foothill and mountain zones and more inland areas of coastal lowlands within San Diego County (e.g., Poway, Santee, Lake Hodges, Escondido, and San Ysidro Mountains). Breeding habitat remains east of Lake Hodges, along the San Diego River, and in drainages east of Otay Reservoir. This species prefers oak woodland adjacent to meadows or grassland for breeding and requires cavities in trees for nesting; it relies extensively on fruits, such as mistletoe berries, during winter. The western bluebird is vulnerable to competition with more aggressive introduced species (e.g., European starling and house sparrow) for scarce nesting cavities (McLaren 1963, Zeleny 1969, Patterson 1969).

Standard

- 1) Include within the open space preserve sufficient breeding and foraging habitat to maintain a viable western bluebird metapopulation.
- 2) Stabilize and maintain preserved breeding populations.
- 3) Enhance preserved breeding populations if they have a reduced probability for long-term viability.

Implementation

- 1) Preserve and manage in natural open space sufficient breeding habitat for this species east of Lake Hodges, along the San Diego River, and along drainages east of Otay Reservoir.
- 2) Stabilize preserved breeding populations by removing impacts or threat of impacts. Restrict activities or factors that degrade western bluebird habitat. These factors include, but are not limited to, overgrazing by livestock, removal of dead trees or dead branches which provide nesting cavities, and the presence of introduced competitors for nesting cavities (e.g., European starling and house sparrow).
- 3) Enhance any decline in the breeding population through habitat enhancement and appropriate management. Enhancement may include, but would not be limited to, installing and maintaining nest boxes and trapping and removing exotic nest cavity competitors such as the European starling and house sparrow.

POLICY 4.34

Preserve the long-term viability of the breeding population of least Bell's vireos (*Vireo bellii pusillus*).

Present status

Federal and state listed endangered species; found only in riparian woodlands in southern California, with the majority of breeding pairs in San Diego, Santa Barbara, and Riverside counties. Vireo populations are currently studied on five rivers in San Diego County: Tijuana, Sweetwater, San Diego, San Luis Rey, and Santa Margarita, although small populations occur on other drainages. data for the Sweetwater, San Diego, and San Luis Rey rivers suggested a stable to increasing population from 1990 to 1992, although annual fluctuations occurred on individual drainages; over 460 breeding pairs or territorial males were documented within San Diego County in 1991 (Salata pers. comm.), with about 25% occurring within the MSCP study area. Banding studies have shown a moderate rate of dispersal between major drainages in the county; San Luis Rey has received dispersants from the Santa Margarita and San Diego rivers and birds from the Santa Margarita, San Luis Rey, San Diego, and Sweetwater rivers have contributed breeding individuals to an expanding population on the Tijuana River (Kus 1991a, 1991b 1992a, 1992b). The least Bell's vireo is endangered because of loss, degradation, and fragmentation of willow-dominated riparian habitat; this species is also vulnerable to brown-headed cowbird parasitism (Kus 1991a, 1991b).

Standards

- 1) Include within the open space preserve existing least Bell's vireo breeding habitat and sufficient potential habitat (as determined by specific, subsequent studies) to maintain and enhance the least Bell's vireo metapopulation.
- 2) Stabilize and maintain preserved breeding populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Preserve and manage in natural open space 100% of existing least Bell's vireo breeding habitat. Preserve potential habitat, including historically occupied and newly created/restored habitat, as determined in number 6 below.
- 2) Stabilize preserved breeding populations by removing impacts or threat of impacts. Restrict activities that degrade least Bell's vireo habitat. These activities include, but are not limited to, livestock grazing, noise, clearing of riparian vegetation, alteration or channelization of riverbeds, invasion of exotic plants and trees into the riparian system, human disturbance, brown-headed cowbird parasitism, insufficient water levels leading to loss of willow riparian habitat, and predation of adults and nests by domestic animals (e.g., cats). Restore degraded habitat as identified in numbers 6 and 7 below.
- 3) Enhance any declining breeding populations through habitat enhancement and appropriate management. Enhancement may include, but would not be limited to,

restricting livestock grazing in and adjacent to vireo habitat, providing sufficient water flow to ensure sustained and increasing willow growth, restriction of human activities during the breeding season, removal of invasive plant species which degrade the habitat, and predator/cowbird control. -

- 4) Provide biological and planning buffers around preserved least Bell's vireo nesting habitat sufficient in size and configuration to minimize the threat of human disturbance, excessive noise, habitat degradation, and predation by domestic animals.

Long-term Management Program

- 5) Continue monitoring of conserved least Bell's vireo populations and habitat. These studies should continue to gather information on variation in population size/density, reproductive success, annual survival, juvenile recruitment, and dispersal capability, particularly in response to adjacent development, cowbird nest parasitism, and variation in predation and weather. Study possible correlations between habitat extent, structure, and rates of cowbird parasitism with the goal of establishing natural, self-sustaining means of nest parasite control. Information from these studies will be used to develop population viability models for the least Bell's vireo. Conduct studies of potential habitat enhancement methods to make currently unoccupied riparian habitat suitable for least Bell's vireos. Determine in conjunction with the results from the population viability analysis, which areas of potential habitat should be enhanced/restored and preserved for potential expansion and establishment of additional least Bell's vireo populations.
- 6) Prepare a specific management plan for this species in the MSCP area which follows recommendations outlined in the Comprehensive Species Management Plan (SANDAG 1989), the USFWS Recovery Plan, and the San Diego River and Sweetwater River Habitat Conservation Plans (SANDAG 1992), once adopted. Management requirements should be refined based on the results of vireo monitoring studies (see number 5 above). The management plan should balance management of least Bell's vireo habitat with the requirements to provide habitat for other riparian-dependent species with different ecological constraints. Management activities could include, but would not be limited to, predator control, expansion of the program to trap and remove brown-headed cowbirds, restriction of human activities in nesting areas during the breeding season, ensuring sufficient water flow to support and enhance the willow riparian habitat, shielding or buffering excessive noise, removing invasive non-native vegetation from the riparian system, restricting livestock grazing in vireo habitat, and restricting other activities that may degrade least Bell's vireo habitat.

POLICY 4.35 **Preserve the long-term viability of the southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*).**

Present status Federal category 2 candidate and California Department of Fish and Game species of special concern. Rufous-crowned sparrows are locally common in coastal sage scrub in San Diego County, although this habitat is rapidly disappearing. A partial listing of locations where large populations are found includes Lake Hodges, San Pasqual Valley, Poway, Los Peñasquitos Canyon, Santee, Dehesa, Sweetwater River, and Otay Mesa (Unitt 1984). Rufous-

crowned sparrows prefer slopes that are steep, sparsely vegetated, and rocky. The southern California rufous-crowned sparrow is vulnerable to the loss, degradation, and fragmentation of coastal sage scrub habitat.

Standards

- 1) Include within the open space preserve adequate populations and potential habitat (as determined by specific, subsequent studies) to maintain a viable metapopulation of the southern California rufous-crowned sparrow.
- 2) Provide for genetic exchange between preserved populations of southern California rufous-crowned sparrows within and adjacent to the MSCP area.
- 3) Stabilize and maintain all preserved populations.
- 4) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys to identify occupied and potential rufous-crowned sparrow habitat within the MSCP area. Preserve and manage in natural open space large populations, and any other smaller populations or potential habitat determined necessary to maintain a viable metapopulation (see number 5 below).
- 2) Identify habitat linkages or corridors between existing populations as well as potential habitat areas. Preserve those habitat corridors or linkages identified as necessary in number 5 below.
- 3) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade southern California rufous-crowned sparrow habitat. These activities include, but are not limited to, livestock overgrazing, brown-headed cowbird parasitism, and introduction of predators (e.g., domestic dogs and cats). Restore degraded habitat based on information obtained from number 1 above and number 5 below.
- 4) Enhance declining populations through habitat enhancement/restoration and management techniques.
- 5) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize the threat of habitat degradation or predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and on the available cover within the habitat.

Long-term Management Program

- 6) Conduct detailed studies of population characteristics, habitat requirements, and reproduction. These studies should continue to gather information on variation in population size/density, reproductive success, annual survival, juvenile recruitment, and dispersal capability, particularly in response to adjacent development, cowbird nest parasitism, and variation in predation and weather. Use this information to determine which populations, population linkages, and potential habitats should be

included in the preserve system and to determine management requirements for this species.

POLICY 4.36 **Preserve the long-term viability of Belding's Savannah sparrows (*Passerculus sandwichensis beldingi*).**

Present status Federal category 2 candidate and state endangered species; distributed along coastline from Santa Barbara County south to northern Baja California; permanent resident in San Diego County. Principal populations of Belding's Savannah sparrows in the MSCP study area include San Dieguito Lagoon, Los Peñasquitos Lagoon, Kendall-Frost Reserve in Mission Bay, San Diego River flood control channel, marshes of south San Diego Bay, and Tijuana Estuary. This species is restricted to salt marsh, mudflat, and low coastal strand vegetated habitats. Belding's Savannah sparrow populations have declined because of destruction, fragmentation, and alteration of salt marsh habitat (Zemba et al. 1987); this species is also impacted by human trampling of salt marsh vegetation, reduction in the tidal regime of salt marsh habitat, and predation by introduced domestic and exotic animals.

Standards

- 1) Include within the open space preserve existing habitat and an adequate amount of potential habitat for Belding's Savannah sparrows (determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.
- 4) Establish new populations of Belding's Savannah sparrows in unoccupied but potential habitat (including historically occupied and newly created/restored salt marsh habitats).

Implementation

- 1) Conduct surveys to identify occupied and potential Belding's Savannah sparrow habitat within the MSCP area. Preserve and manage in natural open space all documented and potential habitat determined necessary to enhance and maintain a viable metapopulation (see number 5, below).
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade Belding's Savannah sparrow habitat. These activities include, but are not limited to, human disturbance, filling and diking of marshland habitat, predation of adults and nests by introduced feral and domestic animals (e.g., dogs and cats), adverse changes in water level, quantity and quality, and the introduction of pesticides and other contaminants into preserve wetlands. Restore damaged habitat based on information obtained from number 5, below.

- 3) Enhance declining populations through habitat enhancement/restoration and management techniques.
- 4) Enhance, restore, or create saltmarsh habitat (as determined from number 5 below) to allow for the expansion of Belding's Savannah sparrow populations into new locations within the MSCP area.
- 5) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize the threat of habitat degradation, human disturbance, and predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and on the available cover within the habitat.

Long-term Management

- 6) Determine which potential habitats identified in number 1 above could be preserved to enhance and maintain the long-term viability of the Belding's Savannah sparrow. Include an analysis of saltmarsh habitat which could be enhanced, restored, or created. Monitor breeding populations of Belding's Savannah sparrows and use this information to determine management requirements. Management activities could include, but would not be limited to, predator control, ensuring adequate combination of fresh water flow and tidal flux to maintain optimal saltmarsh habitat, restriction of human activity during the breeding season, and restriction of other activities that could impact the Belding's Savannah sparrow.

POLICY 4.37 **Preserve the long-term viability of breeding and wintering populations of large-billed Savannah sparrows (*Passerculus sandwichensis rostratus*).**

Present status

Federal category 2 candidate and California Department of Fish and Game species of special concern. This species typically inhabits coastal marshes and beaches and has remained quite scarce during the 1980s, although small numbers have appeared intermittently along the southern California coast and at the Salton Sea (McCaskie 1985, 1988a, 1988b). A relatively large influx of approximately 20 birds occurred at the mouth of the Sweetwater River and west shore of San Diego Bay in the fall and winter of 1989 (McCaskie 1989, Lovio unpub.), but a surge in numbers has not persisted into the early 1990s (McCaskie 1991, 1992). The decline of the large-billed Savannah sparrow is attributed to breeding habitat alteration in the Gulf of California and at the lower reaches of the Colorado River (Unit 1984, Wilbur 1987).

Standards

- 1) Include within the open space preserve adequate coastal marsh, beach, and dune habitats to potentially enhance and maintain a viable metapopulation of the large-billed Savannah sparrow.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys to identify occupied and potential large-billed Savannah sparrow habitat within the MSCP area. Preserve and manage in natural open space all documented and potential habitat determined necessary to enhance and maintain a viable metapopulation.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade large-billed Savannah sparrow habitat. These activities include, but are not limited to, human disturbance, filling and diking of wetland habitat, predation of adults and nests by domestic animals (e.g., dogs and cats), adverse changes in water level and quality, and the introduction of pesticides and other contaminants into preserve wetlands. Restore degraded habitat based on information obtained from number 6 below.
- 3) Enhance populations through habitat enhancement/restoration and management techniques.

POLICY 4.38 **Preserve the long-term viability of the breeding population of the grasshopper sparrow (*Ammodramus savannarum*).**

Present status

This species has no state or federal sensitivity status although it is considered sensitive in San Diego County (Everett 1979). San Diego County represents the southern extent of the species' range on the west coast since it is rare and restricted in the vicinity of the international border in Northern Baja California (Wilbur 1987). Breeding grasshopper sparrows remain scattered in distribution in lowland San Diego County; a small number of birds overwinter in the county. This species is an obligate of grassland habitats and is vulnerable to the rapid decline in suitable grassland breeding habitat in San Diego County (Unitt 1984).

Standards

- 1) Include within the open space preserve adequate populations and potential habitat to maintain a viable metapopulation of the grasshopper sparrow.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys to identify occupied and potential grasshopper sparrow habitat within the MSCP area. Preserve and manage in natural open space large populations, and any other smaller populations or potential habitat determined necessary to maintain a viable metapopulation.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict any activities or factors within the preserve that could degrade grasshopper sparrow

habitat. These activities include, but are not limited to, overgrazing by livestock, the brown-headed cowbird parasitism, and introduction of predators (e.g., domestic dogs and cats). Restore damaged habitat based on information obtained from number 1 in implementation section, above.

- 3) Enhance populations through habitat enhancement/restoration and management techniques.
- 4) Provide biological and planning buffers around preserved populations and preserved potential habitat sufficient in size and configuration to minimize the threat of habitat degradation or predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and on the available cover within the habitat.

POLICY 4.39 **Preserve the long-term viability of the tricolored blackbirds (*Agelaius tricolor*).**

Present status

Federal category 2 candidate species and California Department of Fish and Game species of special concern. The number and size of tricolored blackbird breeding colonies have declined with loss of wetland habitats; the state population size is less than 10,000, an 89% decline since the 1930s (Beedy et al. 1991). In San Diego County, it is a common to abundant but highly localized resident, primarily occurring in coastal lowlands (Unitt 1984); within the MSCP area, tricolored blackbirds have recently nested in the Tijuana River Valley, Otay River Valley, near Sweetwater Reservoir, near Old Mission Dam in the San Diego River, Lindo Lake at Lakeside, and Santee Lakes. They breed in freshwater marshes and forage in agricultural fields, grasslands, and along lakeshores. Tricolored blackbird populations have primarily declined because of loss, alteration, fragmentation, and degradation of wetland breeding habitat and historic human persecution (Beedy et al. 1991); this species is also vulnerable to contamination of wetlands with agricultural runoff (e.g., pesticides and salts), human disturbance, and predation by a large number of animal species at nesting colonies (Beedy et al. 1991).

Standards

- 1) Include within the open space preserve existing tricolored blackbird breeding habitat, sufficient associated foraging habitat, and an adequate amount of potential breeding and foraging habitat (as determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Conduct surveys to identify occupied and potential tricolored blackbird habitat within the MSCP area. Preserve and manage in natural open space all documented

and potential habitat determined necessary to enhance and maintain a viable metapopulation (see number 6 below).

- 2) Stabilize preserved populations by removing impacts-or threat of impacts. Restrict activities within the preserve that could degrade tricolored blackbird habitat. These activities include, but are not limited to, human disturbance, livestock grazing, filling and diking of freshwater marsh habitat, invasion of exotic plants into freshwater marsh habitat, alteration or channelization of streambeds and riverbeds, predation of nests by domestic animals (e.g., cats), artificially enhanced populations of natural predators (e.g., American crows, raccoons, and skunks), adverse changes in water level and quality, and the introduction of pesticides and other contaminants into preserve wetlands, agricultural fields, and grasslands. Restore degraded habitat based on information obtained from number 6 below.
- 3) Enhance declining populations through habitat enhancement or restoration and management techniques.
- 4) Enhance, restore, or create freshwater marsh habitat (as determined from number 6 below) to allow for the expansion of tricolored blackbird populations into new or historically occupied locations within the MSCP area.
- 5) Provide biological and planning buffers around preserved breeding habitat sufficient in size and configuration to minimize the threat of habitat degradation, human disturbance, and predation by domestic animals. Buffer distances would depend on the type of land use bordering the preserve areas and on the available cover within the habitat.

Long-term Management

- 6) Conduct a study to determine which potential habitats (identified in number 1 in the implementation section, above) could be preserved to enhance and maintain the long-term viability of the tricolored blackbird. Include an analysis of freshwater marsh habitat which could be enhanced, restored, or created. Conduct a study to identify important foraging habitats associated with preserved breeding habitat. Determine the foraging habitats that should be preserved. Conduct studies to periodically monitor breeding populations of tricolored blackbirds and use this information to determine management requirements. Management activities could include, but would not be limited to, predator control, ensuring adequate water quality and quantity to maintain healthy freshwater marshes, restriction of human activity during the breeding season, and restriction of other activities which could impact tricolored blackbirds.

POLICY 4.40 **Preserve the long-term viability of the Townsend's western big-eared bat (*Plecotus townsendii*).**

Present status

California Species of Special Concern. The Townsend's western big-eared bat inhabits a variety of habitats in southern California, including oak woodlands, grasslands, and deserts. Roost sites, which must be free of human disturbance, include caves, mines, tunnels, lava tubes, buildings, and other man-made structures. Because this species does not effectively conserve water, drinking sites must be in proximity to roost sites. In the western San Diego region, this species is known from Barrett Dam, Escondido, and

Ramona; within the MSCP study area, Townsend's western big-eared bats have been reported from Otay Mountain (Bond 1977). Available information indicates a decline in the species over the last 40 years; the species was common in the central valley, but was rarely seen by the early 1970s (Williams 1986). sensitivity to human disturbance likely is a major factor in the decline of the species.

Standards

- 1) Include within the open space preserve the known existing roosting sites of the Townsend's western big-eared bat, sufficient potential roosting habitat (as determined by specific, subsequent studies), sufficient foraging habitat (e.g., oak woodlands and grasslands), and drinking sites in the vicinity of the roosts to maintain a viable metapopulation.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Evaluate available information for caves, mines, tunnels, and other suitable roost sites within the study area to determine potential roost sites for the Townsend's western big-eared bat. Obtain roost site data from Dr. Pat Brown or Karen Pluff (State Parks). Conduct focused surveys in areas with high potential to support the species. Preserve and manage in natural open space documented habitat and sufficient potential habitat determined necessary to enhance and maintain a viable metapopulation (see number 5 below). Determine foraging areas for the bat in the general vicinity of known roosting sites. Preserve oak woodland, grassland, and open water drinking sources in the vicinity of roost sites.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade Townsend's western big-eared bat habitat. These activities include, but are not limited to, human disturbance at roost sites and the introduction of pesticides and other contaminants into foraging habitat.
- 3) Enhance declining populations through appropriate management techniques.
- 4) Provide biological and planning buffers around preserved roosting habitat sufficient in size and configuration to minimize the threat of habitat degradation and human disturbance. Buffer distances would depend on the type of land use bordering the preserve areas and on the ease of access to the roosting area. Human activity should be restricted at the roosting sites. Information from number 5 below, should be used to determine the buffer distances and the extent of limitations on human activities near the roosting sites. Restrict public information about Townsend's western big-eared bat roost sites. Single disturbances can cause local extirpations (Pat Brown pers. comm. 1992).

Long-term Implementation Program

- 5) Because relatively little is known about the current distribution, population status, and habitat needs of the Townsend's western big-eared bat, long-term biological

studies are needed. Studies should concentrate on population distribution, foraging habitat and roost site characteristics, foraging requirements, impacts of human disturbance on roost site tenacity and selection, and general population biology and life history necessary to develop population viability analyses. Based on the information obtained from these studies and from number 1 above, determine which potential roosting habitat and which foraging habitat should be preserved. Information from these studies should also be used to manage preserved Townsend's western big-eared bat populations and habitat.

POLICY 4.41 **Preserve the long-term viability of the California mastiff bat (*Eumops perotis californicus*).**

Present status

Federal category 2 candidate for listing as threatened or endangered and California Species of Special Concern. The mastiff bat ranges from central California southward to central Mexico; it is a resident in California, but likely makes seasonal movements. This species uses crevices in rugged, rocky areas, high buildings, trees, and tunnels and forages in areas with chaparral and oak woodlands. Within the MSCP study area, mastiff bats have been reported from Lake Hodges, Dulzura, and Otay (Bond 1977); available information indicates a substantial decline in the species, probably due to loss of habitat to urbanization and cultivation of foraging areas, and perhaps from insecticides which have reduced the prey base (Williams 1986).

Standards

- 1) Include within the open space preserve the known existing roosting sites of the California mastiff bat, sufficient potential roosting habitat, and sufficient foraging habitat (chaparral and oak woodland) in the vicinity of the roosts (as determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Evaluate available information for caves, crevices, and other suitable roost sites within the study area to determine potential roost sites for the mastiff bat (e.g., Lake Hodges area). Roost sites generally consist of crevices that open downward, are at least 5 cm wide, 30 cm deep, and narrow to 2.5 cm at the upper end (Vaughan 1959). Obtain roost site data from Dr. Pat Brown. Conduct focused surveys in areas with high potential to support the species. Preserve and manage in natural open space documented habitat and sufficient potential habitat determined necessary to enhance and maintain a viable metapopulation (see number 5 below). Determine foraging areas for the bat in the general vicinity of known roosting sites. Preserve substantial chaparral and oak woodland in the vicinity of roost sites. Mastiff bats are known to forage up to 15 miles from roost sites.
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade mastiff bat habitat. These activities

include, but are not limited to, human disturbance at roost sites and the introduction of pesticides and other contaminants into foraging habitat.

- 3) Enhance declining populations through appropriate management techniques.
- 4) Provide biological and planning buffers around preserved roosting habitat sufficient in size and configuration to minimize the threat of habitat degradation and human disturbance. Buffer distances would depend on the type of land use bordering the preserve areas and on the ease of access to the roosting area. Human activity should be restricted at the roosting sites. Information from number 5 below, should be used to determine the buffer distances and the extent of limitations on human activities near the roosting sites. Restrict public information about the location of mastiff bat roost sites. Single disturbances can cause local extirpations (Pat Brown pers. comm.).

Long-term Management Program

- 5) Because relatively little is known about the distribution of the mastiff bat, long-term biological studies are needed to determine the status of the species in California and San Diego County and assess its habitat and resource needs. Such studies should concentrate on population distribution, foraging habitat and roost site characteristics, foraging requirements, impacts of human disturbance on roost site tenacity and selection, and general population biology and life history data necessary to develop population viability analyses. Based on the information obtained from these studies and from number 1 above, determine which potential roosting habitat and which foraging habitat should be preserved. Information from these studies should also be used to manage preserved mastiff bat populations and habitat.

POLICY 4.42 **Preserve the long-term viability of the Pacific pocket mouse (*Perognathus longimembris pacificus*).**

Present status Federally endangered species and California Species of Special Concern (Highest Priority). The Pacific pocket mouse inhabits the narrow coastal plain between El Segundo, Los Angeles County, south to Baja California; it is known from the Tijuana River Valley and Tijuana River mouth in the MSCP study area (Williams 1986). This species is generally found in fine or sandy soils with sparse coastal sage scrub or disturbed grassland but may also occur in rockier soils supporting coastal sage scrub. Very little is known about the Pacific pocket mouse's distribution and habitat affinities, but it is likely to be seriously threatened with extinction because of urbanization of its historic range.

Standards

- 1) Include within the open space preserve sufficient populations and potential habitat (as determined by specific, subsequent studies) to maintain a viable metapopulation.
- 2) Stabilize and maintain preserved populations.
- 3) Enhance preserved populations that have a reduced probability for long-term viability.

Implementation

- 1) Trapping studies should be conducted for the Pacific pocket mouse in historic sites to assess population status. Trapping studies should also be conducted on coastal sites that have potential habitat, i.e., fine or sandy soils with coastal sage scrub, non-native annual grassland, or weedy vegetation. Because so little data are available concerning the distribution of the Pacific pocket mouse, studies should be conducted in as many locales as possible. Preserve and manage in natural open space sufficient occupied and potential habitat determined necessary to enhance and maintain a viable metapopulation (see number 5 below).
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade Pacific pocket mouse habitat. These activities include, but are not limited to, the introduction of predators (e.g., cats), off-road vehicular activity, the construction of roads through occupied habitat, and the introduction of herbicides into foraging habitat.
- 3) Enhance declining populations through appropriate management techniques.
- 4) Provide biological and planning buffers around preserved habitat sufficient in size and configuration to minimize the threat of habitat degradation and human disturbance. Buffers between development and known populations should be at least 1500 feet to prevent predation by house cats. Alternatively, restrictions on cat ownership may be considered.

Long-term Management Program

- 5) Systematic, range-wide trapping studies should be conducted in suitable habitat along the coast between Baja California and Los Angeles to determine the status of the species. Based on this information and that from number 1 above, determine which occupied and potential habitats should be preserved.
- 6) A range-wide conservation and management program for the Pacific pocket mouse should be developed following the thorough census of potential habitat. Measures to control predation by introduced animals should be formulated.

POLICY 4.43 **Preserve the long-term viability of the American badger (*Taxidea taxus*).**

Present status

California Species of Special Concern. The badger's range includes most of the western U.S., arid portions of southwestern Canada, and northern Mexico. The badger is a solitary species that generally inhabits open grasslands and arid environments. While the badger has a widespread range and is not in danger of extinction, populations are thought to be declining in California, and local extirpation is possible as a result of conversion of grassland habitat to urban uses.

Standards

- 1) Include within the open space preserve sufficient populations and potential habitat (as determined by specific, subsequent studies) to maintain a viable metapopulation.

Preservation of grassland may be done in conjunction with preservation for other sensitive species (e.g., burrowing owl nesting habitat and foraging habitat for other raptors).

- 2) Stabilize and maintain preserved populations.
- 3) If future studies indicate that it is necessary and feasible, establish new populations of American badger into suitable but unoccupied preserved habitat

Implementation

- 1) Assess status by conducting surveys for badgers on lands under consideration for conservation as raptor foraging habitat or nesting and foraging habitat for burrowing owls. Conservation efforts for species such as the burrowing owl, golden eagle, ferruginous hawk, Swainson's hawk, and northern harrier should provide an umbrella for the badger. Preserve and manage in natural open space sufficient occupied and potential habitat determined necessary to enhance and maintain a viable metapopulation (see number 4 below).
- 2) Stabilize preserved populations by removing impacts or threat of impacts. Restrict activities within the preserve that could degrade American badger habitat. These activities include, but are not limited to, excessive trapping and poisoning of prey species under pest control programs (e.g., California ground squirrel *Spermophilus beecheyi* eradication programs).
- 3) If it is determined to be necessary and feasible in number 4 below, translocate individuals to suitable but unoccupied habitat within the open space preserve.

Long-term Management Program

- 4) Relatively little is known about the current distribution of the badger in San Diego County. Therefore, long-term biological studies are needed to determine the status of the species in the study area and assess its habitat and resource needs. Such studies should concentrate on population distribution, foraging habitat requirements, impacts of human disturbance on site fidelity, and general population biology and life history data necessary to develop population viability analyses. Based on the information obtained from these studies and from number 1 above, determine which occupied and potential habitats should be preserved. Determine if translocation of individuals into suitable, unoccupied preserve habitat is required to preserve the long-term viability of this species in the MSCP area. Map historic sites from museum collections to determine whether translocation of individuals to historically suitable habitat is possible. Information from these studies should also be used to manage American badger populations and habitat.

POLICY 4.45 **Preserve the long-term viability of the mountain lion (*Felis concolor*).**

Present status

The mountain lion has no present federal status but is provided some state protection; locally it is considered sensitive by the San Diego Nongame Wildlife Subcommittee for Vertebrates. The mountain lion has the largest geographical distribution of any mammal species in the western hemisphere, but it is restricted primarily to unpopulated regions in western North America (Hall and Kelson

1959). Mountain lions inhabit forest and shrubland habitats throughout California where deer, their primary prey, are found; in western San Diego County, mountain lions are known from Camp Pendleton, Palomar, Escondido, Laguna Indian Reservation, Peñasquitos Canyon Reserve, Torrey Pines State Park, NAS Miramar, Sweetwater River, and Otay Ranch. Although the mountain lion is not threatened with extinction throughout its range, urbanization of coastal southern California, without appropriate conservation measures, could result in its regional extirpation.

Standards

- 1) Include within the open space preserve sufficient habitat (as determined by specific, subsequent studies) to maintain a viable population of mountain lion.
- 2) Provide for movement corridors between large patches of occupied habitat.
- 3) Stabilize and maintain the preserved population.

Implementation

- 1) Determine present population levels and distribution of mountain lions in western San Diego County. Conduct radiotelemetry studies to determine habitat use and requirements, movement activities, and causes of mortality. Identification of both intra-range and inter-range movement corridors is essential because immigration and emigration is critical for population viability. Beier (1993) indicates that a population of 15-20 adult individuals in an area of 150,000 to 400,000 acres of habitat would be viable if movement corridors are provided. Without corridors the habitat area required to maintain a viable population increases to 250,000 to 540,000 acres. Require site-specific surveys for mountain lion use and movement for all proposed projects containing chaparral, coastal sage scrub, riparian zones, and other habitats that could provide forage or cover. Surveys should evaluate the potential of a site as a movement corridor. Studies indicate that mountain lions use canyon bottoms for movement (Ogden 1992b). Studies should concentrate on those areas that provide the best continuous cover and is buffered from development. Site-specific studies should include an evaluation of the prey base in the area (i.e., deer and smaller mammals). Preserve and manage in natural open space the habitat and movement corridors identified as necessary for preserving the long-term viability of the mountain lion population.
- 2) Maintain movement corridors of at least 1000 feet in width where possible. This assumes that the lion is only moving through the corridor and not using it for foraging. Site-specific studies would be required to demonstrate that a narrower corridor was adequate for movement or use. Road crossings should be fitted with suitable underpasses since automobiles are a major source of mortality for mountain lions. Bridge-type underpasses should be at least 12 feet in height and at least half as wide as they are long. Fencing should be used along roads to direct crossings to the underpass.
- 3) Stabilize the preserved population by removing impacts or threat of impacts. Restrict factors within the preserve that could degrade mountain lion habitat and movement corridors. These factors include, but are not limited to, human disturbance, illegal hunting, unsafe road crossings that increase the incidence of road-kills, human activity, artificial lighting, and noise.

Long-term Management Program

- 4) Quantify human impacts on mountain lion populations as a function of distance from roads and other developed sites. Determine what habitat factors and human impacts are related to mortality (e.g., areas with frequent road kills or shooting). Determine whether certain areas function as sink habitats.
- 5) Develop a long-term management plan for mountain lions. Include as management goals a determination of appropriate population densities in relation to available habitat and necessary dispersal to maintain genetically healthy populations in the region. The management plan should prescribe land use policies and practices compatible with mountain lions.

POLICY 4.44 Preserve the long-term viability of the southern mule deer (*Odocoileus hemionus fuliginata*)

Present status

No present state or federal status under the Endangered Species Act, but managed as a game species by CDFG; a widespread indicator species that requires relatively large, undisturbed tracts of chaparral, coastal sage scrub, and mixed grassland/shrub habitats (Padley 1992). Mule deer presently are widespread throughout undeveloped portions of western San Diego County, including the Laguna Mountains, Camp Pendleton, Torrey Pines, Miramar, and Palomar (Bond 1977). The southern mule deer is not threatened with extinction within its range, but the present checkerboard of private property distribution in western San Diego County and urbanization, without appropriate conservation measures, could result in local extirpation.

Standards

- 1) Include within the open space preserve sufficient habitat (as determined by specific, subsequent studies) to support regional southern mule deer populations and to maintain a viable metapopulation.
- 2) Provide for movement corridors between large patches of occupied habitat.
- 3) Stabilize and maintain the preserved population.
- 4) Enhance preserved populations that have a reduced probability for long-term survival.

Implementation

- 1) Establish contiguous, interconnected preserve areas of at least 1100 acres (based on home range estimates of 170 acres (does) to 1100 acres (bucks) for non-migratory mule deer in coastal southern California (Padley 1992). Preserves should contain a mosaic of coastal sage scrub or chaparral, grassland, and oak woodland, where possible. Require site-specific surveys for mule deer use and movement for all proposed projects containing chaparral, coastal sage scrub, grassland, oak woodland, and other habitats that could provide forage or cover for a viable mule deer population. Surveys should evaluate the potential of the site as a movement

corridor. Preserve and manage in natural open space the habitat and movement corridors identified as necessary for preserving the long-term viability of the southern mule deer population.

- 2) Monitor movement activities of dispersing individuals through known corridors. Determine habitat type and terrain in relation to dispersal movements. These studies should be undertaken on a regional level, perhaps by CDFG or as part of a university research program. Maintain movement corridors/habitat linkages between core preserves of at least 1000 feet in width (Ogden 1992b). Movement corridors intersecting roads may be as narrow as 400 feet at road crossings for no more than 500 feet in length. Underpasses should be bridge-type structures at least 12 feet in height and at least half as wide as they are long, with adequate lighting (e.g., an opening in the middle of the underpass). Underpasses should be buffered from light and sound. Deer are known to use underpasses between 40 to 56 dBA in San Diego County, but did not use underpasses exposed to noise greater than 68 dBA (Ogden 1992b). Fencing at least 10 feet in height should be used to keep deer from crossing roadways and funnel them toward underpasses. Larger proposed projects potentially having substantial impacts on mule deer (e.g., large residential or transportation corridor projects) should conduct radiotelemetry studies of habitat use and movement patterns to determine potential impacts of the project.
- 3) Stabilize preserved populations by removing impacts or threat of impacts. Restrict factors within the preserve that could degrade mule deer habitat and movement corridors. These factors include, but are not limited to, human disturbance, illegal hunting of mule deer, unsafe road crossings that increase the incidence of road-kills, restriction of access to water sources, and human activity, artificial lighting, and noise near movement corridors.
- 4) Enhance declining populations as identified in number 5 below, through habitat enhancement and appropriate management techniques.

Long-term Management Program

- 5) Monitor population levels and distribution in western San Diego County over time. Assess ratios of does, bucks, and fawns and maintain appropriate sex and age class ratios. An acceptable ratio is 70 fawns and 20-30 bucks per 100 does (CDFG pers. comm.).
- 6) Quantify human impacts on mule deer populations as a function of distance from roads and other developed sites. Determine what habitat factors and human impacts are related to mortality (e.g., areas with frequent road kills). Determine whether certain areas function as sink habitats.
- 7) Develop a long-term management plan for coastal mule deer populations. Review the substantial body of mule and black-tailed deer management literature. Include as management goals a determination of appropriate population densities in relation to available habitat and necessary dispersal to maintain genetically healthy populations in the region. The management plan should prescribe land use policies and practices compatible with mule deer.

REFERENCES

- Anderson, D.W. and J.W. Hickey. 1970. Eggshell changes in certain North American birds. Ed. K. H. Voous. Proc. (XVth) Inter. Ornith. Congress, pp 514-540. E.J. Brill, Leiden, Netherlands.
- Anderson, D.W., J.R. Jehl, Jr., R.W. Risebrough, L.A. Woods, Jr., L.R. Deweese, and W.G. Edgecomb. 1975. Brown pelicans: improved reproduction of the southern California Coast. Science 190:806-808.
- Beedy, E. C., S. D. Sanders, and D. Bloom. 1991. Breeding status, distribution, and habitat associations of the tricolored blackbird (*Agelaius tricolor*) 1850-1989. Prepared for the U. S. Fish and Wildlife Service in cooperation with Jones and Stokes Associates, Inc., Sacramento, CA.
- Beier, P. 1993. Determining minimum habitat areas and habitat corridors for cougars. Conservation Biology 7:94-108.
- Bloom, P.H. 1991. The status of the golden eagle population on Marine Corps Base Camp Pendleton. Prepared for Natural Resources Office, Camp Pendleton.
- Bond, S.I. 1977. An annotated list of the mammals of San Diego County, California. San Diego Soc. Nat. Hist. Trans. 18:229-248.
- Bostic, D. L. 1966. Thermoregulation and hibernation of the lizard, *Cnemidophorus hyperythrus beldingi*. Southwestern Naturalist 11:275-289.
- Brown, J.W. 1991. Sensitive and declining butterfly species (Insecta: Lepidoptera) in San Diego County, California. September. Unpublished manuscript. 27 pp.
- Brown, J.W. and W.W. McGuire. 1983. A new subspecies of *Euphyes vestris* (Boisduval) from southern California (Lepidoptera: Hesperidae). Trans. San Diego Soc. Nat. Hist. 20:57-68.
- Brown, J.W., H.A. Wier, and D. Belk. *In press*. New records of fairy shrimp (Crustacea: Anostraca) from Baja California, Mexico. Southwestern Naturalist.
- Buehler, D.A., S.K. Chandler, T.J. Mersmann, T.D. Fraser, and J.K. Seegar. 1992. Nonbreeding Bald Eagle perch habitat on the northern Chesapeake Bay. Wilson Bull. 104: 540-545.
- Caton, E.L., B.R. McClelland, D.A. Patterson, and R.E. Yates. 1992. Characteristics of foraging perches used by breeding Bald Eagles in Montana. Wilson Bull. 104: 136-142.
- City of San Diego. 1992. Draft environmental impact report for the Black Mountain Ranch North and South planned residential developments.
- Cogswell, H.L. 1977. Water birds of California. Univ. California Press, Berkeley.
- Collins, C.T. 1979. The ecology and conservation of burrowing owls. Pages 6-17 in P.P. Schaeffer and S.M. Ehlers (eds.). Owls of the West, their ecology and

conservation. National Audubon Society Western Education Center, Tiburon, CA. October.

- Copper, E. 1986. A study of the breeding biology of the California least tern at Delta Beach, Naval Amphibious Base, Coronado. Western Division Naval Facilities Engineering Command, San Bruno, CA.
- Eng, L.L., D. Belk, and C.H. Eriksen. 1990. California Anostraca: distribution, habitat, and status. *Journal of Crustacean Biology* 10: 247-277.
- ERC Environmental and Energy Services (ERCE) [Ogden]. 1990. Phase I report, Amber Ridge California gnatcatcher study. Prepared for Weingarten, Siegel, Fletcher Group, Inc. April. 26 pp.
- Everett, W. T. 1979. Threatened, declining, and sensitive bird species in San Diego County. San Diego Audubon Society Sketches. June.
- Faber, P.A., E. Keller, A. Sands, and B.M. Massey. 1989. The ecology of riparian habitats of the southern California coastal region: a community profile. USFWS Biol. Report No. 85-7.27. 152 pp.
- Fancher, J.M. 1992. Population status and trends of the California least tern. *Transactions of the Western Section of the Wildlife Society* 28:59-66.
- Finch, D.M. 1992. Threatened, endangered, and vulnerable species of terrestrial vertebrates in the Rocky Mountain region. Prepared for the U.S.D.A. Forest Service. General Technical Report RM-215. August. 38 pp.
- Garrett, K. and J. Dunn. 1981. *Birds of Southern California*. Los Angeles Audubon Soc. 408 pp.
- Grinnell, J. and A.H. Miller. 1944. The distribution of the birds of California. *Pacific Coast Avifauna* No. 27.
- Hall, E.R. and K.R. Kelson. 1959. *The Mammals of North America*. Ronald Press Company, New York.
- Hamerstrom, F. 1986. *Harrier, hawk of the marshes*. Smithsonian Institution Press. Washington, D.C. 170 pp.
- Hayes, M.P. and M.R. Jennings. 1986. Decline of ranid frog species in western North America: are bullfrogs (*Rana catesbiana*) responsible? *Journal of Herpetology* 20: 490-509.
- Holland, D. C. 1991. A synopsis of the ecology and status of the western pond turtle, *Clemmys marmorata*. in 1991. Draft report prepared for the USFWS. 141 pp.
- Johnsgard, P.A. 1981. *The plovers, sandpipers and snipes of the world*. University of Nebraska Press.
- Johnsgard, P.A. 1990. *Hawks, eagles, and falcons of North America*. Smithsonian Institution Press, Washington. 403 pp.

- Jorgensen, P. D. 1975. Habitat preference of the light-footed clapper rail in Tijuana Marsh, California. M.S. Thesis, San Diego State University. 115 pp.
- Kus, B.E. 1991a. Least Bell's Vireo studies at the Sweetwater, San Luis Rey, and San Diego rivers, San Diego County, California. Unpublished progress report to California Department of Transportation.
- Kus, B.E. 1991b. Habitat use and breeding status of the least Bell's vireo at the Tijuana River, California, 1991. Unpublished report to the International Boundary and Water Commission.
- Kus, B.E. 1992a. Breeding status of the least Bell's vireo at the Tijuana River, California. Unpublished report to the International Boundary and Water Commission.
- Kus, B.E. 1992b. Monitoring study of least Bell's vireo in Goat Canyon and Smuggler's Gulch, 1992. Unpublished report to the International Boundary and Water Commission.
- Leachman, B. and B. Osmundson. 1990. Status of the mountain plover, a literature review. U. S. Fish and Wildlife Service, Fish and Wildlife Enhancement, Golden, CO. 83 pp.
- McCaskie, G. 1985. The winter season. Southern Pacific Coast Region. Amer. Birds 39:320.
- McCaskie, G. 1986. The nesting season. Southern Pacific Coast Region. Amer. Birds 40:1255.
- McCaskie, G. 1987. The nesting season. Southern Pacific Coast Region. Amer. Birds 41:1488.
- McCaskie, G. 1988a. The fall migration. Southern Pacific Coast Region. Amer. Birds 42:139.
- McCaskie, G. 1988b. The winter season. Southern Pacific Coast Region. Amer. Birds 42:323.
- McCaskie, G. 1989a. Fall migration. Southern Pacific Coast Region. Amer. Birds 43:140.
- McCaskie, G. 1989b. The spring season. Southern Pacific Coast Region. Amer. Birds 43:537.
- McCaskie, G. 1991. The spring season. Southern Pacific Coast Region. Amer. Birds 45:540..
- McCaskie, G. 1992. The spring season. Southern Pacific Coast Region. Amer. Birds 46:535..
- McLaren, W.D. 1963. A preliminary study of nest-site competition in a group of hole-nesting birds. M.S. Thesis, University of British Columbia, Vancouver, B.C.

- Michael Brandman and Associates. 1991. Sensitive faunal elements of the vernal pools of Otay Ranch; Report No. 17 in Otay Ranch technical reports, Volume IV, Biology. Prepared by the University of San Diego Biology Department. 24 pp.
- Milstead, W. W. 1957. Some aspects of competition in natural populations of whiptail lizards (genus *Cnemidophorus*). Texas Journal of Science 9:410-447.
- Murphy, D.D. 1990. A report on the California butterflies listed as candidates for endangered status by the United States Fish and Wildlife Service. Prepared for California Department of Fish and Game. Contract No. C-1755. 60 pp.
- Ogden Environmental and Energy Services (Ogden). 1992a. Otay Ranch raptor management study. Prepared for Otay Ranch Project Team. 50 pp.
- Ogden Environmental and Energy Services (Ogden). 1992b. Baldwin Otay Ranch wildlife corridor studies. Prepared for the Otay Ranch Project Team. December. 106 pp.
- Ogden Environmental and Energy Services (Ogden). 1993a. Population viability analysis for the coastal cactus wren within the MSCIP study area. Prepared for the Clean Water Program, City of San Diego.
- Ogden Environmental and Energy Services (Ogden). 1993b. Population viability analysis for the California gnatcatcher within the MSCIP study area. Prepared for the Clean Water Program, City of San Diego. February. 61 pp.
- Padley, D. 1992. County of Orange deer telemetry study. Prepared for Environmental Sciences Associates, Inc. and submitted to the County of Orange.
- Page, G.W., L.E. Stenzel, D.W. Winkler, and C.W. Swarth. 1983. Spacing out at Mono Lake: breeding success, nest density, and predation in the snowy plover. Auk 100:13-24.
- Palmer, R.S. (ed.). 1962. Handbook of North American birds, vol. 1: Loons through flamingos. Yale University Press, New Haven, CT.
- Patterson, R.M. 1979. Experimental nesting box program: sparrow competition thwarted? *Sialia* 1:36-39.
- Pavelka, M. 1991. Peregrine falcons nesting in San Diego, California. Western Birds 21:181-183.
- Rathbun, G.B., N. Siepel, and D. Holland. 1992. Nesting behavior and movements of western pond turtles, *Clemmys marmorata*. Southwestern Naturalist 37:319-324.
- Rea, A.M., and K.L. Weaver. 1990. The taxonomy, distribution, and status of coastal California cactus wrens. Western Birds 21:81-126.
- Remsen, J.V., Jr. 1978. Bird species of special concern in California. Calif. Dep. Fish and Game, Sacramento. Wildl. Manage. Admin. Rep. No. 78-1. 54 pp.
- SANDAG. 1989. Comprehensive species management plan for the least Bell's vireo. May. 226 pp.

- SANDAG. 1992. Draft habitat conservation plan for the least Bell's vireo and riparian habitat on the Sweetwater and San Diego rivers in San Diego County, California. Prepared for U.S. Fish and Wildlife Service and California Department of Fish and Game. August. 93 pp + appendices.
- Sanders, S.D. and M.A. Flett. 1989. Ecology of a Sierra Nevada population of willow flycatchers (*Empidonax traillii*), 1986-1987. State of California, The Resources Agency, Department of Fish and Game.
- San Diego Herpetological Society. 1980a. Status of the indigenous amphibians of San Diego County. Fish and Wildlife Committee, San Diego County Department of Agriculture. 22 pp.
- San Diego Herpetological Society. 1980b. Survey and status of endangered and threatened species of reptiles natively occurring in San Diego County. Prepared for Fish and Wildlife Committee, San Diego Department of Agriculture. 33 pp.
- Scott, T.A. 1985. Human impacts on the golden eagle population of San Diego County from 1928 to 1981. Masters Thesis, San Diego State University. 100 pp.
- Simovich, M.A. and M. Fugate. 1992. Branchiopod diversity in San Diego County, California, U.S.A. Transactions of Western Section of Wildlife Society 28:6-14.
- Snow, C. 1973. Technical note: habitat management series for unique or endangered species: Report no. 7 golden eagle (*Aquila chrysaetos*). Bureau of Land Management, U.S. Department of the Interior. Denver Service Center, Denver, CO. 52 pp.
- Stebbins, R.C. 1966. A field guide to western reptiles and amphibians. Houghton-Mifflin Co. 279.
- Storm, R.M. 1960. Notes on the breeding biology of the red-legged frog (*Rana aurora aurora*).
- Taylor, D.M. and C.D. Littlefield. 1986. Willow flycatcher and yellow warbler response to cattle grazing. Amer. Birds 40(5):1169-1173.
- Terres, J.K. 1980. The Audubon Society encyclopedia of North American Birds. A.A. Knopf, New York.
- U.S. Fish and Wildlife Service. 1980. Selected vertebrate endangered species of the seacoast of the United States: light-footed clapper rail. FWS/OBS-80/01.4.
- U.S. Fish and Wildlife Service. 1986. Preliminary survey of contaminant issues of concern on national wildlife refuges. U. S. Fish and Wildlife Service, Division of Refuge Management, Washington, D.C.
- U.S. Fish and Wildlife Service. 1991. Summary of the proposed rule to list the coastal California gnatcatcher (*Poliptila californica californica*) as endangered in California and Baja, Mexico. September. 114 pp.
- Unitt, P. 1984. The birds of San Diego County. Memoir 13, San Diego Society of Natural History. 276 pp.

- Unitt, P. 1987. *Empidonax traillii extimus*, an endangered subspecies. *Western Birds* 18:137-162.
- Vaughan, T. A. 1959. Functional morphology of the three bats: *Eumops*, *Myotis*, and *Macrotus*. *Univ. of Kansas Publ., Mus. Nat. Hist.* 12:1-153.
- Wilbur, S.R. 1987. *The birds of Baja California*. University of California Press, Berkeley.
- Willett, G. 1933. A revised list of the birds of southwestern California. *Pacific Coast Avifauna* 21. Cooper Ornithological Club, Berkeley, California.
- Williams, D.F. 1986. Mammalian species of special concern in California. *wildlife Management Division Administrative Report 86-1*. CDFG. 112 pp.
- Zarn, M. 1974. Technical note: habitat management series for unique or endangered species: Report no. 1; burrowing owl (*Speotyto cunicularia hypugaea*). Bureau of Land Management, U.S. Department of the Interior. Denver Service Center, Denver, CO. 25 pp.
- Zeiner, D.C.W.F. Laudenslayer, Jr, K.E. Mayer, and M. White. 1990. California's wildlife. Vol. II. Birds. California Department of Fish and Game, Sacramento, CA.
- Zeleny, L. 1969. Starlings versus native cavity-nesting birds. *Atlantic Naturalist* 23:158-161.
- Zembal, R. 1992. Status and management of light-footed clapper rails in coastal southern California. *Transactions of the Western Section of the Wildlife Society* 28:1-5
- Zembal, R., K.J. Kramer, and M.J. Elpers. 1987. A survey of Belding's Savannah sparrow in California, 1986. Prepared for the U.S. Navy. 20 pp.

ATTACHMENT A

MSCP TARGET SPECIES LIST

| Species | | Common Name | Scientific Name | Status* | Group** | Habitat*** |
|---------------|--------|---------------------------|---|---------|---------|-------------------------------|
| SS Code | Symbol | | | | | |
| Plants | | | | | | |
| 501 | AI | San Diego thorn-mint | <i>Acanthomintha tlicifolia</i> | C1/CE | 1 | G, CSS, CHP |
| 502 | AS | Shaw's agave | <i>Agave shawii</i> | C2/ | 2 | CSS, Bluff scrub |
| 503 | AP | San Diego ambrosia | <i>Ambrosia pumila</i> | C2/ | 2 | CSS, Bluff scrub |
| 504 | AB | Aphanisma | <i>Aphanisma blitoides</i> | C2/ | 2 | Maritime scrub |
| 505 | AG | Del Mar manzanita | <i>Arctostaphylos glandulosa var. crassifolia</i> | PE/ | 1 | CSS, S. Maritime CHP |
| 506 | AO | Olay manzanita | <i>Arctostaphylos otayensis</i> | C2/ | 2 | CHP |
| 507 | AD | Dean's milk vetch | <i>Astragalus deanei</i> | C2/ | 2 | CSS |
| 508 | AT | Coastal dunes milk vetch | <i>Astragalus tener var. tili</i> | C1/CE | 1 | Coastal strand/foredunes |
| 509 | BV | Encinitas baccharis | <i>Baccharis vanessae</i> | PE/CE | 1 | CHP |
| 510 | BF | Thread-leaved brodiaea | <i>Brodiaea filifolia</i> | PT/CE | 1 | VP, G |
| 511 | BO | Orcutt's brodiaea | <i>Brodiaea orcuttii</i> | C2/ | 2 | G, VP, seeps, wet meadows |
| 514 | CA | Dunn's mariposa lily | <i>Calochortus dunnii</i> | C2/CR | 1 | G, CHP (openings) |
| 515 | CS | Slender-pod jewelflower | <i>Caulanthus stenocarpus</i> | C3/CR | 1 | burned CHP |
| 516 | CC | Lakeside ceanothus | <i>Ceanothus cyaneus</i> | C2/ | 2 | CHP |
| 517 | CV | Wart-stemmed ceanothus | <i>Ceanothus verrucosus</i> | C2/ | 2 | CHP, S. maritime CHP |
| 518 | CO | Orcutt's spineflower | <i>Chorizanthe orcuttiana</i> | PE/CE | 1 | Maritime CHP |
| 519 | CM | Salt marsh bird's-beak | <i>Cordylanthus maritimus ssp. maritimus</i> | FE/CE | 1 | SM |
| 520 | CR | Orcutt's bird's-beak | <i>Cordylanthus orcuttianus</i> | C2/ | 2 | Maritime scrub |
| 521 | CL | Del Mar Mesa sand aster | <i>Corethrogyne filaginifolia var. linifolia</i> | PT/ | 1 | CHP (openings) |
| 522 | CF | Tecate cypress | <i>Cupressus forbesii</i> | C2/ | 2 | CHP, Cypress Wld., drainages |
| 523 | DB | Short-leaved dudleya | <i>Dudleya brevifolia</i> | PE/CE | 1 | CHP openings, S. maritime CHP |
| 524 | DV | Variiegated dudleya | <i>Dudleya variegata</i> | C2/ | 2 | CSS |
| 525 | DU | Sticky dudleya | <i>Dudleya viscidula</i> | C1/ | 1 | CSS, CHP |
| 526 | EP | Palmer's ericameria | <i>Ericameria palmeri ssp. palmeri</i> | C2/ | 2 | Riparian (edges), CSS |
| 527 | EA | San Diego button-celery | <i>Eryngium aristulatum var. parishii</i> | FE/CE | 1 | VP, G |
| 528 | ER | Coast wallflower | <i>Erysimum amorphilum</i> | C2/ | 2 | Coastal bluff |
| 529 | FV | San Diego barrel cactus | <i>Ferocactus viridescens</i> | C2/ | 2 | CSS |
| 530 | FM | Mexican flannelbush | <i>Fremontodendron mexicanum</i> | C2/CR | 1 | CHP, Cypress Wld., drainages |
| 531 | GD | Mission Canyon bluecup | <i>Githopsis diffusa ssp. filicaulis</i> | C2/ | 2 | CSS |
| 532 | HC | Olay tarplant | <i>Hemizonia conjugens</i> | C2/CE | 1 | G, CSS |
| 533 | HF | Tecate tarplant | <i>Hemizonia floribunda</i> | C2/ | 2 | CHP |
| 535 | LC | Heart-leaved pitcher sage | <i>Lepechinia cardiophylla</i> | C2/ | 2 | CHP |
| 536 | LG | Gander's pitcher sage | <i>Lepechinia ganderi</i> | C2/ | 2 | CHP |
| 553 | LN | Nuttall's lotus | <i>Lotus nuttallianus</i> | C2/ | 2 | Foredunes, CSS |
| 539 | ML | Willowly monardella | <i>Monardella linooides ssp. viminea</i> | C2/CE | 1 | RS, washes/floodchannel |
| 540 | MC | San Diego goldenstar | <i>Muilla cleavelandii</i> | C2/ | 2 | G, CHP (openings) |

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ATTACHMENT A

MSCP TARGET SPECIES LIST

| SS Code | Species Symbol | Common Name | Scientific Name | Status* | Group** | Habitat*** |
|--------------------------------|----------------|-------------------------------|---|---------|---------|---------------------------------|
| 541 | MM | Little mousetail | <i>Myosurus minimus ssp. apus</i> | C2/ | 2 | VP |
| 542 | NF | Prostrate navarretia | <i>Navarretia fossalis</i> | PT | 1 | VP |
| 543 | NI | Dehesa bear-grass | <i>Nolina interrata</i> | C1/CE | 1 | CHP, CSS |
| 544 | OP | Snake cholla | <i>Opuntia parryi var. serpentina</i> | C2/ | 2 | CSS, maritime scrub |
| 545 | OC | California orcutt grass | <i>Orcuttia californica</i> | FE/CE | 1 | VP |
| 546 | PT | Torrey pine | <i>Pinus torreyana ssp. torreyana</i> | C2/ | 2 | S. maritime CHP |
| 547 | PA | San Diego mesa mint | <i>Pogogyne abramsii</i> | FE/CE | 1 | VP |
| 548 | PN | Otay Mesa mint | <i>Pogogyne nudiuscula</i> | FE/CE | 1 | VP |
| 549 | RM | Small-leaved rose | <i>Rosa minutifolia</i> | --/CE | 1 | CSS |
| 550 | SG | Gander's butterweed | <i>Senecio ganderi</i> | C2/CR | 1 | CHP |
| 551 | ST | Narrow-leaved nightshade | <i>Solanum tenuilobatum</i> | C2/ | 2 | CHP |
| 552 | TD | Parry's tetracoccus | <i>Tetracoccus dioicus</i> | C2/ | 2 | CHP |
| Invertebrates | | | | | | |
| 106 | HS | Harbison's dun skipper | <i>Euphyes vestris harbisoni</i> | PE/ | 1 | RW, RS, OW |
| 102 | MS | Salt marsh skipper | <i>Panoquina errans</i> | C2/ | 2 | SM |
| 101 | HB | Hermes copper butterfly | <i>Lycæna hermes</i> | C2/ | 2 | CSS, CHP |
| 105 | TH | Thorne's hairstreak butterfly | <i>Mitoura thornei</i> | PE/ | 1 | Cypress Wldd. |
| 103 | WC | Quino checkerspot butterfly | <i>Euphydryas editha quino</i> | C1/ | 1 | CSS, VP, NG |
| 104 | RS | Riverside fairy shrimp | <i>Streptocephalus woottoni</i> | FE/ | 1 | VP |
| Amphibians and Reptiles | | | | | | |
| 201 | AA | Arroyo southwestern toad | <i>Bufo microscaphus californicus</i> | FE/SSC | 1 | CSS, CHP, near water (breeding) |
| 202 | RF | California red-legged frog | <i>Rana aurora draytonii</i> | PE/SSC | 1 | Aquatic/Riparian |
| 203 | WT | Southwestern pond turtle | <i>Clemmys marmorata pallida</i> | C2/SSC | 2 | Aquatic/Riparian |
| 204 | HL | San Diego horned lizard | <i>Phrynosoma coronatum blainvilliei</i> | C2/ | 2 | CSS, CHP |
| 205 | OW | Orange-throated whiptail | <i>Cnemidophorus hyperythrus beldingi</i> | C2/ | 1 | CSS, CHP, G |
| Birds | | | | | | |
| 301 | BP | California brown pelican | <i>Pelecanus occidentalis</i> | FE/CE | 1 | Open Water |
| 302 | RE | Reddish egret | <i>Egretta rufescens</i> | C2/ | 2 | SM |
| 303 | WI | White-faced ibis | <i>Plegadis chihii</i> | C2/ | 2 | FWM, Estuaries |
| 351 | CU | Canada goose | <i>Branta canadensis</i> | none | 4 | Ag fields, G, FWM, SM |
| 304 | BE | Bald eagle | <i>Haliaeetus leucocephalus</i> | FT/CE | 1 | Open Water |
| 325 | NH | Northern harrier | <i>Circus cyaneus</i> | --/SSC | 4 | G, SM, Ag |
| 305 | CH | Cooper's hawk | <i>Accipiter cooperii</i> | --/SSC | 4 | OW (breeding), RW |

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ATTACHMENT A
MSCP TARGET SPECIES LIST

| SS Code | Species Symbol | Common Name | Scientific Name | Status* | Group** | Habitat*** |
|----------------|----------------|-----------------------------------|---|--------------|---------|---|
| 306 | SH | Swainson's hawk | <i>Buteo swainsoni</i> | --/CT | 1 | Ag fields, G |
| 307 | FH | Ferruginous hawk | <i>Buteo regalis</i> | C2/ | 2 | G, Ag fields |
| 308 | GE | Golden eagle | <i>Aquila chrysaetos</i> | BEP/SSC | 3 | CSS, CHP, G, cliffs (breeding), Ag fields |
| 309 | PF | American peregrine falcon | <i>Falco peregrinus</i> | FE/CE | 1 | G, Ag fields, cliffs, beach |
| 310 | LR | Light-footed clapper rail | <i>Rallus longirostris levisipes</i> | FE/CE | 1 | SM |
| 311 | WP | Western snowy plover | <i>Charadrius alexandrinus nivosus</i> | FT/SSC | 1 | Ocean/bay shoreline, river mouths |
| 312 | MP | Mountain plover | <i>Charadrius montanus</i> | C2/ | 2 | open fields, G |
| 313 | BC | Long-billed curlew | <i>Numenius americanus</i> | C3/SSC | 4 | SM |
| 314 | ET | Elegant tern | <i>Sterna elegans</i> | C2/ | 2 | SM, salt flat, open water (ocean) |
| 315 | LT | California least tern | <i>Sterna antillarum browni</i> | FE/CE | 1 | Coastal strand, mud flats, beach |
| 350 | BW | Burrowing owl | <i>Speotyto cunicularia hypugaea</i> | C2/SSC | 4 | G, Coastal strand, Ag |
| 316 | WF | Southwestern willow flycatcher | <i>Empidonax traillii</i> | PE/CE | 1 | RW |
| 317 | CW | Coastal cactus wren | <i>Campylorhynchus brunneicapillus couesi</i> | C3B/SSC | 1 | CSS, Cactus patches |
| 318 | CG | California gnatcatcher | <i>Poliopitila californica</i> | FT/SSC | 1 | CSS |
| 319 | WB | Western bluebird | <i>Sialia mexicana</i> | none | 4 | OW (edges, sparse phase), G |
| 320 | LB | Least Bell's vireo | <i>Vireo bellii pusillus</i> | FE/CE | 1 | RW, RF |
| 333 | RP | California rufous-crowned sparrow | <i>Aimophila ruficeps canescens</i> | C2/ | 2 | CSS, rock outcroppings |
| 322 | BS | Belding's savannah sparrow | <i>Passerculus sandwichensis beldingi</i> | C2/CE | 1 | SM |
| 321 | LS | Large-billed savannah sparrow | <i>Passerculus sandwichensis rostratus</i> | C2/ | 2 | SM, G, FWM |
| 323 | GS | Grasshopper sparrow | <i>Ammodramus savannarum</i> | none | 4 | G |
| 324 | TB | Tricolored blackbird | <i>Agelaius tricolor</i> | C2/ | 2 | FWM |
| Mammals | | | | | | |
| 403 | BB | Townsend's western big-eared bat | <i>Plecotus townsendii</i> | C2/SSC | 2 | Caves, crevices |
| 402 | CB | California mastiff-bat | <i>Eumops perotis californicus</i> | C2/SSC | 2 | Caves, crevices |
| 401 | PM | Pacific little pocket mouse | <i>Perognathus longimembris pacificus</i> | FE/SSC | 1 | Sandy washes |
| 410 | BA | American Badger | <i>Taxidea taxus</i> | --/SSC | 4 | G |
| 405 | LI | Mountain lion | <i>Felis concolor</i> | --/see text | 3 | CSS, CHP, RW, OW |
| 404 | MD | Mule deer | <i>Odocoileus hemionus</i> | --/game spp. | 3 | CSS, CHP, RW, OW |

*Status (Federal/State)
 FE = Federally endangered.
 PE = Proposed for federal listing as endangered.
 FT = Federally threatened.
 PT = Proposed for federal listing as threatened.
 C1 = Category 1 candidate for federal listing.
 C2 = Category 2 candidate for federal listing.

***Habitat
 CSS - coastal sage scrub
 CHP - chaparral
 S. maritime CHP - southern maritime chaparral
 G - grassland
 NG - native grassland

Cypress wldld. - Tecate cypress woodland
 RW - riparian woodland
 RS - riparian scrub
 RF - riparian forest
 SM - saltmarsh

ATTACHMENT A

MSCP TARGET SPECIES LIST

C3B = Category 3B candidate for federal listing. VP - vernal pool FWM - freshwater marsh
C3 = Category 3 candidate for federal listing. OW - oak woodland
BEPA = Bald Eagle Protection Act
CE = State endangered.
CR = State rare.
CT = State threatened.
SSC = State Species of Special Concern

**Group

- 1 = All federal and state listed species, category 1 species, species proposed for listing, and NCCP target species.
- 2 = Federal category 2 species.
- 3 = Species important to preserve design.
- 4 = Habitat indicator species.

Note: On vegetation maps, plant codes are shown in italics and animal codes are shown in regular type.

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APPENDIX A-10

GIS HABITAT EVALUATION MODEL

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APPENDIX A-10

GIS HABITAT EVALUATION MODEL FOR THE MSCP STUDY AREA

The primary purpose of the Multiple Species Conservation Program (MSCP) is to mitigate potential direct, indirect, and cumulative impacts associated with the construction of sewage treatment and water reclamation facilities by the City of San Diego Clean Water Program. The overall goal of the program is to maximize and enhance biological diversity in the region and to conserve viable populations of endangered, threatened, and key candidate species and their habitats within the MSCP study area, thereby preventing local extirpation and ultimate extinction.

To accomplish these objectives, a model was developed for prioritizing critical biological resource areas within the 567,000-acre study area in southwestern San Diego County. In the absence of adequate and systematically-collected biological data for the entire study area, the model uses biological and physical data relative to the potential presence of 90 target species (listed, rare, and/or indicator species – see Attachment A) and relative to factors that contribute to high biodiversity. Four habitat evaluation procedures were performed, using a Geographic Information System (GIS) (see attached flow diagram). The first procedure identifies key habitat areas for California gnatcatchers. The second procedure evaluates areas with rare habitats, high species richness, and other physical parameters that may affect biodiversity. The third procedure maps the distribution of all federal and state listed species, category 1 candidate species, and species proposed for listing (excluding the gnatcatcher, which is addressed in the first procedure). The fourth analysis identifies potential wildlife corridors.

Individual components (numbered items below) were combined for each of the procedures A, B, and C to produce three maps: A) priority gnatcatcher habitat, B) biological diversity/species richness (habitat value index), and C) high priority target species and vernal pool habitat. These three maps were then combined with Map D (potential wildlife corridors) to produce an overall Habitat Evaluation Map (Composite Model Results – see flow diagram). The final map shows the distribution of critical biological resource areas that will serve as the biological basis for use in the gap analysis and for prioritizing lands for preservation and management.

For these evaluations, GIS layers of mapped vegetation communities and MSCP target species locations were used. Vegetation communities were delineated by interpretation of June 1990 color infrared aerial photography (1:24,000), were field-checked by helicopter overflights, use of existing vegetation maps, and ground-truthing in certain potential problem areas. On-screen digitizing was used to input vegetation data onto a merged Spot and Thematic Mapper (TM) satellite image base. The satellite data served as a source of coordinate control. An accuracy assessment of the vegetation mapping was performed (see Appendix A-12).

Target species locations were mapped onto 1:24,000 topographic maps from existing data (including the California Natural Diversity Data Base and unpublished data from local experts), Environmental Impact Reports, and surveys of selected areas. Field survey data were available for less than half the study area; therefore, distribution data for most of the target species are considered incomplete. Other data sources included a digital elevation model, USFWS National Wetlands Inventory maps, USGS topographic maps, Soil Conservation Service soils maps, vernal pools maps (Bauder 1986 and Beauchamp 1979), and unpublished data on documented golden eagle nest sites from T.A. Scott.

A. California Gnatcatcher Habitat Evaluation

Priority coastal sage scrub habitat for gnatcatchers was highlighted using the GIS, based on the following three criteria:

- 1) **Habitat patch size.** For this analysis, coastal sage scrub included Diegan coastal sage scrub, maritime succulent scrub, coastal sage scrub/chaparral, and their respective disturbed phases. For coastal sage scrub within the Maritime and Coastal Climate Zones, as delineated by the U.C. Agricultural Extension Service (1970), a patch size of greater than or equal to 25 acres was used. This patch size was chosen due to the large home range size of the gnatcatcher and the expected edge effects on smaller patches. For coastal sage scrub east of the Coastal Climate Zone, a patch size of 50 acres was chosen to reflect the decrease in gnatcatcher density with increasing distance from the coast (Ogden 1993, unpubl. data).
- 2) **Occurrence of coastal sage scrub habitat relative to the elevational distribution of California gnatcatchers.** Atwood and Bolsinger (1992) documented the tendency for the majority (94%) of the known gnatcatcher distribution in San Diego County to be below the 800-foot elevational contour. Ogden reviewed the extensive database of gnatcatcher sightings (approximately 1700) within the MSCP study area. The 950-foot elevation contour includes 90% of the documented gnatcatcher sightings within the MSCP study area.
- 3) **Coastal sage scrub habitat on slopes less than 40 percent.** Ogden's detailed studies (Ogden 1992a) and anecdotal observations (e.g., Bontrager 1991, USFWS 1991, B. Wagner pers. comm.) suggest that gnatcatchers prefer to nest in less steep areas containing suitable sage scrub habitat. Habitat on slopes greater than 40% appears to have low to moderate potential for nesting, but is potentially suitable for foraging and dispersal. Approximately 93% of the documented gnatcatcher sightings within the MSCP study area occur where the slope gradient is less than 40%.

These three criteria were combined to highlight areas that have the best potential to support gnatcatchers. Over 70% of the MSCP database gnatcatcher sightings within coastal sage scrub patches were in areas that met all three criteria. Potential core population areas were identified from the above modelling procedure. These relatively large areas of highly suitable habitat were used as the base preserve network to be evaluated by a computer simulation model of the gnatcatcher metapopulation (Ogden 1993; see Appendix A-7).

B. Habitat Value Index

This evaluation procedure focuses on ranking areas of relative biological value, based on the seven physical and biological parameters discussed below which are known to influence the biological diversity of an area. Similar to the Carlsbad Habitat Management Plan methodology (Michael Brandman Assoc. and Dudek & Assoc. 1992), a grid system consisting of 0.23-acre cells (i.e., 100' x 100' cells) was overlaid onto the MSCP study area. Each cell was assigned a relative point value (generally, 0 to 3 points) for each parameter. Each of the following parameters was developed as a separate GIS data layer.

- 1) **Presence of soil types known to support target plant species.** The following soils were mapped from Soil Survey maps (SCS 1973) and ranked by a committee of local botanists, based on correlation of these soils with the presence of MSCP target plant species:

- Coastal sandstone soils (including LvF3, TeF, and RuG) 3 pts

- Gabbro-derived soils above 1000 ft 3 pts
- Metavolcanic soils above 1000 ft 3 pts
- Metasedimentary soils above 1000 ft 2 pts
- Clay soils 2 pts

Soils within developed areas and all other soil types were assigned 0 points.

- 2) **Edge effect.** This criterion allows an assessment of the adverse effects of development on biological resources by determining whether the area of concern is within a specified distance of developed lands. A major concern is the invasion and subsequent degradation of native habitats by nonnative (e.g. domestic/feral cat, Norway rat) and human-associated native species (e.g., opossum, raccoon, brown-headed cowbird) from surrounding developed areas. Using the 0.23-acre grid, each cell was examined to determine its proximity to the edge of developed lands. Three "neighborhoods," that correspond to all cells within radial distances of 150, 300, and 600 feet from the central cell, were evaluated. These values are consistent with empirical studies of detrimental edge effects (e.g., Alberts et al. 1993, Andr n et al. 1985, Andr n and Angelstam 1988, Angelstam 1986, Brittingham and Temple 1983, Gates and Gysel 1978, Santos and Teller a 1992, Sauvajot and Buechner 1993, Scott 1993, Temple 1987, Wilcove 1985, Vissman 1993). This evaluation was performed on a cell by cell basis for all cells classified as having vegetation. A weighted sum, based on proximity to the developed edge, of developed cells in all three neighborhoods was derived, and this value was rank-ordered for the assignment of point value. Cells in proximity to developed areas were assigned -3 points, -2 points, or -1 point, based on relative distance from development; cells greater than 600 feet from development were assigned 0 points.
- 3) **Micro-habitat features.** Vegetated cells with physical micro-habitat elements that may contribute to high species diversity were given points for these special resources. Cliffs (nesting sites for raptors), mines (roosting sites for bats), vernal pool habitat, springs, and drainages/wetlands/ponds from the National Wetlands Inventory maps that were not mapped as vegetation communities were given 3 points. Cells without such resource elements were assigned 0 points. Cliffs are defined as areas having slopes greater than 80 percent. Springs and mines were identified from USGS topographic maps, vernal pools were from the MSCP vernal pool layer, cliffs were mapped using Digital Elevation Model (DEM) slope data, and water sources were mapped from the National Wetlands Inventory maps.
- 4) **Ecotone index.** Ecotone is the interface between two or more natural habitats. It is well known that species richness/diversity generally is higher in ecotone areas compared to monotypic stands of a single habitat. Only cells classified as having natural vegetation were used in this analysis, using an approximately 2-acre grid. Ecotone was evaluated for each cell, using 10 aggregated habitat categories (i.e, coastal sage scrub, chaparral, coastal sage scrub/chaparral, grassland, riparian/wetland, conifer forest, oak woodland, eucalyptus, beach/foredune, and marine waters) using a 0.5-mile radius to define the "neighborhood." The amount of inter-habitat interface within the "neighborhood" was used to calculate an ecotone index. This index was rank-ordered according to 25 percentile blocks for assignment of point value.
- 5) **Habitat diversity index.** In order to maintain community and ecosystem viability, the full range of habitats represented within the MSCP study area should be maintained. This criterion specifically addresses diversity or the relative abundance of different habitats in a given area. Only cells classified as having natural vegetation were used in this analysis, using an approximately 2-acre grid. Diversity was evaluated for each

cell, using 27 habitat categories and using a 0.5-mile radius to define the "neighborhood." Simpson's diversity index (Ludwig and Reynolds 1988: page 91) was used to calculate the proportional abundance of native habitat types, after correcting for developed cells within each neighborhood. This index was rank-ordered according to 25 percentile blocks for assignment of point value.

- 6) **Rarity of native habitats.** This criterion is based on the acreage of each habitat within the MSCP study area. Generally, native habitats of approximately 2000 acres or less within the MSCP study area were considered very rare and received the highest number of points (3). Native habitats greater than 5000 acres but less than 25,000 acres received 2 points. Native habitats greater than 25,000 acres received 1 point.

The following exceptions were allowed: Southern interior cypress forest is considered to be a very rare community; it occurs on only four peaks in the U.S., with the greatest portion of its distribution (84%, 5712 acres) within the MSCP study area. Shallow saltwater bay is also considered to be regionally rare, even though it was not mapped as a specific habitat within the MSCP study area. Coastal sage scrub/chaparral (1494 acres) represents a transition between coastal sage scrub and chaparral and thus was ranked with coastal sage scrub, receiving 1 point. Chaparral (112,820 acres), the only native vegetation that did not receive any points, is well-represented outside (i.e., east of) the MSCP study area, whereas relatively little coastal sage scrub occurs east of the MSCP study area. Ocean and non-native habitats, including eucalyptus (1648 acres) and disturbed habitat (27,234 acres), were also assigned 0 points. Vernal pools were not addressed in this analysis as they are addressed in the micro-habitat features criterion and below in Model C - High Priority Target Species and Vernal Pool Habitat.

The point value for each habitat is listed in the table below. These point values were used to assign the point value for the primary habitat type within each 0.23-acre cell.

Rarity of Native Habitats (acres)

| High - 3 points | Moderate - 2 points | Low - 1 point |
|--|----------------------------|------------------------------|
| Torrey pine forest (167) | Oak woodland (5286) | Grassland (28,541)* |
| So. foredunes (184) | Oak-riparian forest (5468) | Coastal sage scrub (115,561) |
| So. coastal bluff scrub (185) | Riparian scrub (5572) | CSS/chaparral (1494) |
| Saltpan (236) | Open water (5913) | |
| Freshwater marsh (727) | | |
| Riparian woodland (749) | | |
| Disturbed wetland (779) | | |
| Natural flood channel/streambed (1040) | | |
| Beach (1071) | | |
| Riparian forest (1267) | | |
| Southern maritime chaparral (1638) | | |
| So. coastal saltmarsh (1752) | | |
| Maritime succulent scrub (2010) | | |
| So. interior cypress forest (5712) | | |
| Shallow saltwater bay | | |

* Includes both native and non-native grassland. Because mapping was conducted by aerial photo-interpretation, native and non-native grasslands could not be differentiated.

- 7) **Potential to support MSCP target species.** Primary and secondary habitats were identified for all target species, based on the MSCP sightings database and a review of the the species' natural history. Primary habitats are those upon which a species is dependent for survival and reproduction. Secondary habitats are those that a species may use only infrequently and is not likely to be critical to the species. Primary habitats were given 1 point and secondary habitats were given 0.5 point for each species. The total points were summed for each habitat to yield an estimate of target species richness for each habitat. These values were rank-ordered for assignment of point values. The point value for each habitat is listed in the table below (species richness values in parentheses). Because of the point distribution, no habitats were assigned 2 points. Grids containing vernal pools overlaying another vegetation community received 3 points. Eucalyptus woodland, disturbed wetland, and disturbed areas supported no MSCP target species and thus received 0 points.

Target MSCP Species Richness Within Habitat Types

| High - 3 points | Low - 1 point | Low - 1 point |
|---------------------------|--------------------------------|----------------------------|
| Chaparral (33) | Maritime succulent scrub (9.5) | Oak riparian forest (6) |
| Coastal sage scrub (30.5) | Vernal pools (9.5) | Riparian forest (5) |
| Grassland (23.5) | Open water (8.5) | Flood channel (4.5) |
| | Maritime chaparral (8) | Beach (4) |
| | Riparian scrub (8) | Tecate cypress forest (4) |
| | Saltmarsh (7.5) | Saltpan (4) |
| | Riparian woodland (7.5) | Oak woodland - dense (3.5) |
| | Coastal sage/chaparral (7) | Southern foredunes (3) |
| | Freshwater marsh (7) | Torrey pine forest (3) |
| | Coastal bluff scrub (6) | Oak woodland - sparse (3) |

Summary of Habitat Value Index Model

The above criteria were used to assess the relative biological value of a given area in a regional context. These criteria contribute to the overall biological value in differing degrees that is reflected in the weighting applied to criteria considered to be regionally important. Criteria 1 through 7, above, were combined to highlight areas that may have relatively high biodiversity. All seven map layers were combined using a 0.23-acre grid. Values for grids in maps B-1 (soils), B-5 (habitat diversity index), and B-6 (rare habitats) were weighted 2 times those in maps B-3 (micro-habitats), B-4 (ecotone index), and B-7 (target species habitats), based on their perceived importance and the degree of confidence in the maps' correlation to actual target species locations.

These criteria weightings were determined through a consensus of opinion of the Biological Task Force, which consisted of representatives from Ogden, Dudek, the County of San Diego, RECON, NCCP Scientific Review Panel, USFWS, and CDFG. The task force felt that the most important criteria for assessing regional habitat value were appropriately weighted. The weighting scheme evolved from a sensitivity analysis of model results. The highest possible score for any one grid in maps B-1, B-5, and B-6 was 6 points each, while the highest possible score for any one grid in maps B-3, B-4, and B-7 was 3 points each. The highest possible score for map B-2 (edge effect) was 0 points each. Therefore, the highest possible score for any one grid in all maps combined was 27 points. Scores

were rank-ordered for assignment of final categories of habitat value. The distribution of total scores for habitat value was divided into quartiles and defined as Very High, High, Moderate, and Low habitat value.

C. High Priority Target Species and Vernal Pool Habitat

All federal and state listed species, category 1 candidate species, and species proposed for listing (i.e., the Group 1 species on the MSCP Target Species List) were mapped as a separate map layer and appropriately buffered to account for potential inaccuracy in the geographic positioning of sighting localities (200-foot buffers). In addition, historic, current, and potential nest sites of golden eagles (unpubl. data provided by T.A. Scott) were plotted. The golden eagle is a representative top carnivore within the food chain; top carnivores are considered key species in preserve design.

California gnatcatchers were not included in this analysis since Model A addresses gnatcatcher habitat. Cactus wren sightings were buffered by a polygon of natural habitat with a 500-foot radius around the point locality. This buffered polygon represents up to 18 acres of natural habitat, an area more than three times the mean size of documented coastal cactus wren territories (Rea and Weaver 1990). The high priority target species are listed in the table below. Vernal pool habitat was also mapped as part of this layer since vernal pools were not incorporated into the plant communities data layer. All grids within the species and vernal pool polygons received 3 points, and all other grids received 0 points.

High Priority Target Species

| | |
|--------------------------------|---|
| Vernal pool habitat | <i>Acanthomintha ilicifolia</i> |
| Wright's checkerspot butterfly | <i>Astragalus tener</i> var. <i>titi</i> |
| Riverside fairy shrimp | <i>Baccharis vanessae</i> |
| California red-legged frog | <i>Brodiaea filifolia</i> |
| Western pond turtle | <i>Calochortus dunnii</i> |
| Brown pelican | <i>Caulanthus stenocarpus</i> |
| Bald eagle | <i>Chorizanthe orcuttiana</i> |
| Peregrine falcon | <i>Cordylanthus maritimus</i> ssp. <i>maritimus</i> |
| Light-footed clapper rail | <i>Dudleya brevifolia</i> |
| Western snowy plover | <i>Dudleya viscida</i> |
| California least tern | <i>Eryngium aristulatum</i> var. <i>parishii</i> |
| Southwestern willow flycatcher | <i>Fremontodendron mexicanum</i> |
| Coastal cactus wren | <i>Hemizonia conjugens</i> |
| Least Bell's vireo | <i>Mahonia nevinii</i> |
| Belding's savannah sparrow | <i>Monardella linoides</i> ssp. <i>viminea</i> |
| Golden eagle | <i>Nolina interrata</i> |
| | <i>Orcuttia californica</i> |
| | <i>Pogogyne abramsii</i> |
| | <i>Pogogyne nudiuscula</i> |
| | <i>Rosa minutifolia</i> |
| | <i>Senecio ganderi</i> |

D. Wildlife Corridor Analysis

Topography and vegetation are important factors in the identification of movement corridors between critical biological resource areas and outside the MSCP study area. Adjacent land use should also be considered in prioritizing alternative corridor routes

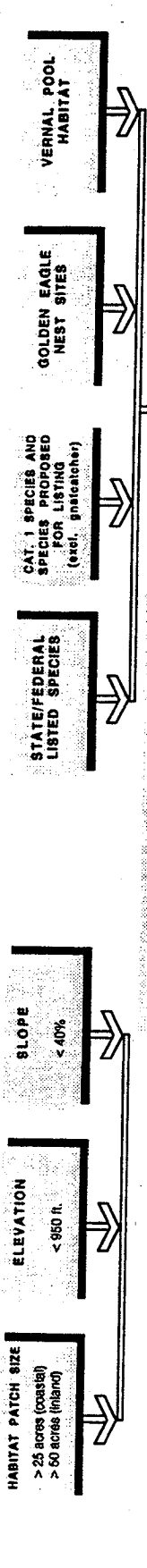
between potential core preserve areas. For this GIS analysis, riparian communities alone were used as preliminary indicators of potential wildlife corridors (Johnson and Jones 1977, Sands 1977, Warner and Hendrix 1984, Faber et al. 1989, Zembal 1993). Riparian woodland, riparian forest, oak-riparian forest, and riparian scrub were highlighted as the vegetation types with the greatest potential for use as wildlife corridors. These vegetation types received 3 points; all other vegetation types received 0 points. It should be noted that this analysis may be limited in scope to movement corridors for certain vertebrates, such as mountain lion, deer, bobcat, and many bird species. The broader issue of the potential necessity for habitat linkages is not addressed in this model. Adequate linkages require that the core preserve areas be identified first and that species-specific linkage requirements then be evaluated (Beier and Loe 1992, Ogden 1992b).

Composite Model Results – Habitat Evaluation Map

Components of Maps A, B, C, and D were combined as shown on the flow diagram, with the highest values on any of the four individual maps also receiving the highest value (Very High) on the composite map. Tabular results (i.e., percent of each vegetation community and target species represented in each of the four categories, Very High, High, Moderate, and Low) were compared to existing data on target species locations and vegetation communities to evaluate the adequacy of the GIS model. A sensitivity analysis of selected model criteria was conducted. The outcome of this analysis resulted in minor modification of some of the model's algorithms, but the overall spatial pattern of the model results remained essentially unchanged. The relative contribution of the four subcomponents of the model to the model results were in order of importance: Habitat Value Index (47%), California Gnatcatcher Habitat Evaluation (25%), Target Species/Vernal Pools (10%), Habitat Value Index and California Gnatcatcher Habitat Evaluation (6%), Wildlife Corridor Analysis (3.5%), and residual contribution from combinations of model subcomponents (8.5%). In general and at a regional level, the consensus opinion of the Biological Task Force and other biologists who reviewed the model is that the resulting map adequately represents critical centers of biological resources throughout the study area and the spatial distribution of relative biological habitat value within the study area.

The model results serve as a tool for use in regional planning and for prioritizing lands for conservation and management. Ideally, development should be discouraged in the Very High Value (magenta) areas and minimized in the High Value (yellow) areas. However, the model results are not intended to replace site-specific field survey data and evaluations. Rather, they provide a regional perspective for site-specific biological assessments. Site-specific verification of biological resources (or lack of biological resources) is needed before land use decisions for sites are finalized.

A. CALIFORNIA GNATCATCHER HABITAT EVALUATION (3 map layers)

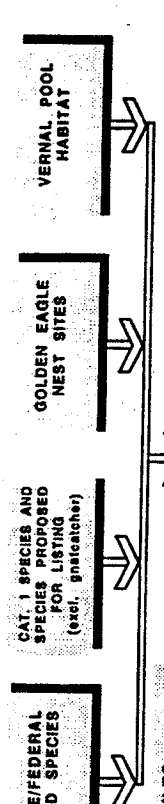


COMPOSITE MODEL RESULTS
 Very High • Very High Priority Target Species and Vernal Pools
 • Very High Habitat Value Index
 • Very High Gnatcatcher Habitat (for Core Subpopulations)
 • Potential Wildlife Corridors
 High • High Habitat Value Index
 • High Gnatcatcher Habitat
 • Golden Eagle Nest Sites
 Moderate • Moderate Habitat Value Index
 • Moderate Gnatcatcher Habitat
 Low • Low Habitat Value Index
 • Low Gnatcatcher Habitat

CALIFORNIA GNATCATCHER HABITAT EVALUATION
 Very High = Intersection of all 3 criteria in core subpopulations
 High = Intersection of all 3 criteria
 Moderate = Intersection of 2 criteria
 Low = 1 criteria only or none

POPULATION VIABILITY ANALYSIS
 Core Subpopulations.

C. HIGH PRIORITY TARGET SPECIES AND VERNAL POOL HABITAT (4 map layers)



HIGH PRIORITY TARGET SPECIES AND VERNAL POOL HABITAT
 Very High = all occurrences except eagle
 High = golden eagle nest sites

POTENTIAL WILDLIFE CORRIDORS ANALYSIS
 Very High = Riparian habitat types

D. POTENTIAL WILDLIFE CORRIDOR ANALYSIS (1 map layer)

HABITAT VALUE INDEX
 Very High = 76 - 100 percentile
 High = 51 - 75 percentile
 Moderate = 26 - 50 percentile
 Low = 1 - 25 percentile

SOILS SUPPORTING TARGET PLANT SPECIES
 High = Coastal sandstone
 Gabbro > 1000 ft.
 Metavolcanic > 1000 ft.
 Moderate = Metasedimentary > 1000 ft.
 City

ECOTONE INDEX

HABITAT DIVERSITY INDEX

MICRO-HABITAT FEATURES
 Cilia, threes, vernal pool habitat, springs, and ponds

RARITY OF NATIVE HABITATS
 Habitat ≤ 2000 ac. = High
 Habitat > 2000 ac. = Moderate
 Habitat > 25000 ac. = Low

POTENTIAL TO SUPPORT TARGET SPECIES

EDGE EFFECT

B. HABITAT VALUE INDEX (7 map layers)



GIS Habitat Evaluation Model for the MSCP Study Area

FIGURE

References

- Alberts, A.C., A.D. Richman, D. Tran, R. Sauvajot, C. McCalvin, and D.T. Bolger. 1993. Effects of habitat fragmentation on native and exotic plants in southern California. Pages 103-110 in J.E. Keeley (ed.). *Interface between ecology and land development in California*. Southern California Academy of Sciences, Los Angeles.
- Andrén, H. and P. Angelstam. 1988. Elevated predation rates and edge effect in habitat islands: experimental evidence. *Ecology* 69:544-547.
- Andrén, H., P. Angelstam, E. Lindström, and P. Widén. 1985. Differences in predation in relation to habitat fragmentation. *Oikos* 45:273-277.
- Angelstam, P. 1986. Predation in ground-nesting birds' nests in relation to predator densities and habitat edge. *Oikos* 47:367-373.
- Atwood, J.L. and J.S. Bolsinger. 1992. Elevational distribution of California gnatcatchers in the United States. *Journal of Field Ornithology* 63:159-168.
- Bauder, E.T. 1986. San Diego vernal pools, recent and projected losses; their condition; and threats to their existence 1979-1990. U.S. Fish and Wildlife Service, Office of Endangered Species.
- Beauchamp, R.M. 1979. San Diego vernal pool study. California Department of Fish and Game, nongame wildlife investigations, endangered plant program, 145. Job II-1.0.
- Beier, P. and S. Loe. 1992. A check list for evaluating impacts to wildlife movement corridors. *Wildlife Society Bulletin* 20:434-440.
- Bontrager, D.R. 1991. Habitat requirements, home range, and breeding biology of the California gnatcatcher (*Poliophtila californica*) in south Orange County, California. Prepared for Santa Margarita Company. April. 19 pp.
- Brittingham, M.C. and S.A. Temple. 1983. Have cowbirds caused forest songbirds to decline? *BioScience* 33:31-35.
- Faber, P.M., E. Keller, A. Sands, and B. Massey. 1989. The ecology of riparian habitats of the southern California coastal region: a community profile. USFWS Biological Report 85 (7.27). 152 pp.
- Gates, J.E. and L.W. Gysel. 1978. Avian nest dispersion and fledgling outcome in field-forest edges. *Ecology* 59:871-883.
- Johnson, R.R. and D.A. Jones. 1977. Importance, preservation, and management of riparian habitat. USFS General Technical Report RM-43.
- Ludwig, J.A. and J.F. Reynolds. 1988. *Statistical ecology - a primer on methods and computing*. John Wiley & Sons, New York.
- Michael Brandman Assoc. and Dudek & Assoc., Inc. 1992. Biological resources and habitat analysis, City of Carlsbad, California. Prepared for City of Carlsbad.
- Ogden Environmental and Energy Services (Ogden). 1992a. Ecology of the California

- gnatcatcher at Rancho San Diego. Technical appendix in the Rancho San Diego Habitat Conservation Plan. Prepared for Home Capital Development Corp. 54 pp. December.
- Ogden Environmental and Energy Services (Ogden). 1992b. Baldwin Otay Ranch wildlife corridor studies. Prepared for the Otay Ranch Project Team. December. 110 pp. plus appendices.
- Ogden Environmental and Energy Services (Ogden). 1993. Population viability analysis for the California gnatcatcher within the MSCIP study area. Prepared for the Clean Water Program, City of San Diego. February. 40 pp. plus appendices.
- Rea, A.M. and K.L. Weaver. The taxonomy, distribution, and status of coastal California cactus wrens. *Western Birds* 21:81-126.
- Sands, A. 1977. Riparian forests in California: their ecology and conservation. Institute of Ecology Publication No. 15, University of California, Davis, CA.
- Santos, T. and J.L. Tellería. 1992. Edge effects on nest predation in Mediterranean fragmented forests. *Biological Conservation* 60:1-5.
- Sauvajot, R. and M. Buechner. 1993. Effects of urban encroachment on wildlife in the Santa Monica Mountains. Pages 171-180 in J.E. Keeley (ed.). *Interface between ecology and land development in California*. Southern California Academy of Sciences, Los Angeles.
- Scott, T.A. 1993. Initial effects of housing construction on woodland birds along the wildland urban interface. Pages 181-188 in J.E. Keeley (ed.). *Interface between ecology and land development in California*. Southern California Academy of Sciences, Los Angeles.
- Soil Conservation Service (SCS). 1973. Soil survey of San Diego area, California, part 1. 104 pp.
- Temple, S.A. 1987. Predation of turtle nests increases near ecological edges. *Copeia* 1987: 250-252.
- U.C. Agricultural Extension Service. 1970. San Diego County agricultural relationships. U.S. Agricultural Extension Service in cooperation with Environmental Science Services Administration and U.S. Weather Bureau.
- U.S. Fish and Wildlife Service (USFWS). 1991. A survey of the California gnatcatcher and cactus wren on Camp Pendleton San Diego County, California. November. 25 pp.
- Vissman, S. 1993. Nest predation in coastal sage scrub: a field experiment on height and edge effects. M.S. Thesis, San Diego State University.
- Warner, R.E. and K.M. Hendrix. 1984. California riparian systems. University of California Press, Berkeley, CA.
- Wilcove, D.S. 1985. Nest predation in forest tracts and the decline of migratory songbirds. *Ecology* 66:1211-1214.

Zemal, R. 1993. The need for corridors between coastal wetlands and uplands in southern California. Pages 205-208 in J.E. Keeley (ed.). Interface between ecology and land development in California. Southern California Academy of Sciences, Los Angeles.

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APPENDIX A-11
HABITAT MANAGEMENT PLAN OUTLINES

**APPENDIX A-11.1
FIRE MANAGEMENT PLAN OUTLINE**

I. GOALS AND OBJECTIVES

- A. Biological Goals and Objectives
 1. Removal of accumulated biomass/recycling of nutrients
 2. Habitat enhancement or restoration
 3. Plant species management
- B. Public Safety and Feasibility Goals and Objectives
 1. Fuel reduction
 2. Lowered liability

II. PRIORITIES

- A. Management and Resource Priorities
 1. Environmental considerations (e.g., atmospheric conditions, topography, soils, geology)
 2. Biological considerations (e.g., habitat patch size, age since last burn, high versus low potential fire communities)
- B. Public Safety and Feasibility Priorities
 1. Proximity to use areas
 2. Type of land use

III. COORDINATION

- A. Local Fire Department
- B. Neighboring Jurisdictions
- C. Other Elements of Preserve Management
- D. Existing Fire Management Plan(s)

IV. MANAGEMENT PLAN

- A. Prescribed Burn Plan
 1. Existing conditions (including vegetation and sensitive species maps)
 2. Fire history (including map of previous burns)
 3. Fire regime survey (e.g., fuel loading, fuel structure or arrangement, fuel type, age of vegetation, potential sources of ignition, influence of previous or current management)
 4. Flammability rating map (including low versus high fire potential habitats)
 5. Map of areas/habitats requiring fire for biological versus safety reasons
 6. Methodology (e.g., prescribed fire, grazing, disking, chaining, brushing, mowing, clearing, fuelbreaks and/or fire roads, "fire-resistant landscaping)
 7. Predicted fire behavior
 8. Fire control resources and safety measures
 9. Implementation (including access)
- B. Fire Suppression Plan
 1. All information in IV.A, above
 2. Priority conservation areas (including map)

V. MONITORING PROGRAM

- A. Burn Phase
 - 1. Habitat type burned
 - 2. Areal extent of burn
 - 3. Burn severity
 - 4. Weather conditions
- B. Post Burn Phase
 - 1. Fire interval
 - 2. Community composition
 - 3. Sensitive species distribution
 - 4. Age structure
 - 5. Regeneration patterns

VI. SCHEDULES

- A. Yearly Schedules
- B. Seasonal Schedules

VII. REPORTS

VIII. RECOMMENDATIONS

**APPENDIX A-11.2
GRAZING MANAGEMENT PLAN OUTLINE**

I. GOALS AND OBJECTIVES

- A. Biological Goals and Objectives
 - 1. Habitat/species enhancement
- B. Public Safety Goals and Objectives
 - 1. Fuel load reduction for fire safety (buffers only)
 - 2. Security needs of preserve areas

II. PRIORITIES

- A. Management and Resource Priorities
 - 1. Target habitats and species
 - 2. Fire management
- B. Feasibility Priorities
 - 1. Economic considerations

III. COORDINATION

- A. Livestock Operators
- B. Other Elements of Preserve Management

IV. MANAGEMENT PLAN

- A. Grazing Management Plan
 - 1. Existing conditions (including vegetation and sensitive species maps)
 - 2. Grazing history
 - 3. Designation of area(s) to be grazed (including map)
 - 4. Terms of grazing leases (e.g., type of animal(s), water sources, stocking rate, rotation system (timing and duration), feeding restrictions, ancillary facilities (e.g., corrals), fencing requirements)

V. MONITORING PROGRAM

- A. Range Management Monitoring
 - 1. Residual dry matter (RDM)
 - 2. Forage quality
- B. Biological Monitoring
 - 1. Habitat quality/shifts in species composition
 - 2. Target species occurrence/dominance/decline
 - 3. Climatic conditions (e.g., wet versus dry year) and correlation to grazing results
- C. Lessee Performance/Supervision

VI. SCHEDULES

- A. Yearly Schedules
- B. Seasonal Schedules

VII. REPORTS

VIII. RECOMMENDATIONS

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**APPENDIX A-11.3
PRESERVE RESTORATION PLAN OUTLINE**

I. GOALS AND OBJECTIVES

- A. Improvement of General Habitat Quality
- B. Wildlife Habitat Enhancement
- C. Enhancement or Reintroduction of Target Species
- D. Connectivity

II. PRIORITIES

- A. Management and Resource Priorities
 - 1. Severely versus moderately degraded habitat
 - 2. Threats to continued viability of target species
 - 3. Threats to genetic integrity of species/habitats
- B. Feasibility Priorities
 - 1. Ecological conditions/constraints
 - 2. Physical site conditions/constraints
 - 3. Logistical conditions/constraints
 - 4. Restoration techniques
 - 5. Pilot projects
 - 6. Economic and funding considerations

III. COORDINATION

- A. Neighboring Jurisdictions
- B. Other Elements of Preserve Management

IV. MANAGEMENT PLAN

- A. Restoration Plan
 - 1. Project management and contractor responsibilities
 - 2. Existing conditions (including vegetation and sensitive species maps)
 - 3. Past management history
 - 4. Methodology (seed and plant procurement procedures; plant palette and planting arrangement; planting and seeding specifications; planting technique (e.g., planting, seeding, transplanting, salvaging); use of mycorrhizal fungi; irrigation specifications and sources; exotic plant control; erosion control; fire suppression; debris removal; site protection measures; equipment constraints; construction documents; maintenance procedures)
 - 5. Installation
 - 6. Bonding and warranties

V. MONITORING PROGRAM

- A. Contractor Education and Construction Monitoring Programs
- B. Horticultural Monitoring
 - 1. Supervise maintenance contractor
 - 2. Specify/implement remedial actions (e.g., erosion control, debris removal, irrigation scheduling and cessation, weed and pest control, protective fencing or other site protection measures)
- C. Biological Monitoring
 - 1. Onsite and offsite (e.g., reference site) data collection (e.g., species composition; mortality of plantings; vegetation cover; species distribution, diversity, and abundance; wildlife habitat value/wildlife presence)
 - 2. Specify and evaluate performance standards

VI. SCHEDULES

- A. Yearly Schedules
- B. Monthly Schedules

VII. REPORTS

VIII. RECOMMENDATIONS

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APPENDIX A-12

**ACCURACY ASSESSMENT OF
MSCP GIS VEGETATION LAYER**

FINAL REPORT

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INTRODUCTION

The Center for Earth Systems Analysis Research (CESAR) of the Department of Geography, San Diego State University was contracted by Ogden Environmental and Energy Services to assess the accuracy of the vegetation GIS layer that had been generated as part of the Multi-Species Conservation Program (MSCP) for the City of San Diego Clean Water Program (Ogden, 1992). This report presents the procedures and results of this assessment effort.

The accuracy assessment was conducted in two phases. In Phase I, accuracy was estimated by randomly sampling from all polygons in the vegetation layer. Phase II focused on the quantification of vegetation classification errors that could most directly influence the results of habitat modeling and preserve design. Therefore, accuracy was assessed for the subset of vegetation polygons that were most likely to be considered significant to these modeling and design efforts.

BACKGROUND

The most critical input to assessing wildlife habitat relationships and for effective planning for conservation of biodiversity is a high quality map of vegetation/land cover types. A land/vegetation cover map was produced by Ogden Environmental as a major component of the MSCP project. Vegetation and other non-urban land cover types were mapped for the entire area of the City of San Diego Clean Water Program, excluding areas of urban land use (as of June, 1990). The map was produced by photo interpretation of color infrared (CIR) aerial photographs acquired in 1990 that were enlarged and printed at 1:24,000-scale. Helicopter reconnaissance flights supplemented the photo interpretation process. Vegetation polygons were delineated according to rules and criteria developed prior to mapping, and delineations were based on a modification of the Holland (1986) Classification System. Polygon boundaries and labels were georeferenced and digitally encoded by San Diego Association of Government (SANDAG) technicians and SDSU graduate research assistants at CESAR, based on geocoded and terrain-corrected satellite data. This was achieved with an interactive GIS-image processing system through a process known as "heads-up" or "interactive" digitizing (Stow et al., 1990).

During the period Nov-91 through Feb-92 CESAR performed Phase I of the accuracy assessment component of the MSCP regional vegetation mapping effort. The focus of the

Phase I assessment was on categorical accuracy of randomly selected polygons within the entire vegetation layer (Congalton, 1988). Positional or boundary mapping error was not assessed. Polygons were selected randomly and then encircled with an aircraft where an observer (John O'Leary) identified the apparent land/vegetation cover type and 35 mm slides were photographed for subsequent interpretation. About a quarter of the 160 samples were also visited and categorized from the ground. Seven of the 160 polygons were eliminated from the statistical analysis due to development or extreme disturbance subsequent to the acquisition of the aerial photographs used for the mapping.

Interest in errors effecting the results of habitat modeling and preserve design motivated Ogden to commission CESAR to perform Phase II of the accuracy assessment effort. Again, only categorical accuracy was assessed, but not positional accuracy of boundaries. Emphasis was placed on categorical accuracy of polygons that met certain size and vegetation-type criteria, based on importance to modeling/design considerations as determined by Ogden biologists. A minimum-size criteria of 25 acres was chosen. The following vegetation types and corresponding codes were chosen as land cover criteria for the Phase II accuracy assessment.

Code - Vegetation Cover Type

- 30 - Coastal Sage Scrub
- 31 - Disturbed Coastal Sage Scrub
- 50 - Chaparral
- 51 - Disturbed Chaparral
- 70 - Coastal Sage Scrub/Chaparral
- 71 - Disturbed Coastal Sage Scrub/Chaparral
- 80 - Grassland
- 81 - Disturbed Grassland
- 140 - Oak Woodland
- 150 - Oak Woodland/Dense Phase
- 151 - Disturbed Oak Woodland/Dense Phase
- 160 - Oak Woodland/Sparse Phase
- 161 - Disturbed Oak Woodland/Sparse Phase
- 240 - Disturbed Habitat

PROCEDURES

Specific accuracy assessment procedures were selected to minimize bias and costs, and to achieve maximum objectivity and efficiency. Efforts were made to cross-calibrate and therefore minimize false error detection due to differences in interpretation criteria applied by mappers and the accuracy assessor. Polygons were selected randomly and the assessor had no *a priori* information that would influence his observation. The assessment was primarily based on real time assessment from a low-flying aircraft and from subsequent photographic slide interpretation of individual polygons. Graduate research assistants who had not participated in the original generation of the GIS layer or with the assessment flights delineated random polygons on aerial photos, and cross-tabulated mapped and verified categories to create contingency matrices. Specific procedures are clarified as follows.

During Phase I, substantial time was spent by the accuracy assessor (O'Leary) and Ogden vegetation mappers (Gordon-Reedy and Kelly) cross-calibrating their interpretative skills and attempting to standardize the application of classification rules and criteria. O'Leary and Gordon-Reedy revisited some of these issues as part of the Phase II effort, and attempted to clarify some apparent discrepancies that had not been resolved in Phase I.

Polygons from the MSCP vegetation layer (ARC/INFO format) were selected randomly by CESAR GIS technicians in Phase I. At the end of the Phase I assessment, 153 samples remained after eliminating some polygons because of changes in land cover between the photographic and accuracy assessment dates, and because of inaccessibility to some sites that could not be classified by aerial assessment with a high degree of confidence.

A different sampling strategy was applied in Phase II. Polygons from the MSCP vegetation layer (ARC/INFO format) were selected randomly by Ogden GIS technicians. Based on the size (> 25 acres) and category (14 classes) stratification criteria described above, 280 polygons were selected randomly from a population of over 10,000. An ARC/INFO file was provided to CESAR that contained the complete vegetation layer and included a descriptor specifying which polygons had been randomly selected.

An initial target of 200 polygons was determined by Ogden and CESAR to be a reasonable number for the Phase II assessment. The determination of this number was based on the expected accuracy (as indicated from Phase I results), a statistical confidence interval of \pm

5%, and the amount of time and funds available to perform the effort (Fitzpatrick-Lins, 1980). From the 280 random polygons, every fourth polygon was ignored leaving 210 in the target sample. Some of the polygons that met the Phase II size and category criteria but were redundant with polygons selected in Phase I were eliminated, as were others that were determined later on to have incurred a major land use conversion between the mapping and assessment periods. Adding back a few of the 70 random polygons that had been originally excluded resulted in 200 polygons being visited for the Phase II accuracy assessment.

Once selected, polygon boundaries were mapped onto CIR aerial photographs for subsequent use during aerial observations. Most of the aerial photographs had no marks other than the boundaries and an arbitrary polygon identification code. In areas where only NASA high altitude CIR photos were available, the same photo that contained mapped boundaries and category codes was used, but the category codes for the random polygons were erased.

Flying routes were planned prior to each flight. This was facilitated by plotting a map with the location of random polygons and major transportation features. Some 30-40 adjacent polygons were connected by line segments on the map to determine an optimal route for a given day. An effort was made to sequence the polygons such that all polygons on a given aerial photo were completed prior to moving to the next aerial photograph. Attention was also given to departure and landing patterns of the home airport, as well as proximity to airports and controlled air space with heavy traffic.

Aerial observations were made by O'Leary at about 1,000- 1,500 ft. above ground level. A visual navigator (Stow) located and delineated the ground site corresponding to each polygon based on the CIR aerial photo. The pilot then slowly circled, (or circum-navigated in the case of large polygons), around each site while O'Leary assessed the vegetation cover on the ground, relative to its depiction on the corresponding aerial photograph. During this interpretation period, Stow would shoot a 35mm color slide(s) of the site. A recorder (Hope) recorded the vegetation code, slide number(s), and any descriptive notes associated with O'Leary's observation. While circling during the site observations, Hope would look ahead to the next aerial photograph and to the plot map to assist in navigating to the next polygon.

After visiting all of the randomly selected sites, O'Leary cross-checked his direct observations against the color slide photographs. Polygons were flagged when neither aerial observation or slide interpretation yielded a highly confident categorization. Some of the inconclusive polygons were rechecked during a final aerial reconnaissance flight. The remaining polygons were accessible on the ground and were rechecked by field assessment.

A final cross-checking occurred between O'Leary and Kelly to clarify special cases and classification rules. All polygons showing disagreement between the GIS layer and the accuracy observation were discussed to ensure that consistency was maintained between the two processes. Note that some bias may be introduced in this process, because only error polygons are rechecked and therefore, can only be modified to increase the apparent accuracy.

Of the 153 polygons checked during Phase I, 39 met the size and category criteria applied in Phase II. These 39 samples were added to those checked in Phase II to increase the sample size to 239 and thus, to minimize the confidence limits. This addendum of samples is valid since the accuracy procedures applied during both phases were the same, and only the dates of observations differed.

Contingency matrices and accuracy figures were generated based on the relationship between the category on the GIS layer and the category observed by O'Leary. Tables were created for the finest level of categorical detail, (potentially 31 map classes for Phase I and 14 classes for Phase II), and for more generalized categories produced by aggregating disturbed and non-disturbed and some of the specific oak woodland classes. Histograms showing the number of sample polygons per size interval were also generated.

RESULTS

Results of the accuracy assessment are depicted in the contingency matrices that follow and are discussed below. Once again, the accuracy figures represent the relative categorical accuracy determined by comparing the category coded for a given polygon on the GIS layer to the category observed by O'Leary for the corresponding area on the ground. Such an assessment is considered to be a "site-specific" accuracy assessment, compared to an "overall" assessment where the proportions or area of each class are compared between map/GIS layer and reference observations (Jensen, 1986). In spite of the more stringent,

"site-specific" nature of this accuracy assessment, there was no treatment of boundary mapping accuracy.

The "Total" accuracy was determined by dividing the number of samples in agreement (sum of diagonal elements of the contingency matrix), by the total number of samples observed (sum of all elements of the matrix). The confidence interval at a confidence limit of 95% (i.e., there is a 0.95 probability that the actual accuracy falls within this interval) was calculated based on the formula from Jensen (1986):

$$\pm [1.96(p \cdot q / n)^{1/2} + 50/n]$$

where:

p = actual percentage correct

q = actual percentage incorrect

n = number of samples

For Phase I, error matrices were generated for two levels of categorical generalization: Level I - the most specific level consisting of the original 31 categories, and Level II - these 31 categories aggregated into 9 categories by ignoring disturbed and undisturbed distinctions.

Contingency matrices were also generated for two levels of categorical generalization in Phase II. Level I consisted of the 14 categories used in the Phase II stratification. Eight categories were used in Level II, the 14 categories in Level I aggregated into 8 categories by ignoring disturbed and undisturbed distinctions.

Statistics for individual classes were derived for Phase II results because of the larger sample size. In spite of the larger total sample size, most of the classes other than Coastal Sage Scrub and Chaparral types did not have a sufficient number of samples to place a high degree of confidence in the results (Van Genderen and Lock, 1977). The "User's" accuracy of a given category was calculated by dividing the number of samples in agreement divided by the total number observed by the assessor. This gives an indication of omission errors in the GIS layer, that is, the percentage of polygons determined by the assessor to be of a given category that were labeled as a different category. The "Producer's" accuracy of a given category was calculated by dividing the number of samples in agreement by the total number of samples represented in the GIS layer. This figure represents commission errors in mapping and digital encoding. Commission error is the percentage of polygons of a given category that were falsely labeled as that category.

Phase I Results: A total accuracy of $55.6\% \pm 8.2$ (at the 95% confidence level) was determined for the Level I assessment. Again, this figure is based on 153 sampled polygons, of which a little over 50% were composed of Coastal Sage Scrub or chaparral types. A third of the possible 31 classes were not sampled, and another third received only 1-4 samples. In the context of an "overall" (i.e., inventory-based) accuracy assessment, Coastal Sage Scrub types were underrepresented by about 6% and chaparral types by 2%. The most apparent causes for confusion were the inability to distinguish between disturbance classes within (e.g., Coastal Sage Scrub vs. Disturbed Coastal Sage Scrub) and between (Disturbed Coastal Sage Scrub vs. Disturbed Habitat) vegetation/land cover categories.

At Level II, $75.2\% \pm 7.2$ (at the 95% confidence level) of the samples were in agreement. This jump in accuracy largely reflects the fact that many of the errors at the most disaggregated classification level are due to confusion between disturbance types within the same class. Coastal Sage Scrub had a relative accuracy of 68% and Chaparral 79%. Chaparral is generally easier to discriminate on the aerial photographs than Coastal Sage Scrub, and is confused only infrequently with Oak Woodland and Coastal Sage Scrub types. Coastal Sage Scrub is confused more frequently with Chaparral, Grassland and Developed Habitat.

Phase II Results: A total accuracy of $64.9\% \pm 6.3$ (at the 95% confidence level) was determined for the Level I assessment. This is about 10% higher than the Level I results from Phase I. The higher accuracy can probably be attributed to the larger polygon sizes sampled in Phase II, as there were very few samples generated for the 17 categories that were excluded in the Phase II sampling.

The Level I categories of highest agreement from a "User's" perspective were Undisturbed Chaparral (87.3%) and Disturbed Habitat (84.6%), followed by Disturbed Chaparral (71.4%) and Undisturbed Coastal Sage Scrub (74.2%). Only the Coastal Sage Scrub and Undisturbed Chaparral classes had sufficient sample sizes to adequately assess individual category accuracy.

At Level II, $77.0\% \pm 5.5$ (at the 95% confidence level) of the samples were in agreement. Again, this increase in accuracy largely reflects the fact that many of the Level I errors are caused by an inability to distinguish disturbance types. However, note that the difference

between Phase I and Phase II results were much less for the Level II than the Level I assessment. This implies that disturbance-related distinctions were similar for polygons of all sizes, at Level II. The Coastal Sage Scrub, Chaparral and Oak Woodland (excluding sparse phase) categories vary between 80-90% accuracy. As before, it is evident that the Coastal Sage Scrub/Chaparral class is underrepresented in the GIS layer, and the Grassland classes appear to be commonly confused with Coastal Sage Scrub and Disturbed Habitat. The latter type of misclassification is likely due to marginal positions of several polygons with respect to the rules/criteria separating grassland from sage scrub types.

SUMMARY

An attempt was made to objectively and precisely determine the categorical accuracy of polygons in the MSCP Vegetation GIS Layer. In Phase I, accuracy was assessed for all possible polygons in the layer, while Phase II emphasized polygons that met specific size and category criteria deemed critical to MSCP objectives. At the most specific level, a total accuracy of 55.6% for Phase I and 64.5% for Phase II was determined based on aerial and ground observations at a more detailed scale than the original mapping. Ignoring disturbance types, the total accuracy was found to be 75.2% for Phase I and 77.0% for Phase II. Categorical errors in the GIS layer are due to errors or difficulties in interpreting aerial photography, failure to apply or conform to classification rules and criteria, and digital encoding. Uncertainties in the accuracy figures reported here occur because of the sample size, possible observer errors, possible errors in co-locating polygons and corresponding ground sites.

We are aware of few other studies that have invested the necessary resources to carefully assess the accuracy of digital GIS vegetation layers that are based on interpretation of medium-scale aerial photography (Congalton and Mead, 1983). The accuracy of the MSCP vegetation layer seems to be reasonable given the time and money that were allotted to produce it. This opinion is based on our own experiences from assessing the accuracy of vegetation layers generated from satellite image data and from viewing most of the MSCP study area from the air, as well as anecdotal information from assessing other photo interpreted vegetation maps whose accuracies have been much lower. The potential for error and uncertainty in the production of vegetation maps and GIS layers is tremendous (Walsh et al., 1987) and yet, the degree of understanding about errors and uncertainty by users is much lower than their expectations.

ACKNOWLEDGMENTS

We wish to acknowledge the contributions of several individuals whose assistance was essential to the successful completion of this study. Arman Eshragi mapped random polygons onto air photos and assisted with flight planning. Paul McCullough and Derren Duburguet generated error matrices. Timo Luostarinen, Paul McCullough and Debbie Turner generated random polygons and associated attribute and size information. Paul Hotchkiss was the pilot for all of the overflights. Patricia Gordon-Reedy and Dan Kelly assisted with the standardization of classification rules and procedures.

REFERENCES

- Congalton, R. 1988. A Comparison of Sampling Schemes Used in Generating Error Matrices for Assessing the Accuracy of Maps Generated from Remotely Sensed Data. *Photogrammetric Engineering and Remote Sensing* 54:593-600.
- Congalton, R., and R. Mead. 1983. A Quantitative Method to Test for Consistency and Correctness in Photointerpretation. *Photogrammetric Engineering and Remote Sensing* 49:69-74.
- Fitzpatrick-Lins, K. 1980. The accuracy of selected land use and land cover maps at scales of 1:250,000 and 1:100,000. *Journal of Research U.S. Geological Survey* 6:169-173.
- Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Department of Fish and Game, Sacramento, California. 156 pp.
- Jensen, J.R. 1986. *Introductory Digital Image Processing: A Remote Sensing Perspective*. Prentice-Hall, Englewood Cliffs, New Jersey. 379 pp.
- Ogden Environmental and Energy Services Co. 1992. Resource Inventory and Mapping Methodology for the Multiple Species Conservation Program. Prepared for the Clean Water Program, City of San Diego. 29 pp. and 4 appendices.
- Stow, D., S. Westmoreland, D. McKinsey, F. Mertz, J. Nathanson, S. Sperry, and D. Nagel. 1990. Efficient Creation, Correction and Updating of Vector-Coded GIS Coverages Using Remotely Sensed Data. Pages 209-218 in *Proceedings of GIS/LIS '90*, Anaheim, California. November, 1990.
- Van Genderen, J.L. and B.F. Lock. 1977. Testing land-use classification accuracy. *Photogrammetric Engineering and Remote Sensing* 43:1135-1137.
- Walsh, S., D. Lightfoot, and D. Butler. 1987. Recognition and Assessment of Error in Geographic Information Systems. *Photogrammetric Engineering and Remote Sensing* 53:1423-1430.

**MSPC VEGETATION CLASSIFICATION PHASE I: ERROR MATRIX
LEVEL I**

| Observed Vegetation | Mapped Vegetation | | | | | | | | | | | | | | | | | | | | Observed Totals | User's Accuracy | | | | |
|----------------------------|-------------------|-------------|-------------|-------------|----------|-------------|-------------|----------|------------|--------------|----------|-------------|------------|-------------|------------|--------------|------------|--------------|--------------|------------|-----------------|-----------------|-------------|-------------|--------------|-----------------------------|
| | 30 | 31 | 50 | 51 | 70 | 80 | 81 | 100 | 110 | 111 | 120 | 130 | 131 | 150 | 151 | 160 | 180 | 200 | 220 | 221 | | | 240 | 250 | 251 | |
| 30 | 14 | 4 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 53.8 | |
| 31 | 2 | 13 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 24 | 59.3 | |
| 50 | 2 | 0 | 18 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 89.6 | |
| 51 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 72.7 | |
| 70 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.0 | |
| 80 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 57.1 | |
| 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 9 | 33.3 | |
| 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.0 | |
| 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.0 | |
| 111 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.0 | |
| 120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 50.0 | |
| 130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 50.0 | |
| 131 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | |
| 150 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 93.8 | |
| 180 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | |
| 161 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 50.0 | |
| 180 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 100.0 | |
| 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 100.0 | |
| 220 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.0 | |
| 221 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | |
| 240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 100.0 | |
| 250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 16.7 | |
| 280 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 42.9 | |
| 281 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 50.0 | |
| Mapped Totals | 21 | 20 | 22 | 15 | 0 | 11 | 7 | 0 | 2 | 1 | 0 | 3 | 2 | 12 | 4 | 2 | 1 | 3 | 2 | 0 | 1 | 15 | 4 | 163 | | |
| Producer's Accuracy | 66.7 | 70.0 | 72.7 | 53.3 | | 36.4 | 42.9 | | 0.0 | 100.0 | | 66.7 | 0.0 | 56.3 | 0.0 | 100.0 | 0.0 | 100.0 | 100.0 | 0.0 | 26.7 | 100.0 | 75.0 | 25.0 | 33.8 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | Total | Confidence Interval: |

- 30: Coastal Sage
- 31: Disturbed Coastal Sage
- 50: Chaparral
- 51: Disturbed Chaparral
- 70: Coastal Sage/Chaparral
- 80: Grassland
- 81: Disturbed Grassland
- 100: Freshwater Marsh
- 110: Riparian Forest
- 111: Disturbed Riparian Forest
- 120: Riparian Woodland
- 130: Riparian Scrub
- 131: Disturbed Riparian Scrub
- 150: Oak Woodland/Dense Phase
- 151: Disturbed Oak Woodland/Dense Phase
- 160: Oak Woodland/Sparse Phase
- 180: Disturbed Oak Woodland/Sparse Phase
- 190: Southern Interior Cypress Forest
- 200: Open Water
- 220: Natural Floodchannel/Streambed
- 221: Disturbed Natural Floodchannel/Streambed
- 240: Disturbed Habitat
- 250: Developed
- 280: Oak Riparian Forest
- 281: Disturbed Oak Riparian Forest

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MSCP VEGETATION CLASSIFICATION PHASE I: AGGREGATED ERROR MATRIX
LEVEL II

Mapped Vegetation

| Observed Vegetation | Mapped Vegetation | | | | | | | | | | Classified Totals | User's Accuracy | | | | | | |
|---------------------|-------------------|-------|----|-------|-----|---------|-----|---------|---------|---------|-------------------|-----------------|-------|------|---------|------|------------------------|---------------------------|
| | 30+31 | 50+51 | 70 | 80+81 | 100 | 110+111 | 120 | 130+131 | 150+151 | 160+161 | | | 180 | 200 | 220+221 | 240 | 250 | 260+261 |
| 30+31 | 4 | 7 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 50 | 88.0 |
| 50+51 | 4 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 79.4 |
| 70 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.0 |
| 80+81 | 1 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 16 | 81.3 |
| 100 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.0 |
| 110+111 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 66.7 |
| 120 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.0 |
| 130+131 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 100.0 |
| 150+151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 100.0 |
| 160+161 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 75.0 |
| 180 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 100.0 |
| 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 100.0 |
| 220+221 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 50.0 |
| 240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 100.0 |
| 250 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 6 | 16.7 |
| 260+261 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 77.8 |
| Reference Totals | 41 | 37 | 0 | 16 | 3 | 3 | 5 | 16 | 3 | 3 | 3 | 2 | 1 | 15 | 1 | 6 | 153 | |
| Producer's Accuracy | 82.9 | 73.0 | - | 72.2 | - | 96.7 | - | 80.0 | 66.6 | 100.0 | 100.0 | 100.0 | 100.0 | 26.7 | 100.0 | 87.5 | Overall Accuracy: 87.5 | Confidence Interval: ±7.3 |

30+31: Coastal Sage 90+81: Grassland 120: Riparian Woodland 150+151: Oak Woodland/Dense Phase 200: Open Water
 50+51: Chaparral 100: Freshwater Marsh 130+131: Riparian Scrub 160+161: Oak Woodland/Sparsely Phase 220+221: Natural Foodchannel/Streambed
 70: Coastal Sage/Chaparral 110+111: Riparian Forest 150+151: Oak Woodland/Dense Phase 240: Disturbed Habitat 250: Developed 260+261: Oak Riparian Forest

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MSCP VEGETATION CLASSIFICATION PHASE II: ERROR MATRIX

LEVEL I

Mapped Vegetation

| Observed Vegetation | Mapped Vegetation | | | | | | | | | | | | | Observed Totals | User's Accuracy | |
|----------------------------|-------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|-------------|------------|----------|----------|-----------------|-------------------------------|----------------------------------|
| | 30 | 31 | 50 | 51 | 70 | 71 | 80 | 81 | 140 | 150 | 151 | 160 | 161 | | | 240 |
| 30 | 4 | 6 | 3 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 66 | 74.2 |
| 31 | 6 | 21 | 0 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 37 | 56.6 |
| 50 | 5 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 55 | 87.3 |
| 51 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 71.4 |
| 70 | 2 | 0 | 7 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 18.2 |
| 71 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.0 |
| 80 | 1 | 2 | 0 | 0 | 0 | 0 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | 3 | 23 | 43.5 |
| 81 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 45.5 |
| 140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 150 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 6 | 66.7 |
| 151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0.0 |
| 160 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0.0 |
| 161 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0.0 |
| 240 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | 84.6 |
| 250 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 3 | - |
| Mapped Totals | 65 | 31 | 63 | 12 | 4 | 0 | 15 | 15 | 0 | 8 | 2 | 0 | 0 | 24 | 239 | |
| Producer's Accuracy | 75.4 | 67.7 | 76.2 | 41.7 | 50.0 | - | 66.7 | 33.3 | - | 50.0 | 0.0 | - | - | 45.8 | Overall Accuracy: 84.9 | Confidence Interval: ±6.3 |

30: Coastal Sage 70: Coastal Sage/Chaparral 140: Oak Woodland 160: Oak Woodland/Sparse Phase
 31: Disturbed Coastal Sage 71: Disturbed Coastal Sage/Chaparral 150: Oak Woodland/Dense Phase 161: Disturbed Oak Woodland/Sparse Phase
 50: Chaparral 80: Grassland 240: Disturbed Habitat
 51: Disturbed Chaparral 81: Disturbed Grassland 250: Developed

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MSCP VEGETATION CLASSIFICATION PHASE II: AGGREGATED ERROR MATRIX

LEVEL II

Mapped Vegetation

| Observed Vegetation | Mapped Vegetation | | | | | | | | | | Observed Totals | User's Accuracy |
|---------------------|-------------------|-------|-------|-------|-----|---------|---------|------|-------------------|--|---------------------------|-----------------|
| | 30+31 | 50+51 | 70+71 | 80+81 | 140 | 150+151 | 160+161 | 240 | | | | |
| 30+31 | 8 | 0 | 1 | 4 | 0 | 0 | 0 | 4 | | | 103 | 83.5 |
| 50+51 | 5 | 5 | 1 | 0 | 0 | 1 | 0 | 0 | | | 62 | 88.7 |
| 70+71 | 2 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | | | 12 | 18.7 |
| 80+81 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 7 | | | 34 | 70.6 |
| 140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 0 | - |
| 150+151 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | | 7 | 85.7 |
| 160+161 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | | | 5 | 0.0 |
| 240 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | | | 13 | 84.6 |
| 250 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | | | 3 | - |
| Mapped Totals | 96 | 75 | 4 | 30 | 0 | 10 | 0 | 24 | Totals | | 239 | |
| Producer's Accuracy | 89.6 | 73.3 | 50.0 | 80.0 | - | 60.0 | - | 45.8 | Overall Accuracy: | | 77.9 | |
| | | | | | | | | | | | Confidence Interval: ±5.5 | |

30+31: Coastal Sage 80+81: Grassland 160+161: Oak Woodland/Sparse Phase
 50+51: Chaparral 140: Oak Woodland 240: Disturbed Habitat
 70+71: Coastal Sage/Chaparral 150+151: Oak Woodland/Dense Phase 250: Developed

CEGAR Laboratory, Department of Geography, San Diego State University. June 30, 1993

MSCP VEGETATION CLASSIFICATION PHASE II: ERROR MATRIX
LEVEL I

| | Mapped Vegetation | | | | | | | | | | | | Observed Totals | User's Accuracy | | |
|----------------------------|-------------------|------|------|------|------|----|------|------|-----|------|-----|-----|-----------------|-----------------|-------------------------------|----------------------------------|
| | 30 | 31 | 50 | 51 | 70 | 71 | 80 | 81 | 140 | 150 | 151 | 160 | | | 161 | 240 |
| 30 | 49 | 8 | 3 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 66 | 74.2 |
| 31 | 8 | 21 | 0 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 37 | 56.8 |
| 50 | 5 | 0 | 48 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 55 | 87.3 |
| 51 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 71.4 |
| 70 | 2 | 0 | 7 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 18.2 |
| 71 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.0 |
| 80 | 1 | 2 | 0 | 0 | 0 | 0 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | 3 | 23 | 43.5 |
| 81 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 45.5 |
| 140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 150 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 6 | 66.7 |
| 151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0.0 |
| 160 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0.0 |
| 161 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0.0 |
| 240 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | 84.6 |
| 250 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 3 | - |
| Mapped Totals | 65 | 31 | 63 | 12 | 4 | 0 | 15 | 15 | 0 | 8 | 2 | 0 | 0 | 24 | 239 | - |
| Producer's Accuracy | 75.4 | 67.7 | 76.2 | 41.7 | 50.0 | - | 66.7 | 33.3 | - | 50.0 | 0.0 | - | - | 45.8 | Overall Accuracy: 84.9 | Confidence Interval: ±6.3 |

30: Coastal Sage 70: Coastal Sage/Chaparral 140: Oak Woodland 160: Oak Woodland/Sparse Phase
 31: Disturbed Coastal Sage 71: Disturbed Coastal Sage/Chaparral 150: Oak Woodland/Dense Phase 161: Disturbed Oak Woodland/Sparse Phase
 50: Chaparral 80: Grassland 240: Disturbed Habitat
 51: Disturbed Chaparral 81: Disturbed Grassland 250: Developed

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MSCP VEGETATION CLASSIFICATION PHASE II: AGGREGATED ERROR MATRIX

LEVEL II

Mapped Vegetation

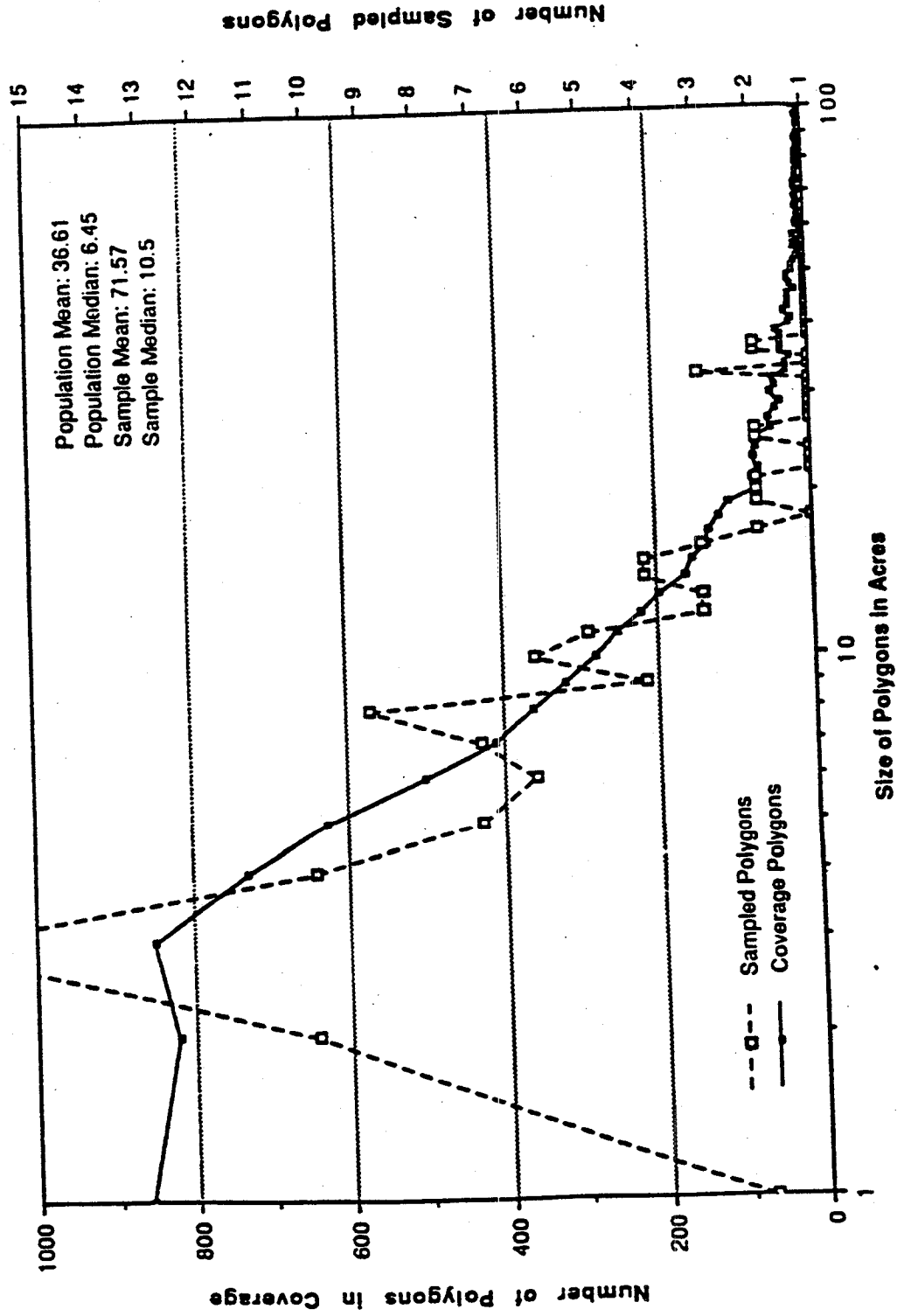
| Observed Vegetation | Mapped Vegetation | | | | | | | | | | Observed Totals | User's Accuracy |
|---------------------|-------------------|-------|-------|-------|-----|---------|---------|------|-------------------|--|----------------------|-----------------|
| | 30 + 31 | 50+51 | 70+71 | 80+81 | 140 | 150+151 | 160+161 | 240 | | | | |
| 30+31 | 86 | 8 | 1 | 4 | 0 | 0 | 0 | 4 | | | 103 | 83.5 |
| 50+51 | 5 | 55 | 1 | 0 | 0 | 1 | 0 | 0 | | | 62 | 88.7 |
| 70+71 | 2 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | | | 12 | 16.7 |
| 80+81 | 3 | 0 | 0 | 24 | 0 | 0 | 0 | 7 | | | 34 | 70.6 |
| 140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 0 | |
| 150+151 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 0 | | | 7 | 85.7 |
| 160+161 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | | | 5 | 0.0 |
| 240 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 11 | | | 13 | 84.6 |
| 250 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | | | 3 | |
| Mapped Totals | 96 | 75 | 4 | 30 | 0 | 10 | 0 | 24 | Totals | | 239 | |
| Producer's Accuracy | 89.6 | 73.3 | 50.0 | 80.0 | | 60.0 | | 45.8 | Overall Accuracy: | | 77.0 | |
| | | | | | | | | | | | Confidence Interval: | ±5.5 |

Observed Vegetation

| | | |
|-------------------------------|-----------------------------------|------------------------------------|
| 30+31: Coastal Sage | 80+81: Grassland | 160+161: Oak Woodland/Sparse Phase |
| 50+51: Chaparral | 140: Oak Woodland | 240: Disturbed Habitat |
| 70+71: Coastal Sage/Chaparral | 150+151: Oak Woodland/Dense Phase | 250: Developed |

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Number of Polygons per Size Category for MSCP Study Area: PHASE I



MSCP PHASE II: HISTOGRAM OF POLYGON AREA

