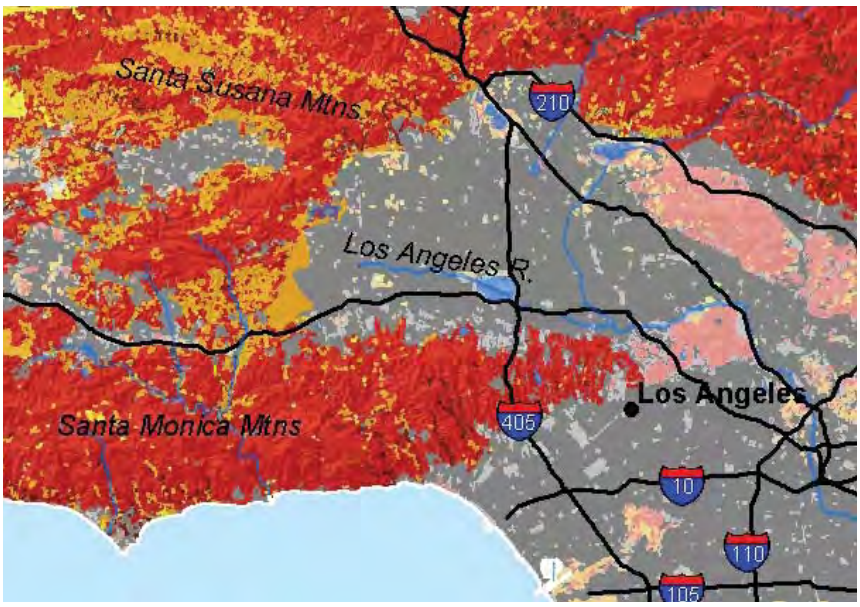
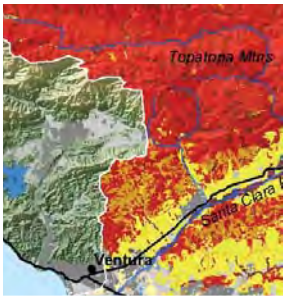
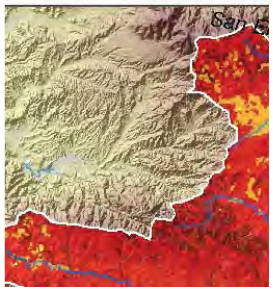
JUNE 2006

THE GREEN VISIONS PLAN

for 21st century southern california







13. Target Species Habitat Mapping

Esther S. Rubin
Heather L. Rustigian
Michael D. White
Conservation Biology Institute

Prepared for: San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy
900 South Fremont Avenue, Alhambra, CA 91802-1460

Cover Art: Habitat map for mountain lion.

Preferred Citation: Rubin, Esther S., Heather L. Rustigian, and Michael D. White. 2006. *Green Visions Plan for 21st Century Southern California: A Guide for Habitat Conservation, Watershed Health, and Recreational Open Space. 13. Target Species Habitat Mapping*, University of Southern California GIS Research Laboratory and Center for Sustainable Cities, Los Angeles, California.

This report was printed on recycled paper.

THE GREEN VISIONS PLAN

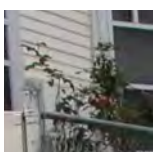
for 21st century southern california

The mission of the Green Visions Plan for 21st Century Southern California is to offer a guide to habitat conservation, watershed health and recreational open space for the Los Angeles metropolitan region. The Plan will also provide decision support tools to nurture a living green matrix for southern California. Our goals are to protect and restore natural areas, restore natural hydrological function, promote equitable access to open space, and maximize support via multiple-use facilities. The Plan is a joint venture between the University of Southern California and the San Gabriel and lower Los Angeles Rivers and Mountains Conservancy, Santa Monica Mountains Conservancy, Coastal Conservancy, and Baldwin Hills Conservancy.

www.greenvisionsplan.net

TABLE OF CONTENTS

INTRODUCTION	1
METHODS	1
SPECIES ACCOUNTS: MAMMALS	16
SPECIES ACCOUNTS: BIRDS	104
SPECIES ACCOUNTS: AMPHIBIANS AND REPTILES	167
SPECIES ACCOUNTS: INVERTEBRATES	193
SPECIES ACCOUNTS: FISH	216



Acknowledgements

This project was funded by the University of Southern California Purchase Order No. 103853 and Watershed Conservation Authority Grant No. WCA32015.

We extend our grateful appreciation to the following individuals who provided reviews of species accounts and/or distributional maps. Comments and corrections provided by these species experts improved the accuracy of information in the species accounts and distributional maps. However, Conservation Biology Institute accepts responsibility for any inaccuracies or errors in this report.

We thank the following individuals for providing their time and expertise:

Gar Abbas	U.S. Forest Service
William Andelt	Colorado State University
Rebecca Barboza	California Department of Fish and Game
Edward Beedy	Jones and Stokes, Inc.
Phil Behrends	Dudek and Associates, Inc.
Paul Beier	Northern Arizona University
Peter Bloom	Western Foundation of Vertebrate Zoology
Doug Bolger	Dartmouth University
Tracey Brown	California State University, San Marcos
Jay Diffendorfer	Illinois Natural History Survey
Shana Dodd	Dodd Biological Consulting
Fred Heath	Camarillo, California
Stephen Holl	Holl Consulting
Robert Lovich	U.S. Navy
Lisa Lyren	U.S. Geological Survey
Robert Meese	University of California, Davis
Karen Miner	California Department of Parks and Recreation
Stephen Montgomery	SJM Biological Consultants
Marie Simovich	University of San Diego
Wayne Spencer	Conservation Biology Institute
Camm Swift	Los Angeles County Museum of Natural History
Scott Tremor	San Diego Natural History Museum
Michael Wall	San Diego Natural History Museum

Introduction

One of the goals of the Green Visions Plan for 21st Century Southern California is to develop a parcel-based GIS tool that provides a "scorecard" for what conservation values could be achieved in the subject parcel, including biodiversity, watershed health, and recreational values. Conservation value will be based on four types of analyses: (1) target species assessment, (2) natural community representation, based on development of a historic vegetation map, (3) a habitat connectivity analysis at local and regional scales, and (4) analysis of the permeability of the urban matrix to wildlife movement.

This report outlines the process and results of the first analysis (target species assessment). The approach for this analysis was to map the hypothetical distributions of a large number of target species, so that their cumulative distributions could be used as a relative measure of conservation value for individual parcels. Forty-eight species, representing mammals, birds, invertebrates, amphibians, reptiles, and fish, were chosen as target species by advisors to the Green Visions Plan. We developed a map of the hypothetical distribution of each species, using rule-based models based on available GIS data layers, known occurrence locations (based either on published locations or expert input), or distributional information described in the literature. The intent of this habitat modeling exercise was not to create a predictive map to be used for single-species management. Rather, the hypothetical distribution maps of these multiple species are intended to be used in concert to assign a relative index of conservation value to patches of land within the Green Visions planning area.

In this report, we outline the methods we used to develop the hypothetical distributions of each species. We first present the general approaches used and explain how data layers were derived. We then present a brief species account for each species, including information about the species' biology pertinent to its likely distribution in southern California, and species-specific methods used to map its distribution. We then include a map of each species' likely distribution in the Green Visions plan. All digital data layers, species distributional maps, and stepwise annotation of our mapping process were provided to University of Southern California in digital format.

Methods

A total of 47 habitat maps were developed for 48 species, including amphibians, birds, fish, invertebrates, mammals, and reptiles (Table 1). Most maps represent the distribution of a single species, while one map represents two species (California and Mountain quail).

For most species, excluding invertebrate and fish species, we used the California Wildlife Habitat Relationship System (WHR; California Interagency Wildlife Task Group 2002) to form the basis of the habitat map. The WHR system rates habitat suitability by vegetation type, seral stage and density, and land uses (e.g., urban, agriculture, see "Habitat Suitability Ratings" below). Although the WHR system provides a range of ratings for various habitat types, many

species have additional habitat requirements beyond vegetation and land cover characteristics considered in the WHR system that influence their distribution. For example, species that breed in or near water may only be found within a certain distance of specific types of water. Other species may only be found in a particular range of elevations or soil types. We reviewed the literature on habitat use and needs for all species and, when appropriate, added additional conditions to the models of their predicted distribution. In other cases, we added additional filters to the WHR system suitability ratings. For example, WHR ratings consider urban habitat as suitable habitat for some species (e.g., coyote, black-tailed jackrabbit), but the WHR system does not consider the land use type or residential density of urban areas. It is possible that these species are found in some urban areas of a particular urban land use type or residential density, while other urban areas are not suitable. Therefore, we further subdivided urban habitat into classes of land use and density (see "Development of Composite Landcover Layer" below) and, based on our review of habitat use for these species and input from species experts, eliminated unsuitable types of urban areas for each species.

The preliminary species maps, based on WHR ratings and additional conditions we imposed on the predictive maps, each showed all possible patches that met the conditions of habitat suitability and included important habitat characteristics for a particular species. These maps did not, however, consider patch size or distance between patches. We therefore identified patches that were too small to sustain even one individual of the focal species by identifying patches that were smaller than recorded home-ranges for the species. For most species, we used the smallest recorded home ranges, thereby taking a conservative approach that allowed small patches of land to provide habitat, even if only for one individual or pair of individuals. In some cases, however, when small estimated home ranges appeared to be due to inadequate sampling, we used the mean reported home range size as the minimum patch size.

Isolated patches of habitat may also have a decreased probability of species occupancy, especially if they are small. Thus, we also identified patches of habitat as less suitable if the distance from that patch to the next closest patch exceeded twice the recorded dispersal distance recorded for the species. We chose this distance because documented dispersal distances likely underestimate true dispersal distances (LaHaye et al. 2001). Large patches capable of sustaining an isolated population would not be as dependent on linkages to other patches, so we relaxed this patch size requirement for patches that could support 50 individuals. We assumed that a patch $\geq$50 times the home range of a species would be likely to support 50 individuals, even if the species were territorial. In each species map, therefore, we identified patches of habitat smaller than the smallest recorded home range and those that were both twice the furthest recorded dispersal distance from a second patch and less than approximately 50 home ranges as those less likely to be occupied as compared to larger and less isolated patches. Our analysis of patch size and distance did not consider the type of background matrix that the patches were located in (e.g., whether the area between patches was an impenetrable urban area versus habitat that could be easily traversed by the species) and did not consider impenetrable barriers such as road, rivers, or urban centers. These important considerations will be addressed in later stages of the Green Visions planning process.

Development of Composite Land Cover Layer

In most cases, we used the CALVEG data layer (2.5-acre minimum mapping unit), developed by the California Department of Forestry and Fire Protection, as a map of the habitat types identified in the WHR system. However, this approach had limited resolution in some situations. For example, the WHR habitat suitability rating system included only one classification for "urban" areas, and did not consider land uses or development density of urbanized areas. Similarly, while the WHR habitat suitability rating system included several classes of agricultural areas, the corresponding CALVEG data layer mapped only one broad agricultural class. In addition, although the WHR system provided habitat suitability ratings related to water for some species, CALVEG does not differentiate between different types of waterbodies (estuary, marine, wetland, etc); rather it identifies them simply as "water." To improve the accuracy of species mapping, we developed a composite land cover layer that incorporated more detailed land cover data available from several different sources.

To improve the resolution of habitat mapping in urban and agricultural areas, we incorporated Southern California Association of Governments (SCAG) 1:24,000 land cover data, which provided a much higher differentiation of land use in these areas. This allowed us to more accurately predict habitat use of species that would use some urban areas (e.g., rural residential) but not others (e.g., commercial/industrial or high density residential). In all cases where CALVEG mapped an area as urban or agriculture, we replaced the CALVEG data with SCAG data. Urban areas in SCAG were then collapsed into 6 new categories (Table 2). When the WHR suitability rating system indicated that urban areas were occupied by a species, we refined the maps by excluding those urban land cover categories that were unlikely to be occupied, based on literature reviews of species habitat use patterns.

Some individual agricultural land cover categories in SCAG represented several CALVEG categories. For these cases, we used the mean rating of the WHR suitability ratings corresponding to the CALVEG agricultural classification (Table 3). However, the SCAG data also included several agricultural categories for which there were no corresponding WHR ratings. For these agricultural categories, which represented intensive agriculture (e.g., dairy, intensive livestock, nurseries, packing houses, grain elevators, and poultry operations), we used the WHR rating for "urban" for the species, assuming that such agricultural areas would have a similar suitability to urban areas.

To incorporate water into our composite land cover layer, we replaced CALVEG "water" data with the California Hydrography (polygons) data (1:100,000, Teale GIS Solutions, California Spatial Information Library), National Hydrography Dataset (1:24,000 streams), National Wetland Inventory (NWI) data (1:24,000), and SCAG data to identify various types of waterbodies. We then applied the WHR ratings to these waterbodies and used this information to refine the maps (e.g., to identify habitat within a certain distance of a specific waterbody type).

We used the Soil Survey Geographic (SSURGO) Database (1:24,000 resolution; http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/) to represent soil types. This data layer did not, however, cover all portions of the study area. Areas lacking soil data corresponded primarily to urbanized areas in the Los Angeles basin. We therefore applied soil restrictions only to land for which this soil layer was available.

Habitat Suitability Ratings

The WHR system uses habitat types described by Mayer and Laudenslayer (1988) and categorizes habitat types by seral stage and density (Table 4). WHR habitat suitability ratings indicate the suitability of each habitat type, stage, and density class for sustaining a particular species, and these are classified from 0 to 1, with 0 representing unsuitable habitat, 0.33 representing low suitability, 0.66 representing medium suitability, and 1 representing high suitability.

Following the species accounts, we present tables with WHR suitability ratings for each species, with the original WHR ratings shown in bold and changes, based either on literature review or reviewer comments, shown in italics. CALVEG coverages did not always provide the same resolution as WHR habitat categories, in terms of seral stage/density classes, and in these cases the mean WHR suitability rating for a particular vegetation type was used. The final codes used for development of the distributional maps are provided in digital format (for mammals, for example, see file "mammals_whr.dbf").

Invertebrate and fish species were mapped using a different approach than that used for birds, reptiles, amphibians, and mammals, primarily because WHR suitability ratings did not exist for these species. For butterflies, we mapped the predicted distribution of each species' host plant, using the same WHR classes used for mapping of vertebrate species, except we did not apply a range of suitability ratings. Rather, the expected distribution of host plants was based on a "0" (presence not likely) versus "1" (presence likely) rating. We did not apply minimum patch size or dispersal restrictions for these species, for reasons discussed in the individual species accounts. For Riverside fairy shrimp, we based our maps on known locations of vernal pools, and for fish species we based our maps on known locations, based on literature review and expert opinion.

Review by Species Experts

We attempted to obtain at least one review by a species expert for each species, and contacted 52 potential reviewers. We obtained reviews from 23 individuals for 36 of the target species. Reviewers were asked to comment on species accounts and/or distributional maps, our general approach, and specific conditions or restrictions applied. Species accounts and distributional maps were modified based on reviewer input within the constraints of data layers and resources available to us.

Literature Cited

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento. http://www.dfg.ca.gov/whdab

LaHaye, W.S., R.J. Gutierrez, and J.R. Dunk. 2001. Natal dispersal of the spotted owl in southern California: dispersal profile of an insular population. The Condor 103:691-700.

Mayer, K.E. and W.F. Laudenslayer (eds.). 1988. A guide to wildlife habitats in California. California Department of Fish and Game, Sacramento, CA 166 pp.

Table 1. List of focal species included in the Green Visions Plan habitat mapping project.

Type	Scientific Name	Common Name
Amphibian	*Pseudacris regilla* (previously *Hyla regilla*)	Pacific Chorus Frog (previously Pacific Tree Frog)
Amphibian	*Spea hammondii*	Western Spadefoot Toad
Amphibian	*Taricha torosa torosa*	Coast Range Newt
Bird	*Agelaius phoeniceus*	Red-winged Blackbird
Bird	*Aimophila ruficeps*	Rufous-crowned Sparrow
Bird	*Amphispiza belli*	Sage Sparrow
Bird	*Athene cunicularia*	Burrowing Owl
Bird	*Callipepla californica*[1]	California Quail
Bird	*Chondestes grammacus*	Lark Sparrow
Bird	*Circus cyaneus*	Northern Harrier
Bird	*Cistothorus palustris*	Marsh Wren
Bird	*Elanus leucurus*	White-tailed Kite
Bird	*Icteria virens*	Yellow-breasted Chat
Bird	*Lanius ludovicianus*	Loggerhead Shrike
Bird	*Oreortyx pictus*[1]	Mountain Quail
Bird	*Passerculus sandwichensis*	Belding's Savannah Sparrow
Bird	*Strix occidentalis*	Spotted Owl
Bird	*Sturnella neglecta*	Western Meadowlark
Invertebrate	*Apodemia virgulti*	Behr's Metalmark
Invertebrate	*Colias eurydice*	California Dogface
Invertebrate	*Limenitis lorquini lorquini*	Lorquin's Admiral
Invertebrate	*Speyeria callippe*	Callippe Fritillary
Invertebrate	*Streptocephalus wootoni*	Riverside Fairy Shrimp
Mammal	*Canis latrans*	Coyote
Mammal	*Dipodomys agilis*	Agile Kangaroo Rat
Mammal	*Lepus californicus*	San Diego Black-tailed Jackrabbit
Mammal	*Lynx rufus*	Bobcat
Mammal	*Microtus californicus*	California Vole
Mammal	*Mustela frenata*	Long-tailed Weasel
Mammal	*Eptesicus fuscus*	Big Brown Bat
Mammal	*Neotoma macrotis*	Dusky Footed Woodrat
Mammal	*Neotoma lepida*	Desert Woodrat
Mammal	*Ovis canadensis nelsoni*	Bighorn Sheep
Mammal	*Perognathus longimembris*	Little Pocket Mouse
Mammal	*Peromyscus eremicus*	Cactus Mouse
Mammal	*Peromyscus maniculatus*	Deer Mouse
Mammal	*Puma concolor*	Mountain Lion

Type	Scientific Name	Common Name
Mammal	*Taxidea taxus*	American Badger
Mammal	*Urocyon cinereoargenteus*	Common Gray Fox
Reptile	*Clemmys marmorata*	Western Pond Turtle
Reptile	*Phrynosoma coronatum*	Coast Horned Lizard
Reptile	*Thamnophis hammondii*	Two-Striped Garter Snake
Fish	*Catostomus santaanae*	Santa Ana Sucker
Fish	*Gasterosteus aculeatus*	Threespined Stickleback
Fish	*Gila orcuttii*	Arroyo Chub
Fish	*Fundulus parvipinnis*	California Killifish
Fish	*Oncorhynchus mykiss*	Rainbow Trout
Fish	*Rhinichthys osculus*	Speckled Dace

[1] The distributions of the two species of quail were combined and represented in one habitat map.

Table 2. Crosswalk between SCAG urban land cover categories and 6 reclassified urban categories.

SCAG Land Cover Category	Reclassified Land Cover Category
Air Field	Commercial/Industrial
Airports	Commercial/Industrial
Attended Pay Public Parking Facilities	Commercial/Industrial
Base (Built-up Area)	Commercial/Industrial
Bus Terminals and Yards	Commercial/Industrial
Chemical Processing	Commercial/Industrial
Commercial Recreation	Commercial/Industrial
Commercial Storage	Commercial/Industrial
Correctional Facilities	Commercial/Industrial
Electrical Power Facilities	Commercial/Industrial
Fire Stations	Commercial/Industrial
Former Base (Built-up Area)	Commercial/Industrial
Former Base Air Field	Commercial/Industrial
Former Base Vacant Area	Commercial/Industrial
Freeways and Major Roads	Commercial/Industrial
Government Offices	Commercial/Industrial
Harbor Facilities	Commercial/Industrial
Harbor Water Facilities	Commercial/Industrial
High-Rise Major Office Use	Commercial/Industrial
Hotels and Motels	Commercial/Industrial
Liquid Waste Disposal Facilities	Commercial/Industrial
Low- and Medium-Rise Major Office Use	Commercial/Industrial
Maintenance Yards	Commercial/Industrial
Major Medical Health Care Facilities	Commercial/Industrial
Major Metal Processing	Commercial/Industrial
Manufacturing	Commercial/Industrial
Manufacturing, Assembly, and Industrial Services	Commercial/Industrial
Marina Water Facilities	Commercial/Industrial
Mixed Commercial and Industrial	Commercial/Industrial
Mixed Transportation	Commercial/Industrial
Mixed Transportation and Utility	Commercial/Industrial
Mixed Urban	Commercial/Industrial
Modern Strip Development	Commercial/Industrial
Motion Picture and Television Studio Lots	Commercial/Industrial
Natural Gas and Petroleum Facilities	Commercial/Industrial
Non-Attended Public Parking Facilities	Commercial/Industrial
Older Strip Development	Commercial/Industrial
Open Storage	Commercial/Industrial
Park-and-Ride Lots	Commercial/Industrial
Petroleum Refining and Processing	Commercial/Industrial
Police and Sheriff Stations	Commercial/Industrial
Railroads	Commercial/Industrial

SCAG Land Cover Category	Reclassified Land Cover Category
Regional Shopping Center	Commercial/Industrial
Religious Facilities	Commercial/Industrial
Research and Development	Commercial/Industrial
Retail Centers (Non-Strip With Contiguous Interconnected Off-Street)	Commercial/Industrial
Skyscrapers	Commercial/Industrial
Solid Waste Disposal Facilities	Commercial/Industrial
Truck Terminals	Commercial/Industrial
Under Construction	Commercial/Industrial
Water Storage Facilities	Commercial/Industrial
Water Transfer Facilities	Commercial/Industrial
Wholesaling and Warehousing	Commercial/Industrial
Communication Facilities	Commercial/Industrial
Navigation Aids	Commercial/Industrial
Other Public Facilities	Commercial/Industrial
Mineral Extraction - Oil and Gas	Commercial/Industrial
Mineral Extraction - Other Than Oil and Gas	Commercial/Industrial
Duplexes, Triplexes and 2-or 3-Unit Condominiums and Townhouses	High Density Residential
High-Density Single Family Residential	High Density Residential
High-Rise Apartments and Condominiums	High Density Residential
Low-Rise Apartments, Condominiums, and Townhouses	High Density Residential
Medium-Rise Apartments and Condominiums	High Density Residential
Mixed Multi-Family Residential	High Density Residential
Mixed Residential	High Density Residential
Trailer Parks and Mobile Home Courts, High-Density	High Density Residential
Other Special Use Facilities	High Density Residential
Special Care Facilities	High Density Residential
Colleges and Universities	Low Density Residential
Elementary Schools	Low Density Residential
Junior or Intermediate High Schools	Low Density Residential
Low-Density Single Family Residential	Low Density Residential
Mobile Home Courts and Subdivisions, Low-Density	Low Density Residential
Pre-Schools/Day Care Centers	Low Density Residential
Senior High Schools	Low Density Residential
Trade Schools and Professional Training Facilities	Low Density Residential
Rural Residential, High-Density	Rural Residential
Rural Residential, Low-Density	Rural Residential
Beach Parks	Urban Green Space
Beaches (Vacant)	Urban Green Space
Cemeteries	Urban Green Space
Developed Local Parks and Recreation	Urban Green Space
Developed Regional Parks and Recreation	Urban Green Space
Golf Courses	Urban Green Space
Other Open Space and Recreation	Urban Green Space
Specimen Gardens and Arboreta	Urban Green Space
Undeveloped Local Parks and Recreation	Urban Green Space

SCAG Land Cover Category	Reclassified Land Cover Category
Undeveloped Regional Parks and Recreation	Urban Green Space
Wildlife Preserves and Sanctuaries	Urban Green Space
Vacant Area	Vacant Urban
Vacant Undifferentiated	Vacant Urban
Vacant With Limited Improvements	Vacant Urban

Table 3. Crosswalk between SCAG and WHR agricultural classifications.

SCAG Land Cover Category	**Corresponding WHR Rating**
Orchards and vineyards (active and abandoned)	Deciduous orchard, Evergreen orchard, and Vineyard (mean rating)
Irrigated cropland and improved pasture land	Irrigated grain crops, Irrigated hayfield, Irrigated row and field crops (mean rating)
Non-irrigated cropland and improved pasture land	Dryland grain crops, and pasture (mean rating)
Horse ranches	Pasture
Dairy, intensive livestock, and associated facilities	Urban
Nurseries	Urban
Other agriculture	Urban
Packing houses and grain elevators	Urban
Poultry operations	Urban

Table 4. WHR Habitat Seral Stage and Density Class Codes

Habitat Type	Code	Description of Code
Alkali Desert Scrub	1	seedling shrub
Alpine Dwarf-Shrub	2S	young shrub sparse
Desert Scrub	2P	young shrub open
Desert Succulent Shrub	2M	young shrub moderate
Low Sage	3S	mature shrub sparse
	3P	mature shrub open
	3M	mature shrub moderate
	4S	decadent shrub sparse
	4P	decadent shrub open
	4M	decadent shrub moderate
Bitterbrush	1	seedling shrub
Chamise-Redshank Chaparral	2S	young shrub sparse
Coastal Scrub	2P	young shrub open
Mixed Chaparral	2M	young shrub moderate
Montane Chaparral	2D	young shrub dense
Sagebrush	3S	mature shrub sparse
	3P	mature shrub open
	3M	mature shrub moderate
	3D	mature shrub dense
	4S	decadent shrub sparse
	4P	decadent shrub open
	4M	decadent shrub moderate
	4D	decadent shrub dense
Annual Grass	1S	short herb sparse
Fresh Emergent Wetland	1P	short herb open
Perennial Grass	1M	short herb moderate
Saline Emergent Wetland	1D	short herb dense
Wet Meadow	2S	tall herb sparse
	2P	tall herb open
	2M	tall herb moderate
	2D	tall herb dense
Desert Riparian	1	seedling tree/shrub
	2S	small tree/shrub sparse
	2P	small tree/shrub open
	2M	small tree/shrub moderate
	2D	small tree/shrub dense
	3S	medium tree/shrub sparse
	3P	medium tree/shrub open
	3M	medium tree/shrub moderate
	3D	medium tree/shrub dense
	4S	large tree/shrub sparse
	4P	large tree/shrub open
	4M	large tree/shrub moderate
	4D	large tree/shrub dense
Aspen	1	seedling tree

Habitat Type	Code	Description of Code
Blue Oak Woodland	2S	sapling tree sparse
Blue Oak-Foothill Pine	2P	sapling tree open
Closed-Cone Pine-Cypress	2M	sapling tree moderate
Coastal Oak Woodland	2D	sapling tree dense
Douglas Fir	3S	pole tree sparse
Eastside Pine	3P	pole tree open
Eucalyptus	3M	pole tree moderate
Jeffrey Pine	3D	pole tree dense
Juniper	4S	small tree sparse
Klamath Mixed Conifer	4P	small tree open
Lodgepole Pine	4M	small tree moderate
Montane Hardwood	4D	small tree dense
Montane Hardwood-Conifer	5S	medium/large tree sparse
Montane Riparian	5P	medium/large tree open
Pinyon-Juniper	5M	medium/large tree moderate
Ponderosa Pine	5D	medium/large tree dense
Red Fir	6	multi-storied tree
Redwood		
Sierran Mixed Conifer		
Subalpine Conifer		
Valley Foothill Riparian		
Valley Oak Woodland		
White Fir		
Desert Wash	1	seedling tree/shrub
	2S	small tree/shrub sparse
	2P	small tree/shrub open
	2M	small tree/shrub moderate
	2D	small tree/shrub dense
	3S	medium tree/shrub sparse
	3P	medium tree/shrub open
	3M	medium tree/shrub moderate
	3D	medium tree/shrub dense
	4S	large tree sparse
	4P	large tree open
	4M	large tree moderate
	4D	large tree dense
Joshua Tree	1	seedling tree
	2S	small tree sparse
	2P	small tree open
	2M	small tree moderate
	3S	large tree sparse
	3P	large tree open
	3M	large tree moderate
Palm Oasis	1	seedling tree
	2S	small tree sparse
	2P	small tree open
	2M	small tree moderate

Habitat Type	Code	Description of Code
	2D	small tree dense
	3S	large tree sparse
	3P	large tree open
	3M	large tree moderate
	3D	large tree dense
Estuarine	1	pelagic
Marine	2O	subtidal organic
	2M	subtidal mud
	2S	subtidal sand
	2G	subtidal gravel/cobble
	2R	subtidal rubble/boulders
	2B	subtidal bedrock
	3O	intertidal organic
	3M	intertidal mud
	3S	intertidal sand
	3G	intertidal gravel/cobble
	3R	intertidal rubble/boulders
	3B	intertidal bedrock
	4O	shore organic
	4M	shore mud
	4S	shore sand
	4G	shore gravel/cobble
	4R	shore rubble/boulders
	4B	shore bedrock
Lacustrine	1	limnetic (Lacustrine), open water (Riverine)
Riverine	2O	submerged organic
	2M	submerged mud
	2S	submerged sand
	2G	submerged gravel/cobble
	2R	submerged rubble/boulders
	2B	submerged bedrock
	3O	periodic flooding organic
	3M	periodic flooding mud
	3S	periodic flooding sand
	3G	periodic floodinggravel/cobble
	3R	periodic flooding rubble/boulders
	3B	periodic flooding bedrock
	4O	shore organic
	4M	shore mud
	4S	shore sand
	4G	shore gravel/cobble
	4R	shore rubble/boulders
	4B	shore bedrock
Deciduous Orchard	1	seedling/sapling trees
Evergreen Orchard	2	young trees
	3	mature trees
Rice	1A	non-flooded open

Habitat Type	Code	Description of Code
	1B	non-flooded covered
	2S	flooded shallow
	2M	flooded medium depth
	2D	flooded deep
Barren	(N/A)	(NO STAGES DEFINED)
Dryland Grain Crops		
Irrigated Grain Crops		
Irrigated Hay Field		
Irrigated Row and Field Crops		
Pasture		
Urban		
Vineyard		

Species Accounts: Mammals

In alphabetical order by Latin name:

Coyote	**(*Canis latrans*)**
Agile Kangaroo Rat	**(*Dipodomys agilis*)**
Big Brown Bat	**(*Eptesicus fuscus*)**
Black-tailed Jackrabbit	**(*Lepus californicus*)**
Bobcat	**(*Lynx rufus*)**
California Vole	**(*Microtus californicus*)**
Long-tailed Weasel	**(*Mustela frenata*)**
Desert Woodrat	**(*Neotoma lepida*)**
Dusky-footed Woodrat	**(*Neotoma macrotis*)**
Bighorn Sheep	**(*Ovis canadensis nelsoni*)**
Little Pocket Mouse	**(*Perognathus longimembris*)**
Cactus Mouse	**(*Peromyscus eremicus*)**
Deer Mouse	**(*Peromyscus maniculatus)***
Mountain Lion	**(*Puma concolor*)**
American Badger	**(*Taxidea taxus*)**
Common Gray Fox	**(*Urocyon cinereoargenteus*)**

Coyote (*Canis latrans*)
Family: Canidae
Order: Carnivora
Class: Mammalia

WHR #: M146

Distribution:
The distribution of coyotes extends from Alaska and central Canada south to Panama (Jameson and Peeters 2004). They are found throughout the western states, typically in open habitats, but they may occur in many diverse habitats (Jameson and Peeters 2004).

Habitat:
Coyotes occur in a wide variety of habitats, including grasslands, deserts, and mountains (Bekoff and Gese 2003). Wilson and Ruff (1999) report that coyotes can be found in "…warm deserts to wet grasslands and plains, to colder climates at high elevations (up to about 3,000 m), to large cities such as Los Angeles, California". They can also be found in agricultural lands (California Interagency Wildlife Task Group 2002).

Food:
Coyotes are opportunistic, generalist predators who feed on primarily on jackrabbits (*Lepus* spp.), cottontails (*Sylvilagus* spp.), ground squirrels (*Spermophilus* spp.), other small mammals, fruits, insects, carrion, domestic sheep, and other domestic animals (Bekoff and Gese 2003, Jameson and Peeters 2004). Although coyotes may occasionally hunt medium-sized ungulates, they more commonly feed on these species when they scavenge the kills of larger predators (Bekoff and Gese 2003).

Ecology/Behavior:
In California, mating occurs primarily in February, and young are born about two months later (Jameson and Peeters 2004). Both parents remain with the litter until autumn, and family groups may be seen hunting together before the young disperse in early winter (Jameson and Peeters 2004). Dens are found in a variety of settings, including brush-covered slopes, steep banks, in boulder piles or under rock ledges, in thickets, and in hollow logs (Bekoff and Gese 2003), with dens often found on south-facing slopes (California Interagency Wildlife Task Group 2002).

Coyotes may be active throughout the day but activity peaks occur during crepuscular hours (Bekoff and Gese 2003). They are non-migratory (California Interagency Wildlife Task Group 2002). Coyotes are usually monogamous, with pair bonds sometimes lasting for years (Wilson and Ruff, 1999). Coyotes may live singly, in pairs, or in packs (Wilson and Ruff, 1999). Coyotes are territorial and, within packs, display a dominance hierarchy similar to that of wolves, although they tend to be less social than wolves (Bekoff and Gese 2003).

Coyote densities vary seasonally, geographically, and are very much influenced by the available prey base (Bekoff and Gese 2003). Home range sizes also vary greatly depending on prey type

and abundance and on pack size. Reported home range sizes vary from 2.7 – 68 km^2 and 2.1 – 27.9 km^2 for adult males and females, respectively (Bekoff and Gese 2003). Males and female seem to disperse in equal proportions and travel similar distances during dispersal (Wilson and Ruff 1999). Dispersal by young coyotes was reported to average 48 km in Minnesota (Berg and Chesness 1978), and the furthest dispersal distance recorded was 544 km (Carbyn and Paquet 1986).

Human activities (poisoning, trapping, vehicular collision) cause a great proportion of mortalities among coyotes, but predation by larger predators, disease, or starvation also cause mortalities (Bekoff and Gese 2003).

Rationale for its use as target species:
In southern California, coyotes were found to control the abundance and distribution of smaller predators (e.g., foxes, domestic cats), thereby increasing diversity and abundance of birds, small mammals, and reptiles (Soulé et al. 1988, Crooks and Soulé 1999). Coyotes are sensitive to highly fragmented habitat, and may serve as an indicator of connectivity in highly fragmented areas were other predators, such as bobcats and mountain lions, have already disappeared (Crooks 2002). Henke and Bryant (1999) also determined that the coyote was a keystone predator in Texas, where it was believed to shape faunal community structure.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab). We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	
Rural Residential	
Urban Green Space	
Vacant Urban	
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	

In addition, we identified patches of habitat that were < 2.1 km^2 large (the size of the smallest recorded home range) and those that were both > 1090 km (twice the furthest recorded dispersal distance) from a second patch and < 105 km^2 (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Bekoff, M. and E. M. Gese. 2003. Coyote. Pages 467-481 in Wild Mammals of North America, Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

Berg, W. E. and R. A. Chesness. 1978. Ecology of coyotes in northern Minnesota. Pages 229-247 in Coyotes: Biology, Behavior, and Management. M. Bekoff (ed.). Academic Press, New York. 384pp.

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Carbyn, L. N. and P. C. Paquet. 1986. Long distance movement of a coyote from Riding Mountain National Park. Journal of Wildlife Management 50:89.

Crooks, K. 2002. Relative sensitivities of mammalian carnivores to habitat fragmentation. Conservation Biology 16:488-502.

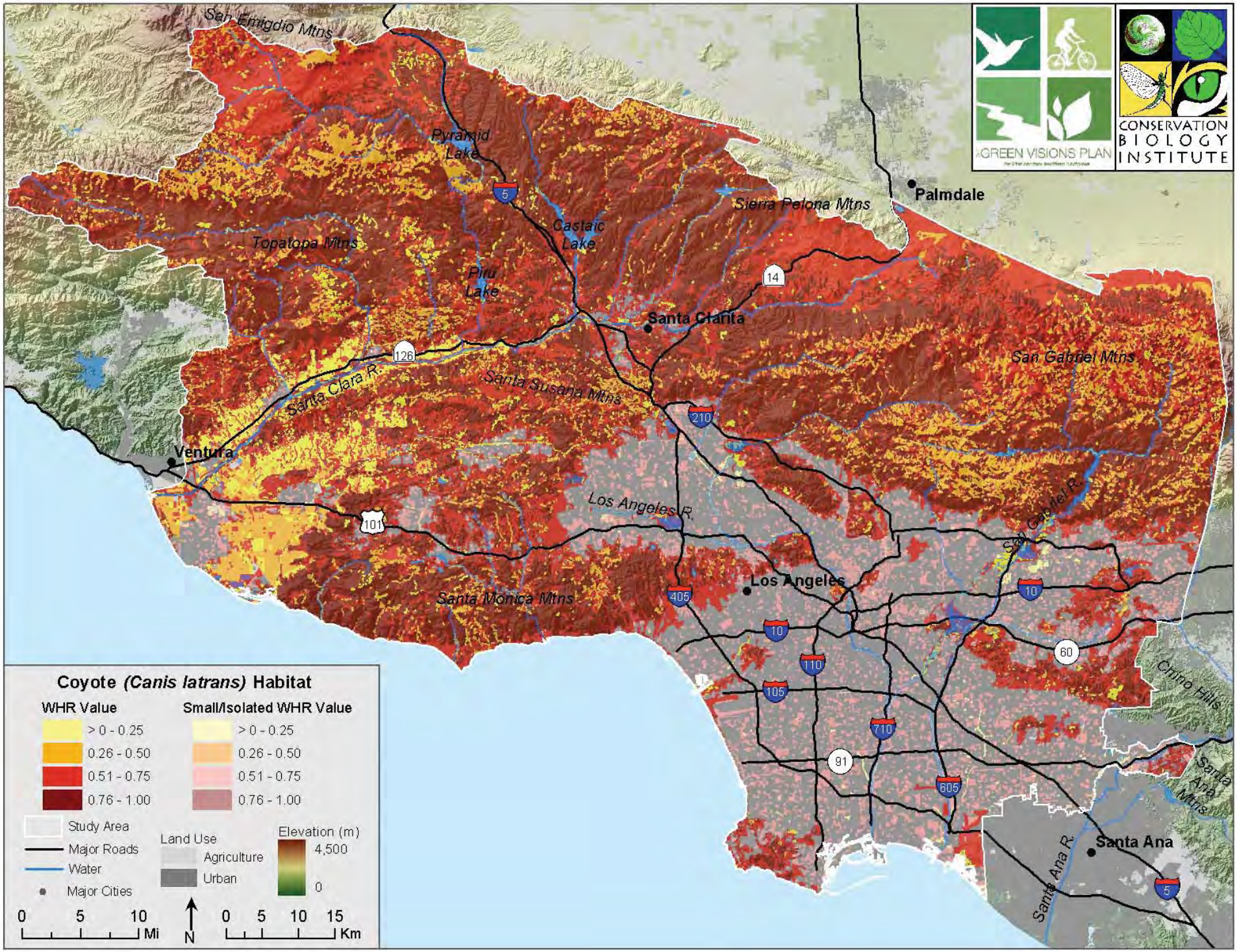
Crooks, K. R. and M. E. Soulé. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563-566.

Henke, S. E. amd F. C. Bryant. 1999. Effects of coyote removal on the faunal community in western Texas. Journal of Wildlife Management 63:1066-1081.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Soulé, M. E., D. T. Bolger, A. C. Alberts, J. Wright, M. Sorice, and S. Hill. Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. Conservation Biology 2:75-92.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
San Emigdio Mtns
Pyramid Lake
Castaic Lake
Sierra Pelona Mtns
Palmdale
Topatopa Mtns
Piru Lake
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
101
210
405
10
60
110
105
710
91
605
Coyote (Canis latrans) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Agile Kangaroo Rat (*Dipodomys agilis*)
Family: Heteromyidae
Order: Rodentia
Class: Mammalia

WHR #: M103

Distribution:
The distribution of this species extends from the South Coast Ranges, with its northern extent near the Santa Barbara-San Luis Obispo County line, south into northern Baja California, Mexico (Jameson and Peeters 2004). The range of this species is typically to the west of the Mojave and Colorado deserts (California Interagency Wildlife Task Group 2002), and includes parts of the San Gabriel and San Bernardino Mountains, as well as the Tehachapi and Piute Mountains (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002). Fossils believed to be from this species were found in Newport Bay Mesa and Rancho La Brea (Wilson and Ruff 1999).

Habitat:
Agile kangaroo rats inhabit sagebrush (*Artemisia* spp.), chaparral, desert scrub, and woodland habitats on sandy soils, and are most often found in open chaparral and coastal sage-scrub communities (Wilson and Ruff 1999, Jameson and Peeters 2004). They have also been found in montane coniferous forests (Sullivan and Best 1997). In the San Gabriel Mountains, they most frequently inhabit level tracts of coastal sage habitat, and may be one of the most abundant mammal species in this habitat (Wilson and Ruff 1999). The distribution of this species is usually limited to areas with loose soil, and these kangaroo rats are absent from heavy chaparral where plant debris and litter cover the ground, as on many north slopes (Wilson and Ruff 1999). A study conducted in western Riverside by Price et al. (1991) found that this species will feed in areas with greater shrub cover, and tended to avoid open areas more than the related Stephen's kangaroo rat (*D. stephensi*). This species is typically found at elevations between 800 and 2200 meters, with the closely related Dulzura kangaroo rat, *D. simulans*, typically occurring at elevations < 800 meters (Sullivan and Best 1997, Jameson and Peeters 2004).

Food:
This species feeds on the seeds of forbs, grasses, and shrubs such as laurel-sumac (*Rhus laurina*) and chamise. It is known to store seeds in underground caches and may, on occasion, eat insects (Jameson and Peeters 2004). It has also been observed caching scrub oak (*Quercus* spp.) acorns and juniper (*Juniperus* spp.) tree berries (Wilson and Ruff 1999).

Ecology/Behavior:
The breeding season is March to July (Wilson and Ruff 1999) and Jameson and Peeters (2004) reported that most young are born in June or early July.

Kangaroo rats are nocturnal and usually solitary (Wilson and Ruff 1999). Home ranges of kangaroo rats have been estimated to average 0.3 hectares (range 0.1-0.6; MacMillen 1964).

Females may be territorial during the breeding season (California Interagency Wildlife Task Group 2002).

Population densities in southern California were reported to range from 5 to 15 individuals/hectare in pinyon (*Pinus* spp.)-juniper habitat (Wilson and Ruff 1999), and densities of up to 45 individuals/hectare were recorded for the related Dulzura kangaroo rat in San Diego County (McClenaghan 1984). Little information is available on dispersal of *D. agilis* but a related species, Merriam's kangaroo rat (*D. merriami*), was reported to move up to 384 meters (Zeng and Brown 1987).

Coyotes (*Canis latrans*), rattlesnakes (*Crotalus* spp.), owls (e.g., *Bubo virginianus*), foxes (*Urocyon cinereoargenteus*), skunks (e.g., *Spilogale gracilis*), badgers (*Taxidea taxus*) and weasels (*Mustela frenata*) may be major predators of kangaroo rats (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002).

Rationale for its use as target species:
Kangaroo rats may act as important seed dispersers, particularly after fires (Borchert et al. 2003, Borchert 2004) and may, therefore, act as keystone species. They also represent a primary prey item for many predators in chaparral habitats. They are sensitive to fragmentation, as they would have difficulty crossing major roads and developed areas.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated a habitat map which included all pixels with a WHR rating > 0. However, we only included habitat at elevations ≥ 800 meters and with soils listed in the attached soils list, and excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	X
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 0.1 hectares (the size of the smallest recorded home range) and those that were both > 768 meters (approximately twice the furthest recorded dispersal distance) from a second patch and < 5.0 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Borchert, M. 2004. Vertebrate seed dispersal of *Marah macrocarpus* (Cucurbitaceae) after fire in the Western Transverse Ranges of California. Ecoscience 11:463-471.

Borchert, M., M. Johnson, D. S. Schreiner, and S. B. V. Wall. 2003. Early postfire seed dispersal, seedling establishment and seedling mortality of *Pinus coulteri* (D. Don) in central coastal California, USA. Plant Ecology 168:207-220.

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

MacMillen, R. E. 1964. Population ecology, water relations and social behavior of a southern California semidesert rodent fauna. University of California Publication in Zoology, Vol. 71, pp. 1-59.

McClenaghan, L. 1984. Comparative ecology of sympatric *Dipodomys agilis* and *Dipodomys merriami* populations in southern California USA. Acta Theriologica 29:175-185.

Price, M. V., W. S. Longland, and R. L. Goldingay. 1991. Niche relationships of Dipodomys agilis and D. stephensi, two sympatric kangaroo rats of similar size. American Midland Naturalist 126:172-186.

Sullivan, R.N., and T.L. Best. 1997. Systematics and morphological variation in two chromosomal forms of the agile kangaroo rat (*Dipodomys agilis*). Journal of Mammalogy, Vol. 78, No. 3, pp. 775-797.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.

Zeng, Z., and J.H. Brown. 1987. Population ecology of a desert rodent: *Dipodomys merriami* in the Chihuahuan Desert. Ecology, Volume 68, Issue 5, 1328-1340.

Soil Categories Included in Agile Kangaroo Rat Habitat (checked soil types are included)

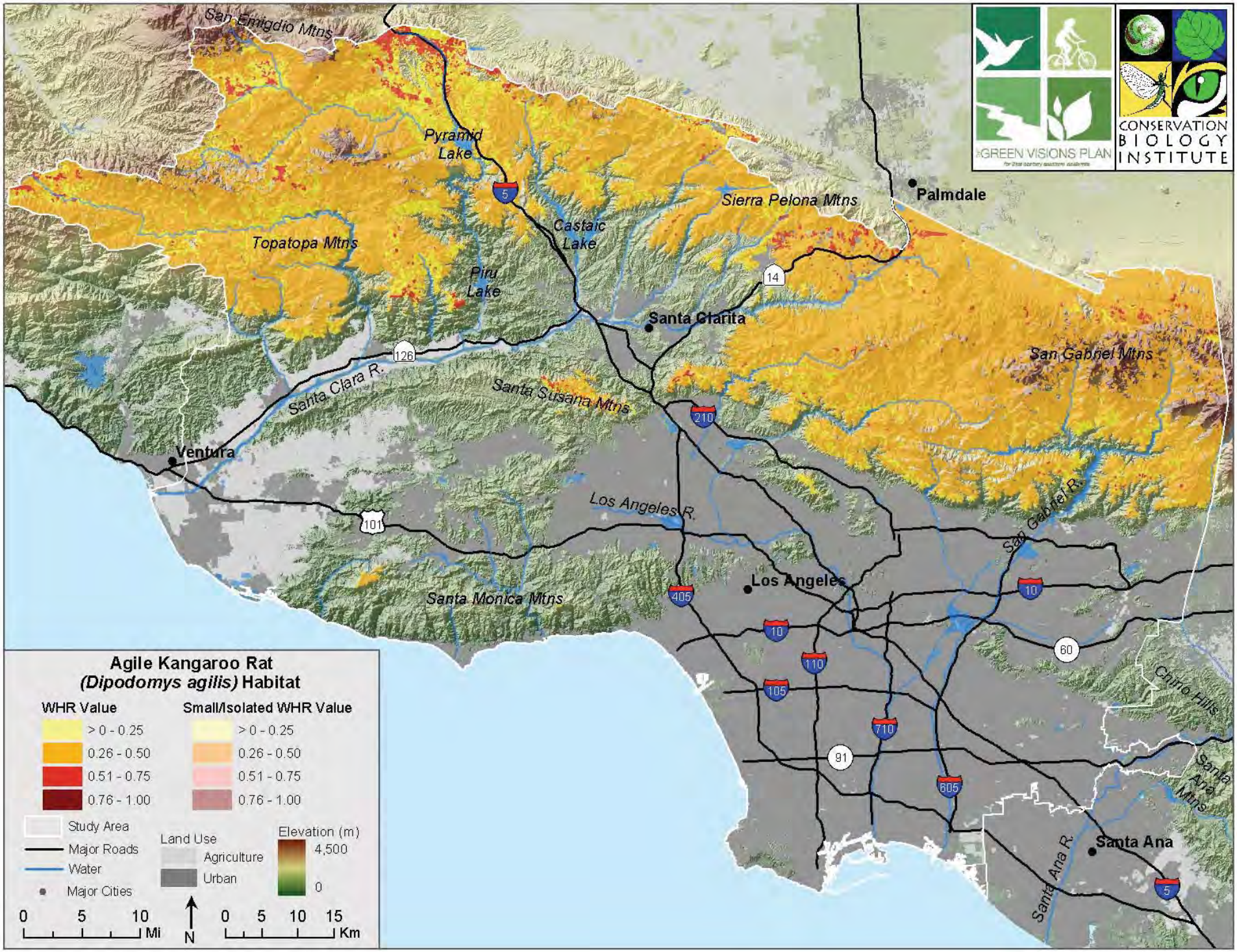
channery clay loam	
channery loam	
channery silty clay loam	
channery silty clay, silty clay	
Clay	
clay loam	x
clay loam, gravelly clay loam	x
clay loam, loam	x
clay loam, loam, sandy clay loam	x
clay loam, sandy clay	x
clay loam, sandy clay loam	x
clay loam, sandy clay loam, sandy loam	x
clay loam, silty clay loam	x
clay, clay loam	x
clay, clay loam, sandy clay	x
clay, clay loam, silty clay	x
clay, silty clay	x
coarse sand	x
coarse sand, fine sand, sand	x
coarse sand, sand	x
coarse sandy loam	x
coarse sandy loam, fine sandy loam	x
coarse sandy loam, fine sandy loam, sandy loam	x
coarse sandy loam, gravelly coarse sandy loam	x
coarse sandy loam, loamy sand, sandy loam	x
coarse sandy loam, sandy loam	x
cobbly clay loam	
cobbly clay loam, cobbly loam, cobbly sandy clay loam	
cobbly clay loam, gravelly clay loam, gravelly loam	
cobbly clay, gravelly clay	
cobbly loam	
cobbly loam, cobbly silt loam	
cobbly loamy sand	
cobbly sand, very gravelly sand	
cobbly sandy clay loam	
cobbly sandy clay loam, gravelly sandy clay loam	
cobbly sandy loam	
cobbly sandy loam, gravelly sandy loam	
extremely cobbly coarse sand	
extremely cobbly loam, very gravelly sandy loam	
extremely cobbly sandy loam, extremely stony sandy loam	
extremely cobbly sandy loam, very gravelly sandy loam	
extremely gravelly coarse sand	
extremely gravelly sand	

extremely stony	
extremely stony coarse sand	
fine sand	x
fine sand, sand	x
fine sandy loam	x
fine sandy loam, loam, sandy clay loam	x
fine sandy loam, loam, sandy loam	x
fine sandy loam, sandy loam	x
fine sandy loam, silt loam, very fine sandy loam	x
gravelly clay	
gravelly clay loam	x
gravelly clay loam, gravelly loam	x
gravelly clay loam, gravelly loam, gravelly sandy clay loam	x
gravelly clay loam, gravelly sandy clay loam	x
gravelly clay loam, sandy clay loam	x
gravelly coarse sand	
gravelly coarse sandy loam	x
gravelly coarse sandy loam, gravelly fine sandy loam, gravelly sandy loam	x
gravelly coarse sandy loam, gravelly loamy coarse sand	x
gravelly coarse sandy loam, gravelly sandy loam	x
gravelly loam	x
gravelly loam, gravelly sandy loam	x
gravelly loam, gravelly sandy loam, sandy loam	x
gravelly loam, gravelly silt loam	x
gravelly loam, gravelly very fine sand	x
gravelly loam, sandy clay loam	x
gravelly loamy coarse sand	x
gravelly loamy coarse sand, gravelly loamy sand	x
gravelly loamy sand	x
gravelly sandy clay	x
gravelly sandy clay	x
gravelly sandy clay loam	x
gravelly sandy clay loam, gravelly sandy loam	x
gravelly sandy clay loam, very gravelly sandy clay loam, very gravelly sandy loam	x
gravelly sandy loam	x
gravelly sandy loam, sandy loam	x
gravelly sandy loam, very gravelly sandy loam	x
gravelly silt loam	
gravelly very fine sandy loam	x
Indurated	
Loam	x
loam, sandy loam	x
loamy coarse sand	x
loamy coarse sand, loamy sand	x
loamy fine sand	x

loamy fine sand, loamy sand, sand	x
loamy sand	x
moderately decomposed plant material	
mucky clay	
mucky clay, mucky silty clay	
mucky peat, muck	
Sand	
sandy clay	x
sandy clay loam	x
sandy clay loam, sandy loam	x
sandy loam	x
silty clay	
silty clay loam	
silty clay loam, silty loam	
silty loam	x
slightly decomposed plant material	
stony clay loam	
stony clay loam, stony sandy clay loam	
stony fine sandy loam	x
stony loam	x
stony sandy loam	x
stratified clay loam	
stratified coarse sand to sandy loam	x
stratified extremely bouldery coarse sand to extremely cobbly coarse sand	x
stratified extremely stony coarse sand to very gravelly loamy sand	x
stratified fine sandy loam	x
stratified gravelly loamy coarse sand to loamy coarse sand	x
stratified gravelly loamy coarse sand to very fine sandy loam	x
stratified gravelly loamy sand to cobbly sandy loam	x
stratified gravelly sand to gravelly loam	x
stratified gravelly sand to gravelly loamy coarse sand	x
stratified gravelly sand to gravelly sandy loam	x
stratified gravelly sand to sandy loam	x
stratified gravelly sand to stony sand	x
stratified gravelly sandy loam to gravelly loam	x
stratified gravelly sandy loam to gravelly loamy sand	x
stratified loam to silty clay loam	x
stratified loamy fine sand to gravelly coarse sand	x
stratified loamy fine sand to silt loam	x
stratified loamy sand	x
stratified loamy sand to coarse sandy loam	x
stratified loamy very fine sand to silt loam	x
stratified sand to fine sand to loamy sand	x
stratified sand to fine sandy loam	x
stratified sand to loam	x

stratified sand to loamy sand	x
stratified sand to sandy clay loam	x
stratified sand to sandy loam	x
stratified sand to silty clay loam	x
stratified sand to silty loam	x
stratified sandy clay loam	x
stratified sandy loam	x
stratified sandy loam to clay loam	x
stratified sandy loam to loam	x
stratified sandy loam to sandy clay loam	x
stratified sandy loam to silty clay loam	x
stratified sandy loam to silty loam	x
stratified silty clay loam, stratified silty loam	
stratified very cobbly clay loam to very gravelly clay	
stratified very cobbly sand to very gravelly sand	
stratified very cobbly sandy loam to very gravelly sandy loam	x
stratified very gravelly clay loam to very cobbly clay	
stratified very gravelly coarse sand to gravelly loamy coarse sand	x
stratified very stony loamy sand to very stony loam	x
unweathered bedrock	
Variable	
very channery clay loam	
very channery loam	
very channery silty clay loam	
very cobbly clay loam	
very cobbly clay loam, very gravelly clay loam, very gravelly sandy clay loam	
very cobbly clay, very gravelly clay	
very cobbly loam	
very cobbly loam, very cobbly sandy loam	
very cobbly loam, very gravelly loam	
very cobbly loam, very gravelly loam, very gravelly sandy loam	
very cobbly loamy sand	
very cobbly loamy sand, very gravelly loamy sand	
very cobbly sandy clay loam	
very cobbly sandy loam	
very cobbly sandy loam, extremely cobbly sandy loam	
very cobbly sandy loam, very gravelly loam, very gravelly sandy loam	
very cobbly sandy loam, very gravelly sandy loam	
very fine sandy loam	x
very gravelly clay	
very gravelly clay loam	
very gravelly clay loam, extremely gravelly clay loam	
very gravelly clay loam, very gravelly loam	
very gravelly coarse sand	
very gravelly coarse sand, extremely gravelly coarse sand, extremely gravelly sand	

very gravelly coarse sandy loam	**x**
very gravelly fine sandy loam	**x**
very gravelly loam	**x**
very gravelly loam, extremely gravelly loam	**x**
very gravelly loam, loamy coarse sand	**x**
very gravelly loam, very gravelly sandy clay loam	**x**
very gravelly loam, very gravelly sandy loam	**x**
very gravelly loam, very gravelly sandy loam, very stony loam	**x**
very gravelly loamy sand	**x**
very gravelly loamy sand, extremely gravelly loamy sand	**x**
very gravelly loamy sand, very gravelly sandy loam	**x**
very gravelly sand	
very gravelly sandy clay loam	**x**
very gravelly sandy clay loam, extremely gravelly sandy clay loam	**x**
very gravelly sandy clay loam, very gravelly sandy loam	**x**
very gravelly sandy loam	**x**
very gravelly sandy loam, extremely gravelly sandy loam	**x**
very stony clay loam	
very stony loam	**x**
very stony loamy sand	**x**
very stony sandy loam	**x**
weathered bedrock	


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Sierra Pelona Mtns
Palmdale
Topatopa Mtns
Piru Lake
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Agile Kangaroo Rat
(Dipodomys agilis) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Big Brown Bat (*Eptesicus fuscus*)
Family: Vespertilionidae
Order: Chiroptera
Class: Mammalia

WHR #: M032

Distribution:
Big brown bats are found in southern Canada, throughout the United States, Central America, the extreme northern parts of South America, and in the West Indies Islands (Gannon 2003). Of 10 recognized subspecies, 8 are found north of Mexico (Gannon 2003). This species is found throughout California. In the colder parts of their range, it is possible that big brown bats migrate seasonally to spend winters at warmer latitudes (Gannon 2003).

Habitat:
Big brown bats have been found in nearly every North American vegetation type, but are uncommon in hot arid desert habitats and absent from very high alpine meadows and talus slopes (California Interagency Wildlife Task Group 2002). This species is believed to originally have been a forest dweller, using hollow trees for roosting during warmer months and hibernating in caves in the winter (Banfield 1974, cited in Nowak and Paradiso 1983). Over time, this species has increasingly used man-made structures for roosting, and is now very common in urban environments (Tuttle 1988). Some research suggests that this species roosts in trees more commonly in the southern United States, and uses buildings and caves more frequently in the northern United States (McNab 1982).

Big brown bats use a wide range of roosting sites. Nursery colonies have been found in hollow trees, caves, mines, buildings, and other man-made structures, and nursery roost sites may often be warmer than non-nursery roosting sites (California Interagency Wildlife Task Group 2002, Gannon 2003). In buildings, this species may roost behind chimneys, in wall spaces, or under eaves (Tuttle 1988). Selection of trees for roosting may vary geographically. In some areas big brown bats may roost either in tree hollows or under loose bark (Tuttle 1988). In one study, however, they selected south-facing tree cavities in trembling aspen (*Populus tremuloides*), which had been excavated by yellow-bellied sapsuckers (*Sphyrapicus varius*; Kalcounis and Brigham 1998, cited in Racey and Entwistle 2003).

This species forages for insects over woodlands, meadows, fields, urban parklands, water, and even around city lights (Gannon 2003). During nighttime foraging, bats may roost at "night roosts" between foraging bouts to ingest food, rest, or to find retreats from predators or inclement weather (Kunz and Lumsden 2003). Night roosts used by big brown bats are often different from their day roosts, and may be much closer to feeding areas than day roosts (Kunz and Lumsden 2003). The choice between using a day or night roosts during the night may be related to season, gender, reproductive status, and distance from day roosts to foraging areas. For example, Brigham (1991, cited in Kunz and Lumsded 2003) found that when big brown bats

foraged < 1 km away from day roosts, they used alternate night roosts only 25% of the time, but that when they foraged up to 4 km from their day roosts, they used night roosts 60% of the time.

Food:
Big brown bats forage for insects, mostly beetles, and consume their prey on the wing (Gannon 2003). They typically visit the same foraging areas consistently, and may rest at night roosts between foraging bouts during a given night (Gannon 2003).

Ecology/Behavior:
Big brown bats typically mate in fall and winter, and females store sperm until spring (Gannon 2003). They become pregnant at the end of hibernation in about March or April, and young are born about 60 days later (Tuttle 1988, Gannon 2003). Pregnant females form nursery colonies during summer, which may number from 12 to several 100 females, while males form separate bachelor colonies (Gannon 2003).

This species is not believed to disperse great distances after birth, with the average distance moved from place of birth being 32 km (Banfield 1974, cited in Nowak and Paradiso 1983). However, big brown bats have been known to travel 150 miles (240 km) between roosting sites and forage areas (Tuttle 1988), and females have been documented to move several hundred kilometers between hibernation and nursery roosts (Hill and Smith 1984). A long-distance move of 288 km was recorded in Ohio (Mills et al. 1975).

Little information on home range size was found for this species. Beer (1955) estimated that home range of this species to be 111 km^2. However, space use needs, such as home range size, are hard to define for bats since they are capable of traveling far distances, yet may use smaller disjunct patches of habitat or resources. Home ranges may also differ greatly between genders, seasons, and the juxtaposition of resources. It is also not clear if home ranges should be considered at the scale of an individual or a colony (Racey and Entwisle 2003).

Big brown bats may be preyed upon by owls, snakes, and hawks (California Interagency Wildlife Task Group 2002).

Rationale for its use as target species:
Big brown bats, along with most bats, are threatened primarily by loss of roosting sites. The seasonal concentration of bats in large numbers and the frequent reliance of big brown bats on human-made structures make their populations very susceptible to human disturbance or natural events such as fire or predation (Gannon 2002). Because the proximity of foraging sites to roosts is important, especially during parturition and lactation periods, the protection of both roosts and nearby foraging areas is important. Their prey base has been depleted by the use of insecticides (Gannon 2003) and, although this species may be more tolerant of human disturbance than other bat species, chronic disturbance may cause them to abandon roosts (California Interagency Wildlife Task Group 2002). This species, as well as other insectivorous bats, is beneficial to humans through its control of insect populations (Tuttle 1988). Forest management practices to maintain high densities of roosting trees can benefit this species (Kunz and Lumsden 2003).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	
Rural Residential	
Urban Green Space	
Vacant Urban	
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	
Nurseries	
Other agriculture	
Packing Houses and Grain Elevators	
Poultry Operations	

In addition, we identified patches of habitat smaller than 111 km^2 (the size of an estimated home range) as those less likely to be occupied as compared to larger patches. For other focal species in the Green Visions project we also identified patches that were isolated (defined as being greater than twice the greatest recorded dispersal distance from another patch) and smaller than 50 home ranges as being less likely to be inhabited. However, because big brown bats can travel great distances and live in large colonies, we did not apply this additional restriction to this species.

Bibliography:

Beer, J. R. 1955. Survival and movements of banded big brown bats. Journal of Mammalogy 36:242-248.

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Gannon, W. L. 2003. Bats. Pages 56-74 *in* Wild Mammals of North America: Biology, Management, and Conservation. Second Edition. Feldhamer, G. A., B. C. Thompson, and J. A. Chapman, (eds.). The John Hopkins University Press, Baltimore, Maryland. 1216pp.

Hill, J. E. and J. D. Smith. 1984. Bats: A Natural History. British Museum (Natural History), London. 243pp.

Kunz, T. H. and L. F. Lumsden. 2003. Ecology of cavity and foliage roosting bats. Pages 1-89 *in* Bat Ecology. T. H. Kunz and M. B. Fenton, (eds.). The University of Chicago Press, Chicago, Illinois. 779pp.

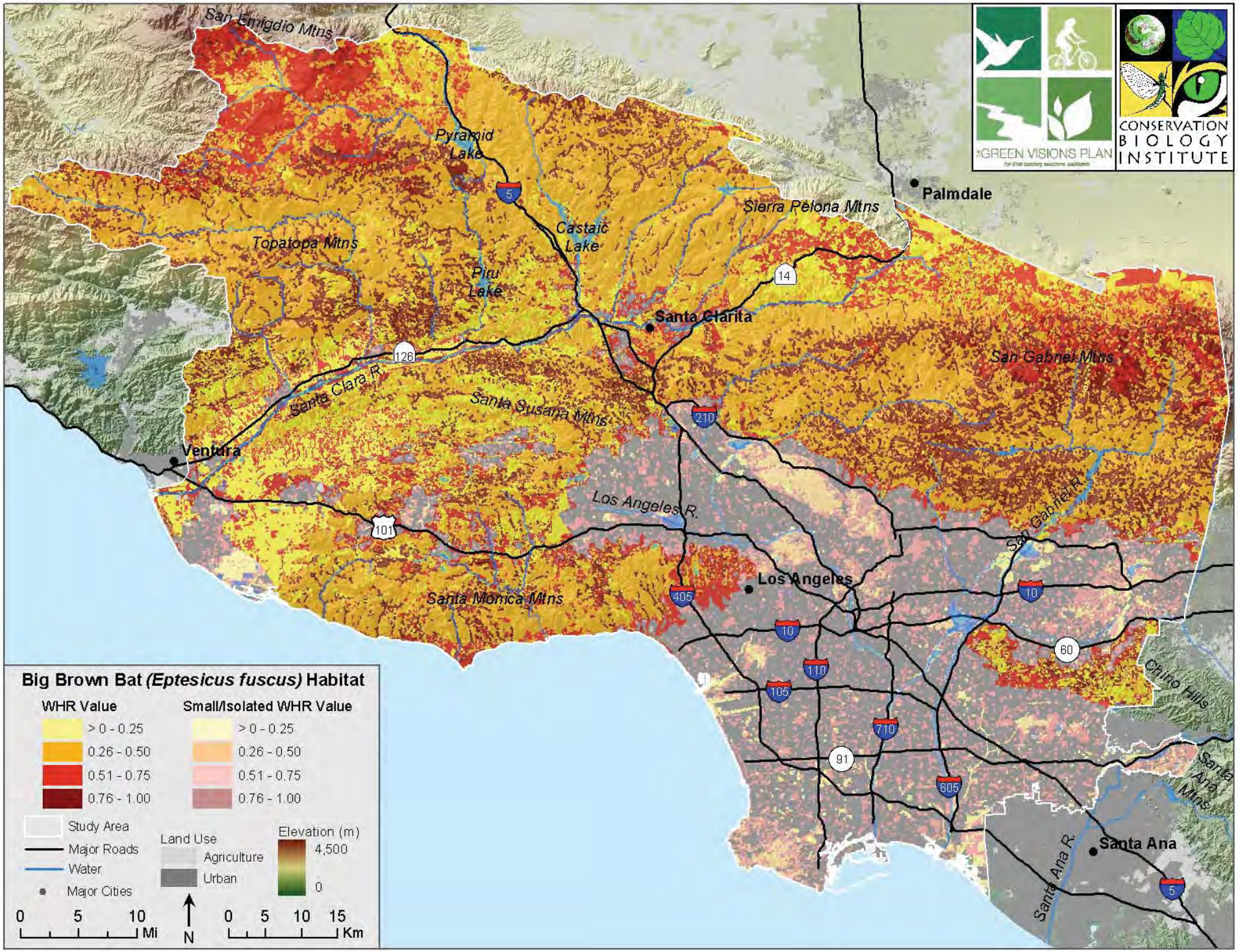
McNab, B. K. 1982. Physiological ecology. Pages 151-200 *in* T. H. Kunz (ed.). Ecology of Bats. Plenum Press, New York. 425pp.

Mills, R. S., G. W. Barrett, and M. P. Farrell. 1975. Population dynamics of the big brown bat (*Eptesicus fuscus*) in southwestern Ohio. Journal of Mammalogy 56:591-604

Nowak, R. M. and J. L. Paradiso. 1983. Walker's Mammals of the World. Fourth Edition. The John Hopkins University Press. Baltimore, Maryland. 568pp.

Racey, P. A. and A. C. Entwistle. 2002. Conservation Ecology of Bats. Pages 680-744 *in* Bat Ecology. T. H. Kunz and M. B. Fenton, (eds.). The University of Chicago Press, Chicago, Illinois. 779pp.

Tuttle, M. D. 1988. America's neighborhood bats. University of Texas Press, Austin. 96pp.


GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
San Emigdio Mtns
Pyramid Lake
Castaic Lake
Topatopa Mtns
Piru Lake
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana R.
Santa Ana
5
14
126
210
101
405
10
110
105
710
91
605
60
Big Brown Bat (Eptesicus fuscus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Black-tailed Jackrabbit (*Lepus californicus*)
Family: Leporidae
Order: Lagomorpha
Class: Mammalia

WHR #: M051

Distribution:
Black-tailed jackrabbits are distributed throughout much of the western United States, from the arid and semiarid regions of Oregon and south-central Washington south to central Mexico and Baja California, Mexico, and as far east as western Missouri and Arkansas (Flinders and Chapman 2003, Jameson and Peeters 2004). In California, they are widely distributed except for forested areas and the eastern slopes of high mountains, and can be found at elevations up to 1143 meters (Flinders and Chapman 2003, Jameson and Peeters 2004). A few disjunct populations occur along the eastern United States coastline, where they have been introduced (Flinders and Chapman 2003).

Habitat:
Black-tailed jackrabbits are found in grasslands, shrublands, early stages of forest and chaparral habitats, both cold and hot deserts, irrigated pastures, and in row crops (California Interagency Wildlife Task Group 2002, Flinders and Chapman 2003, Jameson and Peeters 2004). In Idaho, black-tailed jackrabbits were found to select open, grass-dominated habitats for feeding at night, and selected habitat with shrub cover during the day (Johnson and Anderson 1984). In California, they have been documented in sagebrush (*Artemisia* spp.)-creosote (*Larrea tridentata*) regions of the Mojave Desert, in creosote-scrub habitat in the Sonoran Desert, and in rangelands and cultivated agricultural areas, while they are found in mesquite (*Prosopis* spp.), snakeweed (*Gutierrezia* spp.), yucca (*Yucca* spp.), juniper (*Juniperus* spp.), and sagebrush dominated habitats in New Mexico and Utah (summarized in Flinders and Chapman 2003).

Food:
Black-tailed jackrabbits feed on a wide variety of vegetation, especially grasses and forbs, and many cultivated crops (Jameson and Peeters 2004). They prefer green succulent vegetation when it is available (Flinders and Chapman 2003), but in some harsh desert environments plants such as creosote, unpalatable to most animals, make up a great proportion of their diet (Wilson and Ruff 1999). Black-tailed jackrabbits may be able to obtain most or all of their water requirements from food (Wilson and Ruff 1999).

Ecology/Behavior:
In California, black-tailed jackrabbits may breed at any time of the year, but most breeding occurs during January through August, with peaks likely coinciding with periods of high food availability (Flinders and Chapman 2003, Jameson and Peeters 2004). Young are born after a gestation of about 43 days (Flinders and Chapman 2003). Black-tailed jackrabbits give birth in a "nest", which is merely a slight depression in the soil, usually under overhead vegetative cover (Flinders and Chapman 2003, Jameson and Peeters 2004).

Black-tailed jackrabbits are mostly nocturnal (Wilson and Ruff 1999) or crepuscular, but may feed during any time of the day (Flinders and Chapman 2003, Jameson and Peeters 2004). They are mostly solitary, except when mating or raising young (California Interagency Wildlife Task Group 2002).

Wilson and Ruff (1999) reported home ranges of 10 – 20 hectares, in accordance with home ranges sizes of less than 20.2 hectares reported by Lechleitner (1958) for a California population. In populations outside of California, home ranges were < 16.2 hectares in Idaho and 16.2 hectares in Kansas, while home ranges in Utah were found to be 73-183 hectares and 52-105 hectares for males and females, respectively (Flinders and Chapman 2003). Moves of up to 35 km in less than 10 days have been recorded, but typical distance traveled in 2-10 days was 5 km (Smith et al. 2002)

Populations fluctuations have been observed with peaks reached every 6-10 years (Wilson and Ruff 1999), and densities have fluctuated from 0.1/hectare to 1.0/hectare in Utah, and 0.4/hectare to 34.6/hectare in Kansas (Flinder and Chapman 2003). In California, densities of 3.0 individuals/hectare have been reported (Lechleitner 1958).

Black-tailed jackrabbits are preyed upon by a wide variety of avian and mammalian predators, including golden eagles (*Aquila chrysaetos*), bald eagles (*Haliaeetus leucocephalus*), and coyotes (*Canis latrans*). In some areas, a large proportion of mortalities is due to vehicular collision.

Rationale for its use as target species:
The San Diego black-tailed jackrabbit (*L. c. bennetti*) is a California State species of special concern (Jameson and Peeters 2004). Black-tailed jackrabbits represent an important prey item for other animals, and the persistence of some predator species such as the golden eagle is closely tied to presence of healthy black-tailed jackrabbit populations (Kochert et al. 1997, Marzluff et al. 1997). In addition, they may act as an important seed disperser (Flinders and Chapman 2003). As black-tailed jackrabbits are negatively impacted by habitat loss, a cascading effect will have negative impacts on their dependent predators.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded elevations > 1143 meters and the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	

Vacant Urban	
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 10 hectares large (the size of the smallest recorded home range), and those that were both > 70 km (twice the furthest recorded dispersal distance) from a second patch and < 500 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Flinders, J. T. and J. A. Chapman. 2003. Black-tailed Jackrabbit. Pages 126-146 in Wild Mammals of North America: Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Johnson, R. D. and J. E. Anderson. 1984. Diets of black-tailed jackrabbits in relation to population density and vegetation. Journal of Range Management 37:79-83.

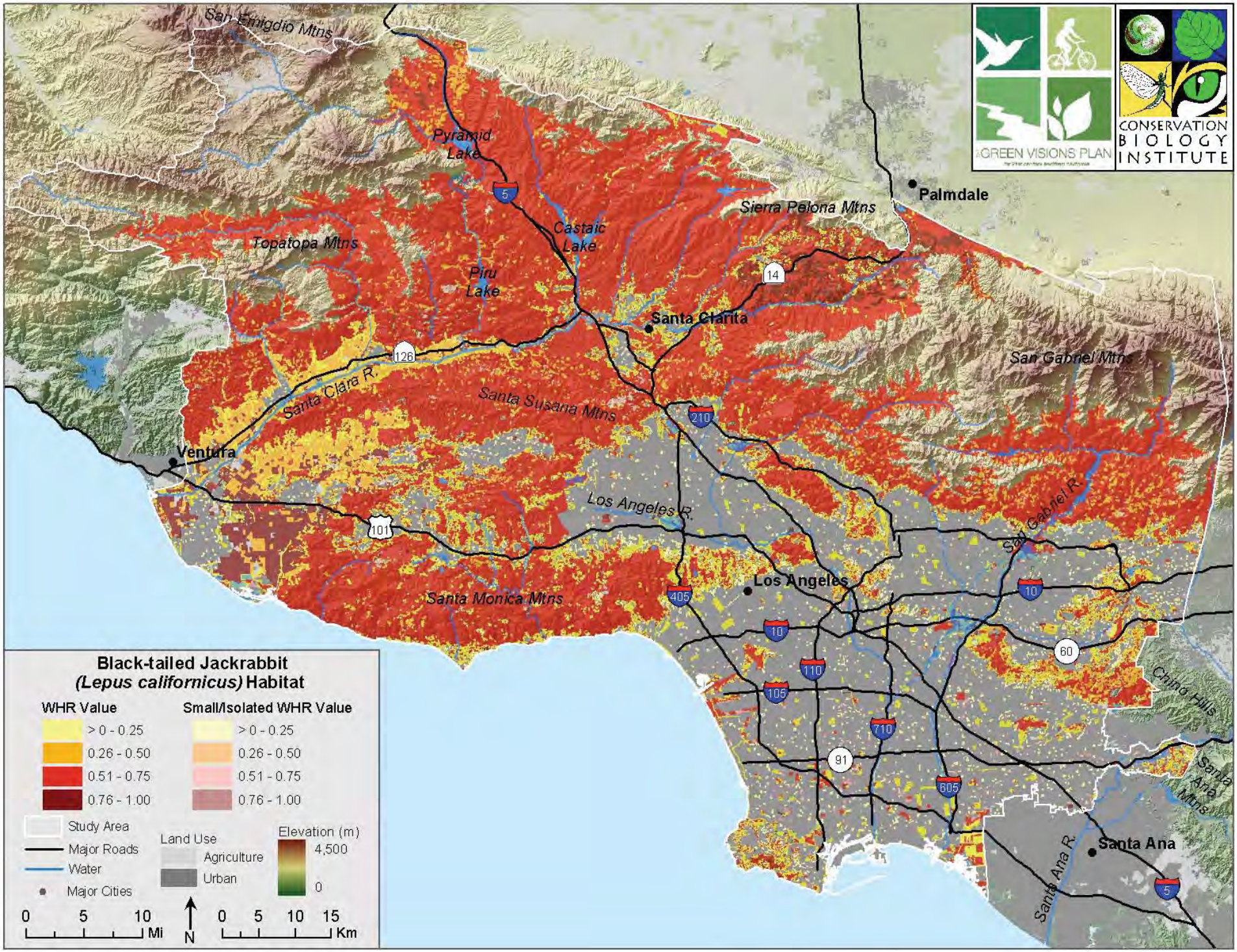
Kochert, M., K. Steenhof, and T. McDonald. 1997. Interactive effects of prey and weather on golden eagle reproduction. Journal of Animal Ecology 66:350.

Lechleitner, R. R. 1958. Movements, density, and mortality in a black-tailed jackrabbit population. Journal of Wildlife Management 22:371-384.

Marzluff, J., S. Knick, M. Vekasy, L. Schueck, and T. Zarriello. 1997. Spatial use and habitat selection of golden eagles in southwestern Idaho. Auk 114:673-687.

Smith, G., L. Stoddart, and F. Knowlton. 2002. Long-distance movements of black-tailed jackrabbits. Journal of Wildlife Management 66:463-469.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Topatopa Mtns
Piru Lake
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
China Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Black-tailed Jackrabbit
(Lepus californicus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Bobcat (*Lynx rufus*)
Family: Felidae
Order: Carnivora
Class: Mammalia

WHR #: M166

Distribution:
Bobcats are the most widely distributed native cat in North America, with a range from southern Canada to central Mexico (Anderson and Lovallo 2003, Jameson and Peeters 2004). In the United States, they occur in most states except for several states just south of the Great Lakes, where their distribution is limited (Anderson and Lovallo 2003). On the west coast they are common in British Columbia, Oregon, Washington, and California (Jameson and Peeters 2004).

Habitat:
Bobcats are found in a wide variety of habitats in southern California, from Death Valley to the high mountains, and are common in brushland, foothill chaparral, sagebrush, swamps, deserts, and forests (Wilson and Ruff 1999, Jameson and Peeters 2004). Although they may be found in any successional stage of these habitats, optimal habitats are brushy stages of low and mid-elevation conifer, oak, riparian, and pinyon-juniper forests, and all stages of chaparral (California Interagency Wildlife Task Group 2002). They prefer rough, rocky terrain interspersed with dense cover (Anderson and Lovallo 2003). Habitat choices may be driven by prey abundance, hunting opportunities by ambush and stalking, and by competition with other carnivores. Protection from severe weather, cover for resting and denning sites, and a lack of disturbance may also influence habitat selection (Anderson and Lovallo 2003). Habitat use may vary by region and habitat availability. The highest bobcat densities and smallest homeranges (presumably indicating high quality habitat) in one California study were in thick chaparral vegetation (Lembeck and Gould 1979), those in Arizona were in rough, dissected desert scrub and desert grasslands (Jones and Smith 1979), and in the Santa Monica Mountains of southern California bobcat abundance was greatest in riparian habitat (Fedriani et al. 2000). In Wisconsin, bobcats tended to use habitat near roads at lower frequency than expected by availability (Lovallo and Anderson 1996).

Food:
Bobcats are opportunistic carnivores whose diet is determined to a great extent by the availability of prey items (Jameson and Peeters 2004). They may eat rabbits (*Sylvilagus* spp.), hares (*Lepus* spp.), various squirrels and mice, pocket gophers (*Thomomys* spp.), mountain beaver (*Aplodontia rufa*), as well as reptiles, birds, fish, insects, and eggs (Anderson and Lovallo 2003, Jameson and Peeters 2004). Bobcats may also kill ungulates such as white-tailed deer (*Odocoileus virginianus*), pronghorn (*Antilocapra americana*), and bighorn sheep (*Ovis canadensis*), with young ungulates making up the greatest proportion killed (Anderson and Lovallo 2003). Bobcats have been observed to crouch near water sources and strike down bats as they fly low to drink (Jameson and Peeters 2004), and have used the same technique to hunt birds at desert waterholes (E. Rubin, personal observation).

Ecology/Behavior:
In California, bobcats usually give birth in spring or summer, after a gestation of about 50 days (Jameson and Peeters 2004); however, breeding season varies by latitude, climate, and prey availability (Anderson and Lovallo 2003). Kittens are often born in caves, rock shelters, dense piles of brush, and even abandoned buildings (Anderson and Lovallo 2003).

Bobcats are primarily nocturnal, but may be active at any time of the day (Wilson and Ruff 1999). Bobcats are primarily solitary, only joining others during the breeding season (Anderson and Lovallo 2003). Although bobcats are believed to be territorial, scent marking reduces the occurrence of actual contact or fighting (California Interagency Wildlife Task Group 2002). Female home ranges may overlap while male home ranges generally do not (California Interagency Wildlife Task Group 2002).

Home range sizes vary widely within and among studies, and are influenced by gender, habitat quality, and prey availability. Anderson and Lovallo (2003) summarized several studies, and reported home range sizes of 2.6 - 138.6 km^2 and 1.0 – 69.7 km^2 for males and females, respectively. In Riverside County, Zezulak and Schwab (1980, cited in California Interagency Wildlife Task Group 2002) reported that the home ranges of 7 individuals ranged from 4.7 - 53.6 km^2, with a mean of 26.3 km^2. Riley et al. (2003) reported mean home ranges of 1.30 - 3.99 km^2 in southern California. Crooks (2002) found that bobcats had less than 50% probability of occurrence in habitat patches smaller than 1.8 km^2. Throughout their range, reported bobcat densities ranged from 4 to 274 individuals per 100 km^2 (Wilson and Ruff 1999). Bobcats may move 1.2 – 4.5 km per day (Anderson and Lovallo 2003). Young bobcat males may disperse sooner and further than young females, and the maximum dispersal distance recorded was 182 km (Anderson and Lovallo 2003).

Throughout bobcat range, harvest by humans, both legal and illegal, is the primary cause of mortality (Anderson and Lovallo 2003). Other causes of mortality include starvation, predation by larger predators, disease, and vehicle collision (Anderson and Lovallo 2003).

Rationale for its use as target species:
Bobcats are sensitive to habitat fragmentation (Crooks 2002) so are good indicators of habitat connectivity. In addition, bobcats, in particular adult females, are more sensitive to habitat modification (urban development) than other carnivores such as coyotes and gray foxes (Riley et al. 2003), so they may be better indicators of habitat quality.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X

High Density Residential	X
Low Density Residential	
Rural Residential	
Urban Green Space	
Vacant Urban	
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

Although the WHR system does not rate urban areas as suitable habitat for this species, we included low-density residential, rural residential, and vacant lot as habitat with a suitability rating of 0.33, and included urban green space as habitat with a suitability rating of 0.44, as per expert reviewer recommendation.

In addition, we identified patches of habitat that were < 1.0 km^2 large (the size of the smallest recorded home range) and those that were both > 364 km (twice the furthest recorded dispersal distance) from a second patch and < 50 km^2 (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Anderson, E. M. and M. J. Lovallo. 2003. Bobcat and lynx. Pages 758-786 in Wild Mammals of North America, Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Crooks, K. R. 2002. Relative sensitivities of mammalian carnivores to habitat fragmentation. Conservation Biology 16:488-502.

Fedriani, J.M, T. K. Fuller, R. M. Sauvajot, and E. C. York. 2000. Competition and intraguild predation among three sympatric carnivores. Oecologia 125:258-270.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

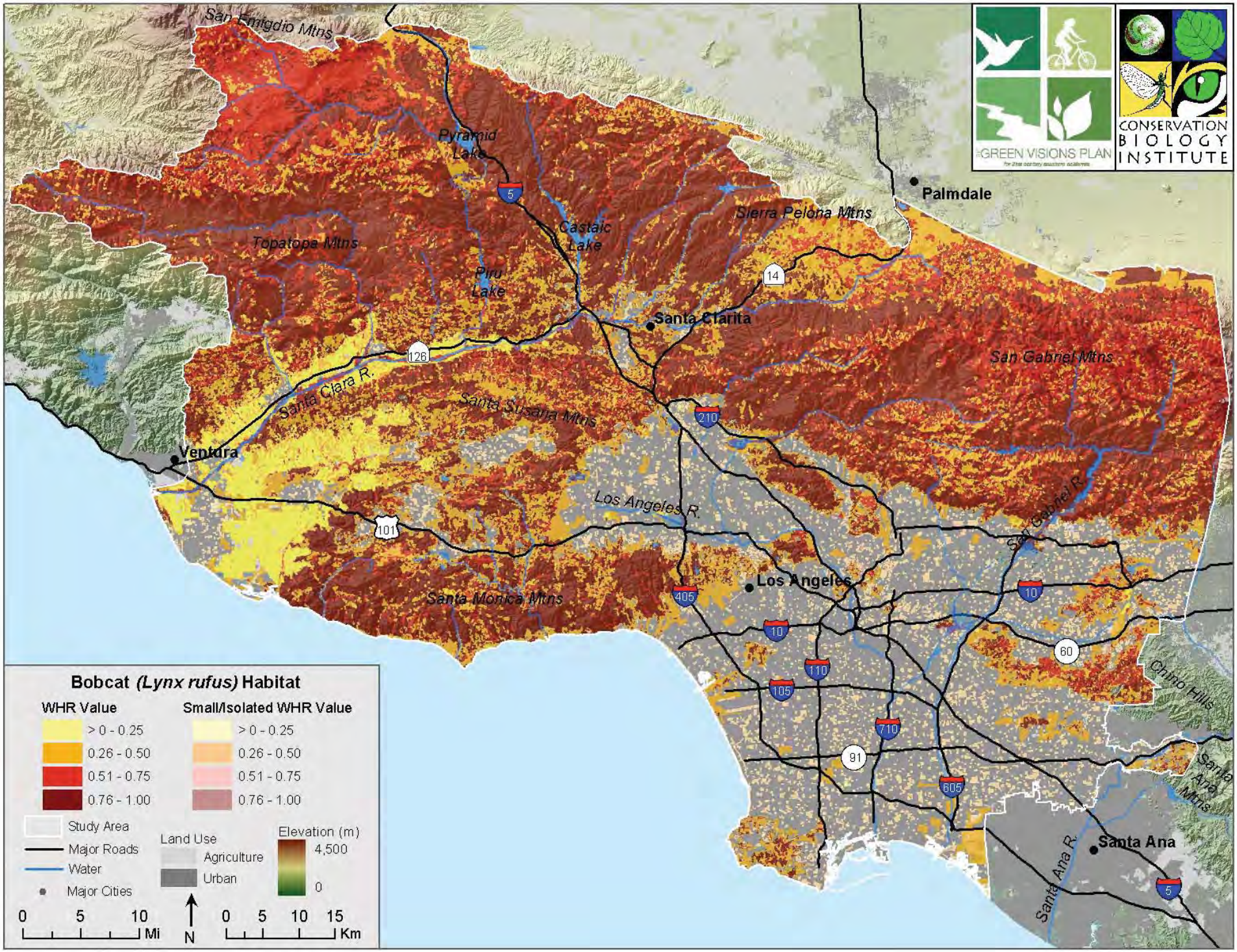
Jones, J. H. and N. S. Smith. 1979. Bobcat density and prey selection in central Arizona. Journal of Wildlife Management 43:666-672.

Lembeck, M. and G. I. Gould, Jr. 1979. Dynamics of harvested and unharvested bobcat populations in California. Pages 53-54 in Proceedings of the 1979 bobcat research conference (Science and Technology Series 6). P. C. Escherich and L Blum (eds). National Wildlife Federation, Washington, D.C.

Lovallo, M .J. and E. M. Anderson 1996. Bobcat (*Lynx rufus*) home range size and habitat use in northwest Wisconsin. American Midland Naturalist 135:241-252

Riley, S. P. D., R. M. Sauvajot, T. K. Fuller, E. C. York, D. A. Kamradt, C. Bromley, and R. K. Wayne. 2003. Effects of urbanization and habitat fragmentation on bobcats and coyotes in southern California. Conservation Biology 17:566-577.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
San Emigdio Mtns
Pyramid Lake
Castaic Lake
Piru Lake
Topatopa Mtns
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
101
210
405
10
60
110
105
710
91
605
Bobcat (Lynx rufus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

California Vole (*Microtus californicus*)
Family: Cricetidae
Order: Rodentia
Class: Mammalia

WHR #: M134

Distribution:
California voles are distributed throughout much of California as well as extreme southern Oregon and northern Baja California (Jameson and Peeters 2004). In California, they are found primarily in central and western parts of the state, from the Sierra Nevada and Cascades west to the Pacific Coast, and from Trinity, Mendocino, and Shasta counties south to San Diego County (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002). California voles are also found in the Owens Valley and disjunct populations in the Mojave Desert and White Mountain/Panamint ranges (Wilson and Ruff 1999). They are often found in lowland and foothill habitat and up to elevations of 1500 meters in the northern Sierra Nevada (Jameson and Peeters 2004).

Habitat:
California voles prefer wet meadows, usually in lowland or foothill habitats, but can also be found in irrigated meadows and agricultural fields such as alfalfa fields (Jameson and Peeters 2004), in coastal wetlands and open oak savannah with good ground cover (Wilson and Ruff 1999), and in early seral stages of montane riparian habitats (California Interagency Wildlife Task Group 2002). Pugh et al. (2003) report that optimal habitat contains consistent water availability and moisture-laden plant food, and friable soils are also an important habitat characteristic (California Interagency Wildlife Task Group 2002).

Most voles construct runways above ground, through litter and vegetation, and tunnels or burrows below ground (Pugh et al. 2003). Nests are often built under rocks, logs, hay bales, against fences, or in brush piles (Pugh et al. 2003).

Food:
California voles eat a wide range of forbs and grasses, and favor tender leaves and developing seeds. They do not usually eat insects (Jameson and Peeters 2004). Batzli and Pitelka (1971) report that the diet of California voles changes seasonally, with seeds and fruits comprising most of the summer diet, while leaves, stems, and roots of dicots are primary winter food items. Voles often are considered agricultural pests due to their food preferences (Pugh et al. 2003).

Ecology/Behavior:
California voles may be monogamous or polygynous (Lidicker 1980), can breed at any time of the year, and breeding is most likely to coincide with the sprouting of grasses and forbs (Jameson and Peeters 2004). Voles, in general, exhibit a wide range of social structures, and may be territorial in some but not all populations. Mating system, social structure, and spatial habitat use depend on the abundance and spatial distribution of food resources (Pugh et al. 2003).

California vole populations may exhibit large fluctuations in numbers over several years (Krebs 1966), and these fluctuations may be influenced by changes in food resources as well as predation patterns. Some coastal populations of California voles have been found to maintain stable densities of about 200 individuals per hectare with slight seasonal variation in density, while other populations show more fluctuation with densities peaking in excess of 450 per hectare (Wilson and Ruff 1999).

Male and female voles are both territorial (Pugh et al. 2003). Male home ranges are typically larger than those of females, and male home ranges may overlap with several female home ranges (Pugh et al. 2003). Although home range size varies with gender and density, home ranges of about 125 m^2 (0.0125 hectare) and 80 m^2 (0.008 hectare) have been reported for males and females, respectively (Wilson and Ruff 1999). In Monterey County, mean home ranges were 0.15 hectare (range 0.1 – 1.0 hectare; Fisler 1962 cited in California Interagency Wildlife Task Group 2002). This species may not persist in isolated patches smaller than 5-20 hectares (J. Diffendorfer, Illinois Natural History Survey, personal communication). Young animals of both sexes may disperse but males tend to disperse more than females (Pugh et al. 2003). Brant (1962, cited in California Interagency Wildlife Task Group 2002) reported movements of up to 34 m between recaptures.

California voles are active at all times of the year, and are primarily crepuscular or nocturnal (Pugh et al. 2003). Voles do not exhibit any kind of seasonal hibernation, daily torpor, or prolonged fasting (Pugh et al. 2003).

Voles are frequently preyed upon by avian predators, and are often reported as the primary prey for a number of predatory bird species (Pugh et al. 2003). They are also preyed upon by a wide variety of mammalian predators. Vole populations are also limited by competition, as niche-partitioning with other sympatric vole species is common (Pugh et al. 2003).

Rationale for its use as target species:
Voles represent an important, and sometimes primary, food source for a wide variety of predatory bird species (Pugh et al. 2003). In addition, plant species richness was associated with the presence of California vole burrow entrances in grasslands of coastal California (Fehmi and Bartolome 2002), and it was speculated that plant species diversity was a result of vole presence rather than voles seeking areas of high plant species diversity. As another example of vole presence benefiting other species, Ackerman (2002) suggested that the presence of adequate numbers of California voles may buffer predation on waterfowl nests, due to shared predators.
The distribution and ecology of California voles are closely tied to grasslands, and voles are therefore threatened by rapid development of grassland habitats. Lidicker (1980) suggested that dispersal is an important component of vole life history, suggesting that habitat fragmentation may also have a negative effect.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as

modified by species experts in this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded areas above 1500 meter elevation and the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	
Urban Green Space	
Vacant Urban	
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	
Other agriculture	
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 0.008 hectares (the size of the smallest recorded home range) and those that were both > 68 meters (twice the furthest recorded dispersal distance) from a second patch and < 5.0 hectares in size as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Ackerman, J. T. 2002. Of mice and mallards: positive indirect effects of coexisting prey on waterfowl nest success. Oikos 99:469-480.

Batzli, G. O. and F. A. Pitelka. 1970. Influence of meadow mouse populations on California grasslands. Ecology 51:1027-1039

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Fehmi, J. S. and J. W. Bartolome. 2002. Species richness and California voles in an annual and a perennial grassland. Western North American Naturalist 62:73-81.

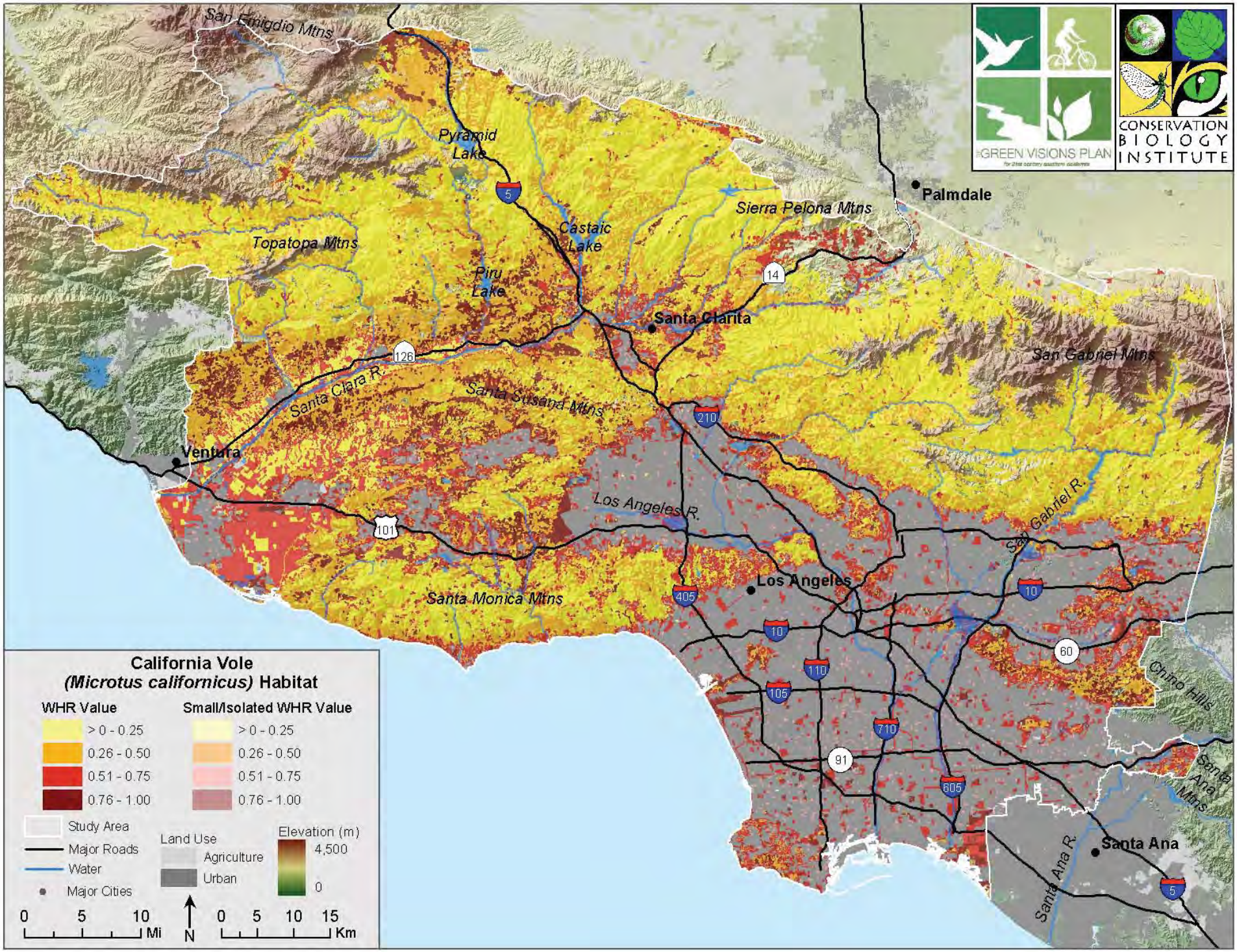
Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Krebs, C. J. 1966. Demographic changes in fluctuating populations of *Microtus californicus*. Ecological Monographs 36:239-273.

Lidicker, W. Z. Jr. 1980. The social biology of the California vole *Microtus californicus*. Biologist 62:46-55.

Pugh, S. R., S. Johnson, and R. H. Tamarin. 2003. Voles. Pages 349-370 in Wild Mammals of North America: Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Piru Lake
Topatopa Mtns
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
California Vole
(Microtus californicus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Long-tailed Weasel (*Mustela frenata*)
Family: Mustelidae
Order: Carnivora
Class: Mammalia

WHR #: M157

Distribution:
The range of the long-tailed weasel extends from southern Canada to southern Bolivia. In California, it is found statewide except for in the deserts (Jameson and Peeters 2004). It is found at elevations up to 3300 meters (Jameson and Peeters 2004).

Habitat:
The long-tailed weasel can be found in many types of habitat from alpine-arctic to tropical habitats, and favored habitats include brushland and open timber, brushy borders to fields, and grasslands along creeks and lakes, swamps, and cattail marshes (Wilson and Ruff 1999, Svendsen 2003). It does not inhabit extremely arid regions and the availability of water in summer appears to limit its distribution (Svendsen 2003). Long-tailed weasels are often absent from streamside habitat where mink (*M. vison*) are present (Jameson and Peeters 2004). Dens are often found in dense brushy vegetation in and around dry creeks and drainage ravines (Wilson and Ruff 1999).

Food:
The long-tailed weasel is an opportunistic predator and the diet includes small mice, pocket gophers (*Thomomys* spp.), ground squirrels (*Spermophilus* spp.), chipmunks (*Eutamias* spp.), small birds, bird eggs, and juvenile rabbits (*Sylvilagus* spp.; Wilson and Ruff 1999, Jameson and Peeters 2004). Its small head and slender body allow it to hunt in burrows and in small crevices.

Ecology/Behavior:
This species is polygynous and exhibits delayed implantation. Breeding occurs in mid-late summer, with young typically born in June (Wilson and Ruff 1999, Jameson and Peeters 2004). The female gives birth in a fur-lined nest, often in a fallen log, under piles of wood, or in a squirrel nest (Jameson and Peeters 2004). Nests may be found in trees or at ground level (California Interagency Wildlife Task Group 2002).

The long-tailed weasel may be active at any time of day, and has been observed to hunt at all hours (Jameson and Peeters 2004).

Long-tailed weasels are solitary and territorial, with males having larger home ranges than female home ranges (Svendsen 2003). A single male home range typically overlaps those of several females and males lacking territories are probably excluded from breeding (Svendsen 2003). Svendsen (2003) reported home ranges of 12-16 hectares, and Wilson and Ruff (1999) reported that home ranges may increase up to 80-160 hectares when prey is scarce. Long-tailed

weasels have been recorded at densities of 6-7 individuals/km^2 although population density likely fluctuates with season and food availability (Svendsen 2003).

Most long-distance moves coincide with breeding activity and males move more than females. A male of the related stoat (*M. erminae*) was recorded to travel 35 linear km in 7 months (Svendsen 2003). Wilson and Ruff (1999) suggested that waterways may be natural avenues for dispersal, especially when suitable habitat is limited.

Predators of long-tailed weasels are foxes (e.g., *Urocyon cinereoargenteus*), raptors, mink, martens (*Martes americana*), bobcats (*Felis rufus*), coyotes (*Canis latrans*), domestic dogs and cats, and rattlesnakes (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002).

Rationale for its use as target species:
Crooks (2002) found that the probability of their presence in a habitat patch was positively related to patch size but not patch isolation. However, Gehring and Swihart (2004) found that they were also sensitive to fragmentation, even that caused by agriculture, indicating that this species may be an indicator of both habitat quality and connectivity. Long-tailed weasels rely on a prey base of small mammals and birds, and may therefore be an indicator of prey abundance while playing an important role in limiting rodent populations.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	
Vacant Urban	
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	
Nurseries	X
Other agriculture	
Packing Houses and Grain Elevators	X
Poultry Operations	

In addition, we identified patches of habitat that were < 12 hectares large (the size of the smallest recorded home range) and those that were both > 70 km (twice the furthest recorded dispersal distance) from a second patch and < 600 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

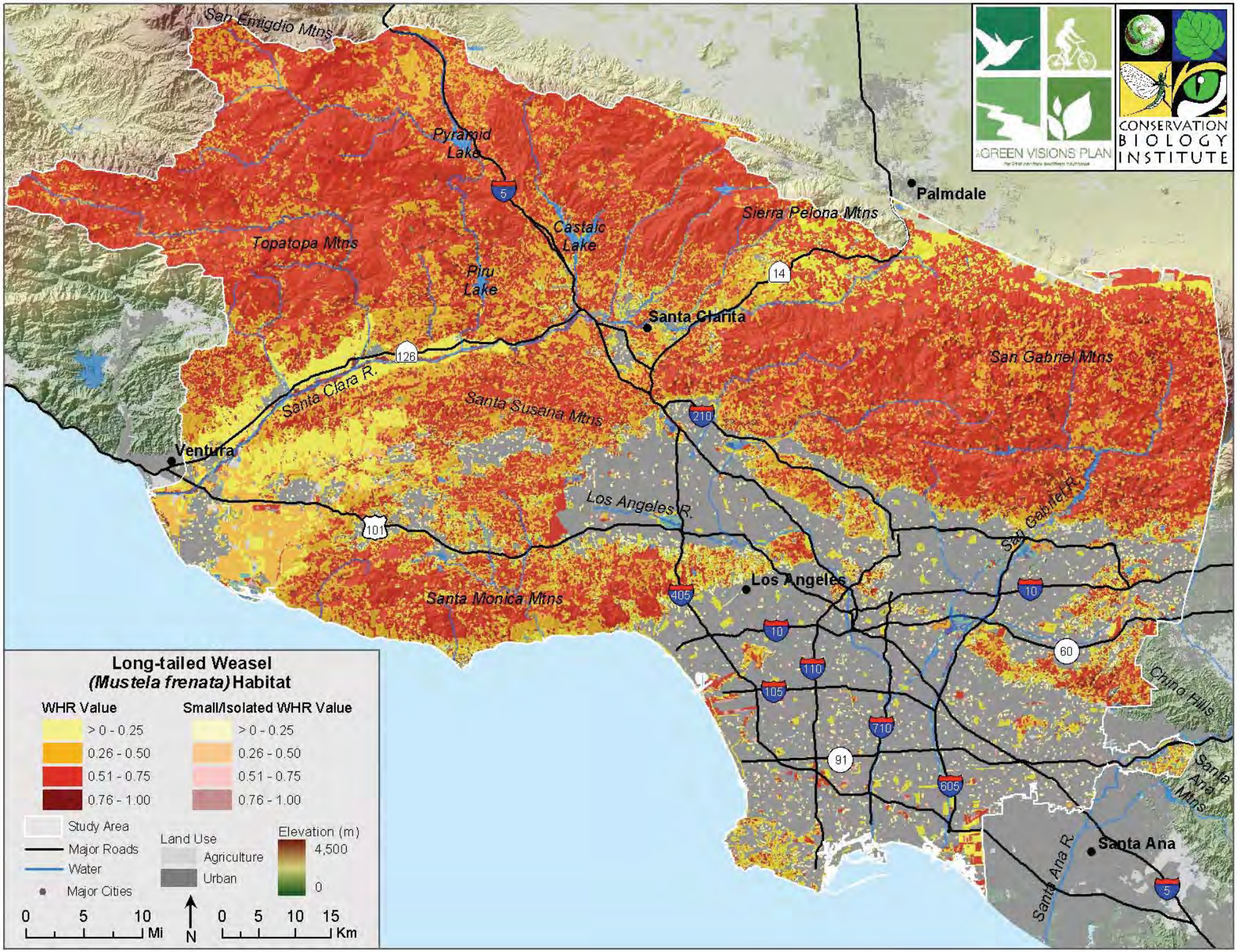
Crooks, K. 2002. Relative sensitivities of mammalian carnivores to habitat fragmentation. Conservation Biology 16:488-502.

Gehring, T. M. and R. K. Swihart. 2004. Home range and movements of long-tailed weasels in a landscape fragmented by agriculture. Journal of Mammalogy 85:79-86.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Svendsen, G. E. 2003. Weasels and black-footed ferrets. Pages 650-661 in Wild Mammals of North America, Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Piru Lake
Topatopa Mtns
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Long-tailed Weasel
(Mustela frenata) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Desert Woodrat (*Neotoma lepida*)
Family: Cricetidae
Order: Rodentia
Class: Mammalia

WHR #: M126

Distribution:
The range of the desert woodrat includes southeastern Oregon, Nevada, southwestern Idaho, western Utah, western Arizona, arid parts of California, northwestern Sonora, and Baja California, Mexico (Wilson and Ruff 1999, Jameson and Peeters 2004). In California, this species is found in two disjunct areas. It is found in northeastern California in the Great Basin areas of eastern Modoc County to southern Lassen County. It also inhabits nearly all of southern California from sea level to about 2600 meter elevation, with the range extending north along to coast to Monterey County (California Interagency Wildlife Task Group 2002).

Habitat:
This species is found in a variety of habitats, including coastal sage scrub, mixed and chamise (*Adenostoma fasciculatum*)-redshank (*A. sparsifolium*) chaparral, piñyon (*Pinus* spp.)-juniper (*Juniperus* spp.), juniper-sagebrush (*Artemisia* spp.), and most desert habitats, especially near rocky outcrops (Stones and Hayward 1968, Wilson and Ruff 1999, Jameson and Peeters 2004). In Colorado, desert wood rats were found to prefer rocky habitat (Monty and Emerson 2003), and the California Interagency Wildlife Task Group (2002) reported that this species prefers moderate to dense canopies, especially near rock outcrops and cliffs. In the desert it is often associated with cholla (*Opuntia* spp.), yucca (*Yucca* spp.), and other desert succulents which provide water, food, and shelter (Jameson and Peeters 2004). In the Mojave Desert, desert woodrats houses were found primarily around the bases of Mojave yucca (*Y. schidigera*) and buckhorn cholla (*O. acanthocarpa*, Smith 1995)

In mountainous habitat this species is often replaced by the bushy-tailed woodrat (*N. cinerea*), and it is sympatric with the dusky-footed woodrat (*N. fuscipes*) in some areas (Jameson and Peeters 2004).

Food:
The desert woodrat feeds on a wide variety of leaves, seeds, bark, and berries of many forbs and shrubs (Jameson and Peeters 2004). Preferred food items, depending on location, include live oak (*Quercus* spp.), chamise, buckwheat (*Eriogonum* spp.), creosote (*Larrea tridentate*), cholla, and prickly pear (*Opuntia* spp.; Cameron and Rainey 1972, cited in California Interagency Wildlife Task Group 2002). In Utah, foliage and berries of juniper trees were the most abundant items in food caches but Mormon tea (*Ephedra* spp.), rattlesnake weed (*Chamaesyce albomarginata*), mustard (*Brassica* spp.), sagebrush, and buckwheat were also eaten (Stones and Hayward 1968). Wilson and Ruff (1999) reported that this species has relatively high water requirements which it meets by eating succulent vegetation.

Ecology/Behavior:
Desert woodrats breed and give birth in fall, winter, and spring, and young are born in a stick house (Jameson and Peeters 2004). Nesting is generally solitary (California Interagency Wildlife Task Group 2002).

Nests, or "houses", are built of sticks, leaves, cactus spines, and other debris, often under the cover of rock ledges or at the base of vegetation such as yuccas and junipers (Stones and Hayward 1968, Jameson and Peeters 2004). Radiocarbon dating has determined that these houses may persist for thousands of years (Jameson and Peeters 2004).

Desert woodrats are primarily nocturnal (Wilson and Ruff 1999) and territorial (California Interagency Wildlife Task Group 2002). In coastal sage habitat , home range sizes ranged from 0.04 to 0.2 hectares and density averaged 30 individuals/hectare (Bleich and Schwartz 1975). In sagebrush-juniper habitat, males moved 80 meters per night while females moved 45 meters per night (Stones and Hayward 1968). Little is known about dispersal distances; however, Smith (1965) found that the related dusky-footed woodrat (*N. fuscipes*) moved up to 1600 meters within 5 nights after being displaced.

Desert woodrats are preyed upon by a large number of species, including owls (e.g., *Bubo virginianus*), coyotes (*Canis latrans*), bobcats (*Lynx rufus*), and possibly snakes (California Interagency Wildlife Task Group 2002).

Rationale for its use as target species:
The San Diego desert woodrat (*N. l. intermedia*) is a California subspecies of special concern (Jameson and Peeters 2004). Because desert woodrats do not occur in urban or agricultural areas they may be a good indicator of undisturbed habitats. Desert wood rats are an important prey item for other species. In addition, other small mammals, reptiles, and amphibians are known to use woodrat houses (California Interagency Wildlife Task Group 2002).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	X

Non-irrigated Cropland and Improved Pasture Land	X
Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 0.04 hectares (the size of the smallest recorded home range) and those that were both > 3200 meters (twice the furthest recorded dispersal distance) from a second patch and < 2.0 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Bleich, V. C. and O. A. Schwartz. 1975. Observations on the home range of the desert woodrat, *Neotoma lepida intermedia*. Journal of Mammaolgy 56:518-519.

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Cranford, J. A. 1977. Home range and habitat utilization by Neotoma fuscipes as determined by radiotelemetry. Journal of Mammalogy 58:165-172.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Monty, A. and R. E. Emerson. 2003. Eastern Woodrat. Pages 381-393 in Wild Mammals of North America: Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

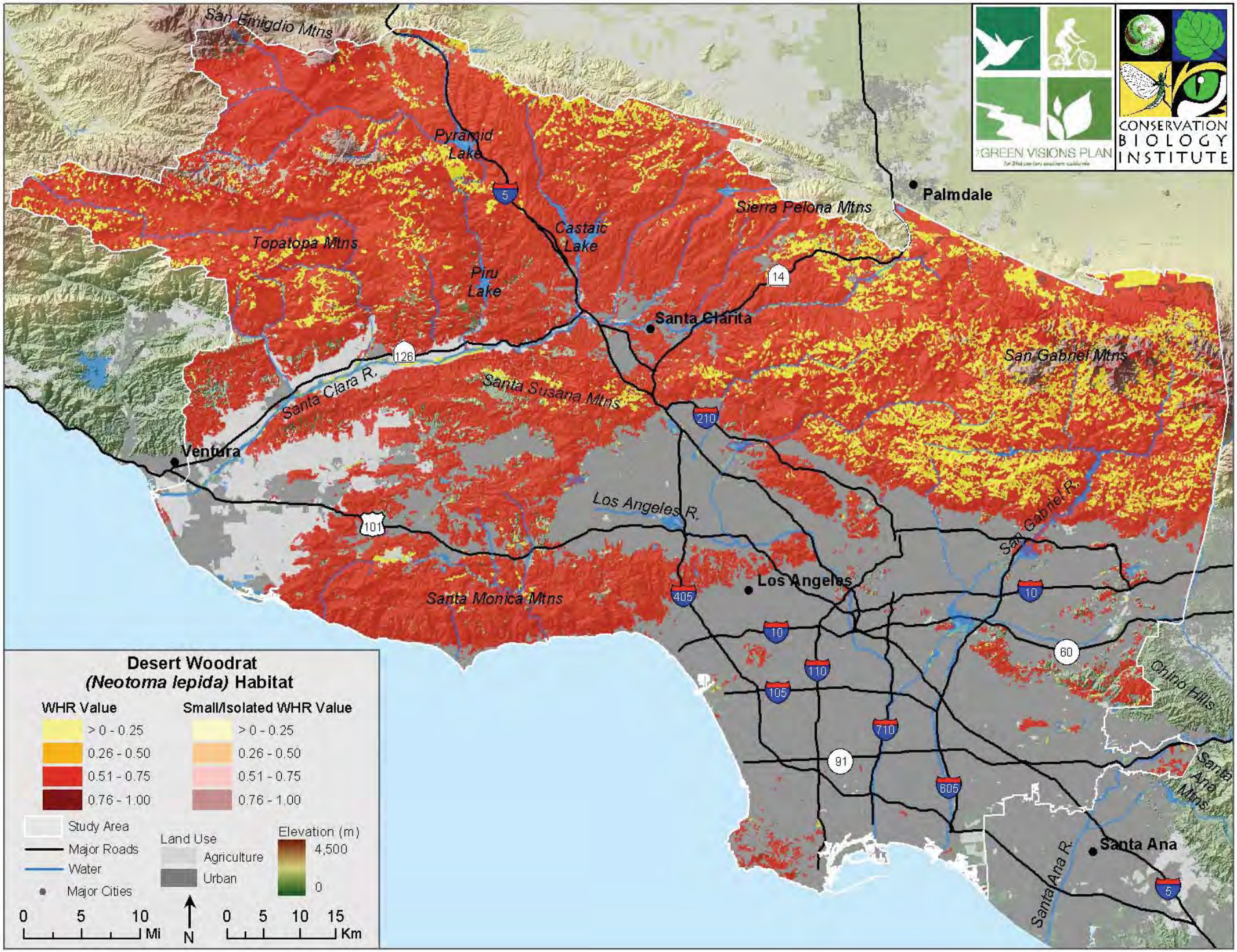
Smith, M. H. 1965. Dispersal capacity of the dusky-footed woodrat, *Neotoma fuscipes*. American Midland Naturalist 74:457-465.

Smith, F. A. 1995. Den characteristics and survivorship of woodrats (*Neotoma lepida*) in the eastern Mojave Desert. Southwestern Naturalist 40:366-372.

Stones, R. C. and C. L. Hayward. 1968. Natural history of the desert woodrat, *Neotoma lepida*. American Midland Naturalist 80:458-476.

Ward, J. P. Jr., R. J. Gutierrez, and B. R. Noon. 1998. Habitat selection by northern spotted owls: the consequences of prey selection and distribution. Condor 100:79-92.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Sierra Pelona Mtns
Palmdale
Topatopa Mtns
Piru Lake
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Desert Woodrat
(Neotoma lepida) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Dusky-footed Woodrat (*Neotoma macrotis*)
Family: Cricetidae
Order: Rodentia
Class: Mammalia

WHR #: M127

Distribution:
Dusky-footed woodrats are found from western Oregon south into northern Baja California, Mexico, generally below elevations of 2150 meters (California Interagency Wildlife Task Group 2002, Monty and Emerson 2003). In California, this species is absent from the Central Valley, areas east of the Sierra Nevada, and from arid desert areas (Jameson and Peeters 2004).

Habitat:
Dusky-footed woodrats are reported to occur in hardwood forests and brushlands (Jameson and Peeters 2004), and are often found in dense chaparral, sclerophyll woodland, riparian woodland, mixed deciduous forest with dense understory, and in mixed coniferous forests (Wilson and Ruff 1999). Numbers tend to be highest in brushy areas and along forest edges, and population declines occur when underbrush is removed (Monty and Emerson 2003). This species is generally absent from cultivated land and open grasslands such as in the Central Valley (California Interagency Wildlife Task Group 2002). *N. fuscipes* may be sympatric in some areas with the desert woodrat (*N. lepida*).

Food:
This species eats many types of leaves, flowers, nuts, and berries, and especially favors the leaves and berries of coffeeberry (*Rhamnus californica*), poison oak (*Toxicodendron diversilobum*), blackberry , and roses (Jameson and Peeters 2004). Other favored species are live oak (*Quercus* spp.), maple (*Acer* spp.), alder (*Alnus* spp.), and elderberry (*Sambucus* spp.; Linsdale and Tevis 1951, cited in California Interagency Wildlife Task Group 2002). It also eats hypogeous fungi during spring (Jameson and Peeters 2004). This species is known to forage in trees high above the ground (Jameson and Peeters 2004).

Ecology/Behavior:
Dusky-footed woodrats breed primarily in the winter and spring (Jameson and Peeters 2004). They are nocturnal, generally solitary, and territorial (Wilson and Ruff 1999).

Dusky-footed woodrats build large nests, or "houses", of twigs, leaves, and other debris, which are often on the ground in thickets such as poison oak, but may also be found in trees (Jameson and Peeters 2004), on brushy hillsides, or below rocky bluffs (Monty and Emerson 2003). Other rodent species such as *Peromyscus truei*, *P. maniculatus*, and *P. californicus* often use the nests built by dusky-footed woodrats (Wilson and Ruff 1999). Several woodrats may use the same house in succession over long periods of time (Wilson and Ruff 1999). Availability of nest-building materials may limit population densities, as nests are defended against conspecifics and

competition for nests is reported to be constant and intense (Linsdale and Tevis 1951, cited in California Interagency Wildlife Task Group 2002).

Reported home range sizes were 0.23 hectare and 0.19 hectare for males and females, respectively (Cranford 1977), and these may vary depending on forage quality, age, and season (Jameson and Peeters 2004). Population densities of 5 to 35 individuals per hectare have been recorded, with higher densities in closed-canopy woodlands than in open habitats (Wilson and Ruff 1999). Seven to 37 woodrat houses have been recorded per hectare (Wilson and Ruff 1999). Males disperse further than females (Wilson and Ruff 1999), however, little data is available on dispersal distance. Males of the related desert woodrat (*N. lepida*) were documented to move 80 meters per night while females moved 45 meters per night in sagebrush-juniper habitat (Stones and Hayward 1968). Smith (1965) found that displaced dusky-footed woodrats traveled a maximum of 1600 meters during a 5-night period.

Dusky-footed woodrats are preyed upon by a large number of species, including owls (e.g., *Bubo virginianus*), coyotes (*Canis latrans*), bobcats (*Lynx rufus*), and possibly snakes (California Interagency Wildlife Task Group 2002).

Rationale for its use as target species:
The Riparian woodrat (*N. f. riparia*), found in the San Joaquin Valley, is a federally listed species and is a California subspecies of special concern (Jameson and Peeters 2004). Two other subspecies, the San Francisco dusky-footed woodrat (*N. f. annectens*) and the Monterey dusky-footed woodrat (*N. f. luciana*) are also California subspecies of special concern (Jameson and Peeters 2004). Dusky-footed woodrats are an important prey item for other species such as spotted owls (Ward et al. 1998). In addition, other small mammals, reptiles, and amphibians are known to use woodrat houses (California Interagency Wildlife Task Group 2002). Grazing, brush removal, and fire may all be detrimental to this species (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	X

Non-irrigated Cropland and Improved Pasture Land	X
Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 0.19 hectares (the size of the smallest recorded home range) and those that were both > 3200 meters (twice the furthest recorded dispersal distance) from a second patch and < 9.5 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Cranford, J. A. 1977. Home range and habitat utilization by *Neotoma fuscipes* as determined by radiotelemetry. Journal of Mammalogy 58:165-172.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

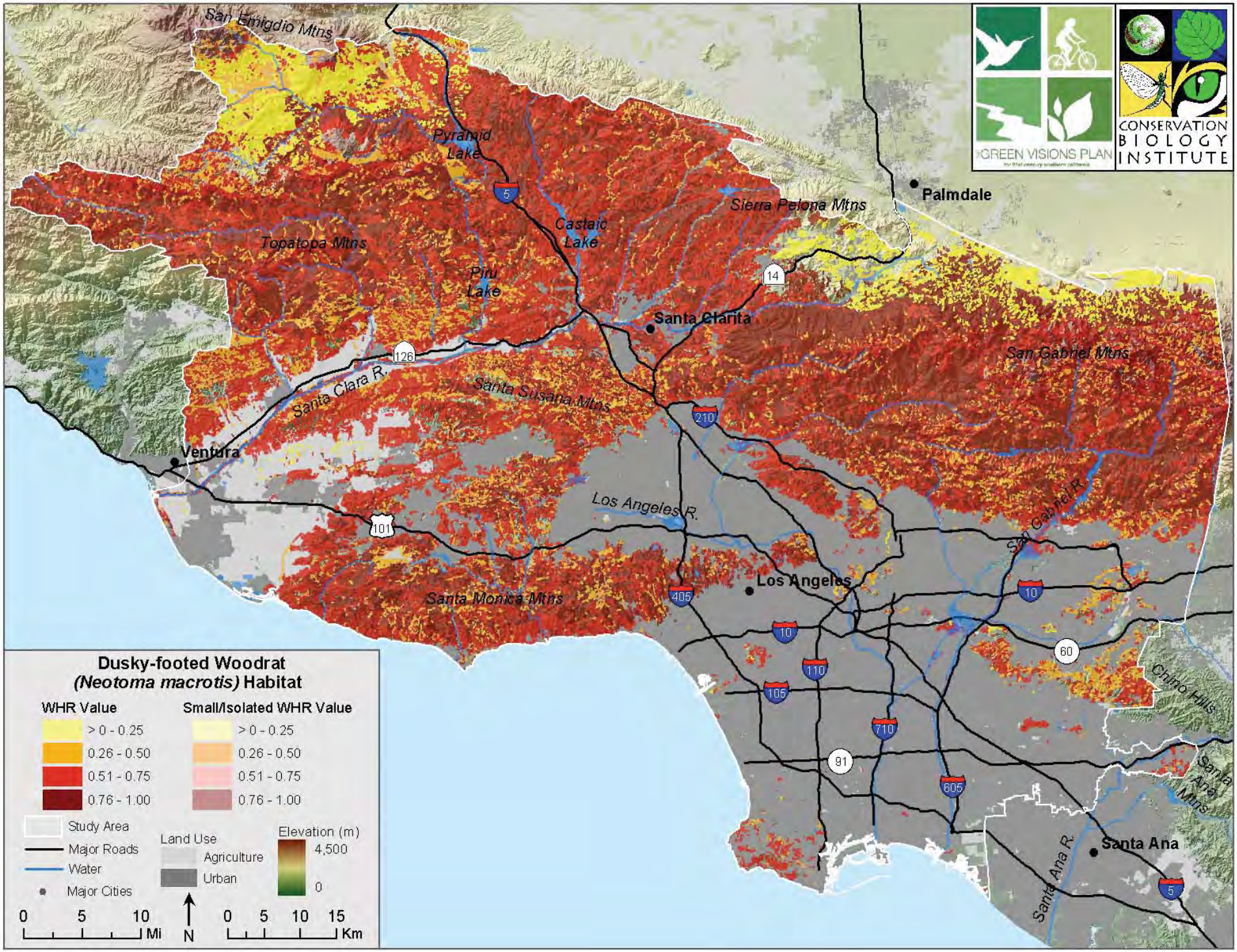
Smith, M. H. 1965. Dispersal capacity of the dusky-footed woodrat, *Neotoma fuscipes*. American Midland Naturalist 74:457-465.

Stones, R. C. and C. L. Hayward. 1968. Natural history of the desert woodrat, *Neotoma lepida*. American Midland Naturalist 80:458-476.

Monty, A. and R. E. Emerson. 2003. Eastern Woodrat. Pages 381-393 in Wild Mammals of North America: Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

Ward, J. P. Jr., R. J. Gutierrez, and B. R. Noon. 1998. Habitat selection by northern spotted owls: the consequences of prey selection and distribution. Condor 100:79-92.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Topatopa Mtns
Piru Lake
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
210
101
405
10
110
105
710
91
605
60
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Dusky-footed Woodrat
(Neotoma macrotis) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Bighorn sheep (*Ovis canadensis nelsoni*)
Family: Bovidae
Order: Artiodactyla
Class: Mammalia

WHR #: M183

Distribution:
Bighorn sheep distribution extends from Alberta and British Columbia in Canada, south along the Rocky Mountains, through Montana, Idaho, Wyoming, and Colorado. Bighorn sheep are also found in the mountains of Washington, Oregon, North Dakota, California, Arizona, New Mexico, Utah, Nevada, and Texas, and in the deserts of Mexico (Krausman and Bowyer 2003). Bighorn sheep are found in a wide range of elevations, from 78 meters below sea level in Death Valley to above 4267 meters above sea level in the White Mountains of California (Krausman and Bowyer 2003). The term "desert bighorn sheep" is often used to refer to bighorn sheep living in arid regions, and this group includes bighorn sheep found in Los Angeles and Ventura Counties.

Habitat:
Throughout their range, bighorn sheep distribution is associated with mountainous terrain. The actual vegetation types vary between ranges, based on latitude, elevation, and aspect; however, the key components of bighorn sheep habitat appear to be related to topography, visibility, water availability, and forage quality and quantity. In all ranges, bighorn sheep are found in or near steep or rugged terrain, where they can use their climbing abilities to evade predators (Geist 1971). In addition, bighorn sheep select habitat where visibility is not obstructed by dense vegetation (Etchberger et al. 1989), and where adequate water and forage can be found. Within these constraints, bighorn sheep have been observed to use both steep and gentle slopes, cliffs and rocky outcroppings, canyons, river benches, mesas, washes, and alluvial fans. Movement across flat habitat between mountain ranges has also been observed, most commonly among males, and represents important genetic and demographic links between neighboring populations (Schwartz et al. 1986, Bleich et al. 1996). Female bighorn sheep tend to be found in the steepest and most rugged terrain during the spring parturition period (Bleich et al. 1997). In desert habitats, summer distribution is often associated with surface water sources; however, desert bighorn sheep may be found in areas without surface water, especially during winter (Krausman et al. 1985, E. Rubin, personal observations). In the San Gabriel Mountains, water sources appear to be abundant, but in these mountains bighorn sheep make seasonal elevational shifts in response to snow cover and forage conditions (Holl and Bleich 1983). Winter and spring ranges are generally between 900 and 1800 meter elevations, while summer and fall ranges are generally between 900 and 2300 meter elevations (Holl and Bleich 1983). Because dense vegetation can limit the quality and suitability of bighorn sheep habitat (Etchberger et al. 1989), fire is important in maintaining habitat quality (Holl et al. 2004).

Food:

Bighorn sheep are herbivores and ruminants, and desert bighorn sheep tend to be browsers as well as grazers (Browning and Monson 1980). They are opportunistic and adaptable feeders, consuming a wide variety of plant species. In the San Gabriel Mountains, browse species account for 60% of the diet, with birch-leaf mountain mahogany (*Cercocarpus betuloides*), California buckwheat (*Eriogonum fasciculatum*), holly-leaf cherry (*Prunus ilicifolia*), and white sage (*Salvia apiana*) being the most frequently consumed species (Perry et al. 1987). Selection of forage species varies by season, and is likely linked to availability and nutritional value. In the San Gabriel Mountains, diet quality increases during winter, peaks in spring, and then declines through summer to its lowest point in the fall (Perry et al. 1987).

Ecology/Behavior:
Bighorn sheep are polygynous breeders (Geist 1971). In Los Angeles and Ventura counties, the breeding season is in the fall, with most lambs born between mid-April and mid-May (Holl and Bleich 1983). Outside of the breeding season, large males are typically found separated from groups containing females, lambs, yearlings, and young males (Geist 1971). During the spring parturition season, females with young lambs are often found in steep and rugged terrain, presumably to reduce the risk of predation (Bleich et al. 1997).

Female bighorn sheep exhibit a high level of philopatry, often living their entire lives in a set of neighboring canyons or mountains (Geist 1971). Males move between female groups during the breeding season, and have larger home ranges than females. Bighorn sheep are not territorial, but males compete for access to receptive females during the breeding season. Home range size is influenced by gender, season, and juxtaposition of resources. Jense et al. (1979) reported home range size of 61 km^2 and 24 km^2 for male and female bighorn sheep, respectively, in Utah. In the Peninsular Ranges of southern California, DeForge et al. (1997) reported mean home ranges of 25.5 km^2 and 20.2 km^2, respectively, for males and females. Holl and Bleich (1983) estimated that approximately 245 hectares of winter-spring range were required to support 10 females in the San Gabriel Mountains.

Bighorn sheep have been observed to move across large expanses of habitat, including stretches of flat terrain not traditionally considered bighorn habitat (Schwartz et al. 1986). A straight-line movement distance of 56 km has been reported in Arizona (Witham and Smith 1979).

Threats to bighorn sheep in southern California include habitat loss and fragmentation, disease, predation by mountain lions (*Puma concolor*), invasion of exotic species (e.g., *Tamarix* spp.), and fire suppression (U. S. Fish and Wildlife Service 2000, Holl et al. 2004).

Rationale for its use as target species:
Bighorn sheep need large tracts of undisturbed habitat that include a range of resources used during various seasons. Although the distribution of bighorn sheep is associated with mountains, which can be viewed as islands in a matrix of flat habitat, long-term population persistence depends on connectivity among these mountains, which allows important genetic and demographic linkages.

Habitat modeling approach:

Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, because bighorn sheep in the San Gabriel Mountains and elsewhere are known to use habitat somewhat differently than that described by the WHR suitability indices (Holl and Bleich 1983, Holl et al. 2004, E. Rubin, personal observation), we also included the following habitat types, which are not considered as habitat under the WHR system, as suitable if available in the study area, with associated suitability ratings based on expert opinion: alpine dwarf-shrub, barren, Jeffrey pine, Joshua tree, juniper, mixed chaparral, montane chaparral, and palm oasis. We also restricted predicted habitat to terrain within 800 meters of pixels with ≥ 20% slope (USFWS 2000), and to elevations ≥ 900 meters (Holl and Bleich 1983). In addition, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	X
Non-irrigated Cropland and Improved Pasture Land	X
Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

Lastly, we identified patches of habitat that were < 20 km^2 large (the size of the smallest recorded home range) and those that were both > 112 km (twice the furthest recorded dispersal distance) from a second patch and < 1000 km^2 (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Bleich, V. C., J. D. Wehausen, R. R. Ramey, and J. L. Rechel. 1996. Metapopulation theory and mountain sheep: implications for conservation. Pages 353-373 *in* Metatpopulations and Wildlife Conservation. D. R. McCullough, ed. Island Press, Washington, D. C. 429pp.

Bleich, V. C., R. T. Bowyer, and J. D. Wehausen. 1997. Sexual segregation in mountain sheep: resources or predation? Wildlife Monographs 134:1-50.

Browning, B. M. and G. Monson. 1980. Food. Pages 80-99 *in* The Desert Bighorn. G. Monson and L. Sumner, (eds). University of Arizona Press, Tucson. 370pp.

DeForge, J. R., S. D. Ostermann, C. W. Willmott, K. B. Brennan, and S. G. Torres. 1997. The ecology of Peninsular bighorn sheep in the San Jacinto Mountains, California. Desert Bighorn Council Transactions 41:8-25.

Etchberger, R. C., P. R. Krausman, and R. Mazaika. 1989. Mountain sheep habitat characteristics in the Pusch Ridge Wilderness, Arizona. Journal of Wildlife Management 53:902-907.

Geist, V. 1971. Mountain Sheep: A Study in Behavior and Evolution. The University of Chicago Press, Chicago. 383pp.

Holl, S. A. and V. C. Bleich. 1983. San Gabriel Mountain sheep: biological and management considerations. Administrative Report, San Bernardino National Forest, San Bernardino, California.

Holl, S. A., V. C. Bleich, and S. G. Torres. 2004. Population dynamics of bighorn sheep in the San Gabriel Mountains, California, 1967-2002. Wildlife Society Bulletin 32:412-426.

Jense, G. K., J. W. Bates, and J. A. Roberston. 1979. Utah bighorn sheep status report. Desert Bighorn Council Transactions 29:29-33.

Krausman, P. R. and R. T. Bowyer. 2003. Mountain sheep. Pages 1095-1115 *in* Wild Mammals of North America, Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

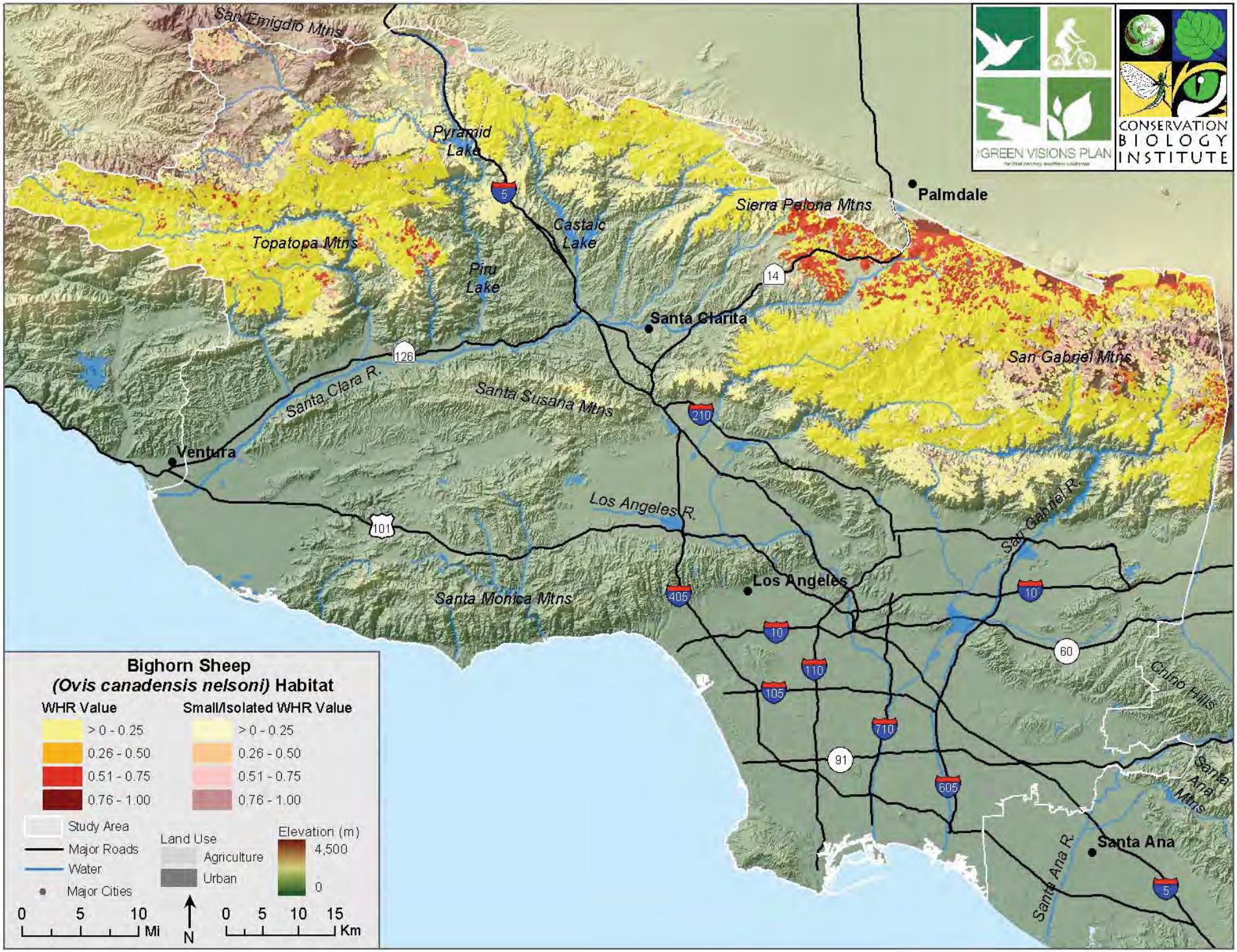
Krausman, P. R., S. Torres, L. L. Ordway, J. J. Hervert, and M. Brown. 1985. Diel activity of ewes in the Little Harquahala Mountains, Arizona. Desert Bighorn Council Transactions 29:24-26.

Perry, W. M., J. W. Dole, and S. A. Holl. 1987. Analysis of the diets of mountains sheep from the San Gabriel Mountains, California. California Fish and Game 73:156-162.

Schwartz, O. A., V. C. Bleuch, and S. A. Holl. 1986. Genetics and the conservation of mountain sheep (*Ovis canadensis nelsoni*). Biological Conservation 37:179-190.

U. S. Fish and Wildlife Service. 2000. Recovery plan for bighorn sheep in the Peninsular Ranges, California. U. S. Fish and Wildlife Service, Portland, Oregon. 251pp.

Witham, J. H. and E. L. Smith. 1979. Desert bighorn sheep movements in a southwestern Arizona mountain complex. Desert Bighorn Council Transactions 23:20-24.


GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
San Emigdio Mtns
Pyramid Lake
Castaic Lake
Topatopa Mtns
Piru Lake
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
210
101
405
10
60
110
105
710
91
605
Bighorn Sheep
(Ovis canadensis nelsoni) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
0 5 10 15 Km
N

Little Pocket Mouse (*Perognathus longimembris*)
Family: Heteromyidae
Order: Rodentia
Class: Mammalia

WHR #: M086

Distribution:
Little pocket mice are found in arid regions of southern Oregon, California, Nevada, Utah, Arizona, and northern Baja California, Mexico (Wilson and Ruff 1999, Jameson and Peeters 2004), typically at elevations ranging from sea level to 1700 meters (California Interagency Wildlife Task Group 2002).

Habitat:
This species is most abundant in the Colorado, Mojave, and Great Basin Deserts, and prefers desert riparian, desert scrub, and desert wash habitats (California Interagency Wildlife Task Group 2002). However, populations also inhabit open grassland, shrub-steppe, coastal scrub, and sagebrush habitats (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002). This species makes very efficient use of energy and water, so is able to live in extremely arid and unproductive regions of the western states (Wilson and Ruff 1999). Little pocket mice typically live on fine sandy soils (Jameson and Peeters 2004), which are preferred for burrowing, but they have also been found less commonly in gravel washes and on stony soils (California Interagency Wildlife Task Group 2002). Spencer (2005) reported that soil type is a critical habitat characteristic, and that vegetation ranked as low suitability (e.g., chaparral) may be managed to increase habitat quality, as long as soil type is appropriate. Little pocket mice may now be extirpated in many parts of Green Visions planning area, such as locations in the Los Angeles basin, where they once occurred (W. Spencer, personal communication).

Food:
This species eats seeds of many desert plants, including grasses, goosefoot (*Chenopodium* spp.), and desert trumpet (*Eriogonum inflatum*, Jameson and Peeters 2004). Little pocket mice eat the vegetation of annual plants and may occasionally eat soil-dwelling insects when these food items are available, but their diet is comprised primarily of seeds, which they hoard in their burrow system (Wilson and Ruff 1999). This species does not need to drink surface water (Wilson and Ruff 1999).

Ecology/Behavior:
This species breeds and gives birth primarily in the spring and fall (Jameson and Peeters 2004), with a peak during March – May (California Interagency Wildlife Task Group 2002). Little pocket mice may go into torpor during periods of cold weather or food shortages, and remain underground in the winter (Chew and Butterworth 1964, Jameson and Peeters 2004). Seeds stored in the burrow system provide food during the winter. During summer, this species rests in shallow burrows during the day, and forages primarily at night (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002).

Little pocket mice are solitary and will defend seed caches (Wilson and Ruff 1999). In Joshua Tree National Park, home range sizes were 0.12 - 0.56 hectare (Chew and Butterworth 1964). In Nevada, home ranges were 0.29 - 1.88 and 0.48 - 3.09 hectares for males and females, respectively (Maza et al. 1973). Dispersal data for little pocket mice are limited; however, it is likely that an individual could disperse several hundred meters (W. Spencer, personal communication).

Little pocket mice are preyed upon by snakes, owls, and predatory mammals, including other rodents such as grasshopper mice (*Onychomys* spp.).

Rationale for its use as target species:
Pacific pocket mice are threatened by habitat loss and are sensitive to fragmentation (Swei et al. 2003), and have exhibited notable population declines in areas of habitat loss and modification (California Interagency Wildlife Task Group 2002). The Pacific pocket mouse (*P. l. pacificus*) is Federally listed as endangered and is a California subspecies of concern (Jameson and Peeters 2004). The Palm Springs pocket mouse (*P. l. bangsi*), the Los Angeles pocket mouse (*P. l. brevinasus*), and the Jacumba pocket mouse (*P. l. internationalis*) are California subspecies of concern (Jameson and Peeters 2004).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated a habitat map which included all pixels with a WHR rating > 0. However, we only included habitat with soils listed in the attached soils list, and excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	X
Non-irrigated Cropland and Improved Pasture Land	X
Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

Next, we identified patches of habitat that were < 0.12 hectares (the size of the smallest recorded home range) and those that were both > 800 meters (approximately twice the furthest estimated dispersal distance) from a second patch and < 6.0 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Finally, based on reviewer input, we excluded habitat in the Santa Monica Mountains, the Santa Susana Mountains and areas to the northwest of these mountains, because these areas are most likely outside of the species' historic geographic range.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Chew, R.M., and B.B. Butterworth. 1964. Ecology of rodents in Indian Cove (Mojave Desert), Joshua Tree National Monument, California. Journal of Mammalogy, Vol. 45, pp. 203-225.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Maza, B.G., N.R. French, and A.P. Aschwanden. 1973. Home range dynamics in a population of heteromyid rodents. Journal of Mammalogy, Vol. 54, pp. 300-319.

Spencer, W. D. 2005. Recovery research for the endangered Pacific pocket mouse: an overview of collaborative studies. Pages 107-125 *in* Planning for Biodiversity: Bringing Research and Management Together. Proceedings of a Symposium for the South Coast Ecoregion. U.S.D.A. Forest Service General Technical Report PSW-GTR-195.

Swei, A., P.V. Brylski, W.D. Spencer, S.C. Dodd, and J.L. Patton. 2003. Hierarchical genetic structure in fragmented populations of Little Pocket Mouse (*Perognathus longimembris*) in southern California. Conservation Genetics, Vol. 4, pp. 501-514.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.

Soil Categories Included in Little Pocket Mouse Habitat (checked soil types are included)

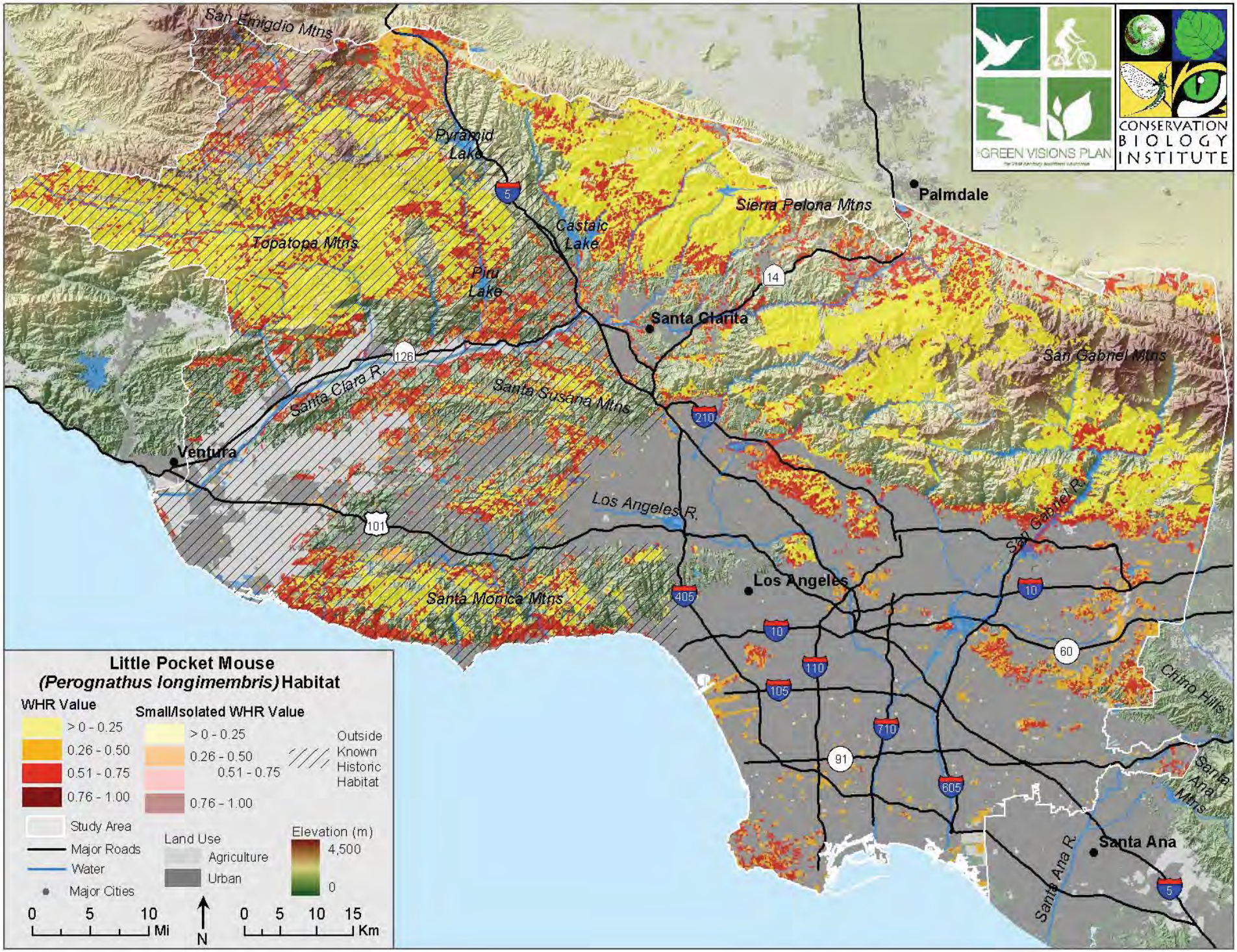
channery clay loam	
channery loam	
channery silty clay loam	
channery silty clay, silty clay	
Clay	
clay loam	
clay loam, gravelly clay loam	
clay loam, loam	
clay loam, loam, sandy clay loam	
clay loam, sandy clay	
clay loam, sandy clay loam	
clay loam, sandy clay loam, sandy loam	
clay loam, silty clay loam	
clay, clay loam	
clay, clay loam, sandy clay	
clay, clay loam, silty clay	
clay, silty clay	
coarse sand	
coarse sand, fine sand, sand	x
coarse sand, sand	
coarse sandy loam	
coarse sandy loam, fine sandy loam	x
coarse sandy loam, fine sandy loam, sandy loam	x
coarse sandy loam, gravelly coarse sandy loam	
coarse sandy loam, loamy sand, sandy loam	x
coarse sandy loam, sandy loam	x
cobbly clay loam	
cobbly clay loam, cobbly loam, cobbly sandy clay loam	
cobbly clay loam, gravelly clay loam, gravelly loam	
cobbly clay, gravelly clay	
cobbly loam	
cobbly loam, cobbly silt loam	
cobbly loamy sand	
cobbly sand, very gravelly sand	
cobbly sandy clay loam	
cobbly sandy clay loam, gravelly sandy clay loam	
cobbly sandy loam	x
cobbly sandy loam, gravelly sandy loam	x
extremely cobbly coarse sand	
extremely cobbly loam, very gravelly sandy loam	
extremely cobbly sandy loam, extremely stony sandy loam	
extremely cobbly sandy loam, very gravelly sandy loam	
extremely gravelly coarse sand	
extremely gravelly sand	

extremely stony	
extremely stony coarse sand	
fine sand	x
fine sand, sand	x
fine sandy loam	x
fine sandy loam, loam, sandy clay loam	x
fine sandy loam, loam, sandy loam	x
fine sandy loam, sandy loam	x
fine sandy loam, silt loam, very fine sandy loam	x
gravelly clay	
gravelly clay loam	
gravelly clay loam, gravelly loam	
gravelly clay loam, gravelly loam, gravelly sandy clay loam	
gravelly clay loam, gravelly sandy clay loam	
gravelly clay loam, sandy clay loam	
gravelly coarse sand	
gravelly coarse sandy loam	
gravelly coarse sandy loam, gravelly fine sandy loam, gravelly sandy loam	x
gravelly coarse sandy loam, gravelly loamy coarse sand	
gravelly coarse sandy loam, gravelly sandy loam	
gravelly loam	
gravelly loam, gravelly sandy loam	
gravelly loam, gravelly sandy loam, sandy loam	x
gravelly loam, gravelly silt loam	
gravelly loam, gravelly very fine sand	x
gravelly loam, sandy clay loam	
gravelly loamy coarse sand	
gravelly loamy coarse sand, gravelly loamy sand	
gravelly loamy sand	x
gravelly sandy clay	
gravelly sandy clay	
gravelly sandy clay loam	
gravelly sandy clay loam, gravelly sandy loam	
gravelly sandy clay loam, very gravelly sandy clay loam, very gravelly sandy loam	
gravelly sandy loam	
gravelly sandy loam, sandy loam	
gravelly sandy loam, very gravelly sandy loam	
gravelly silt loam	
gravelly very fine sandy loam	x
Indurated	
Loam	
loam, sandy loam	x
loamy coarse sand	
loamy coarse sand, loamy sand	x

loamy fine sand	x
loamy fine sand, loamy sand, sand	x
loamy sand	x
moderately decomposed plant material	
mucky clay	
mucky clay, mucky silty clay	
mucky peat, muck	
Sand	x
sandy clay	
sandy clay loam	
sandy clay loam, sandy loam	x
sandy loam	x
silty clay	
silty clay loam	
silty clay loam, silty loam	
silty loam	
slightly decomposed plant material	
stony clay loam	
stony clay loam, stony sandy clay loam	
stony fine sandy loam	x
stony loam	
stony sandy loam	x
stratified clay loam	
stratified coarse sand to sandy loam	x
stratified extremely bouldery coarse sand to extremely cobbly coarse sand	
stratified extremely stony coarse sand to very gravelly loamy sand	
stratified fine sandy loam	x
stratified gravelly loamy coarse sand to loamy coarse sand	
stratified gravelly loamy coarse sand to very fine sandy loam	x
stratified gravelly loamy sand to cobbly sandy loam	
stratified gravelly sand to gravelly loam	
stratified gravelly sand to gravelly loamy coarse sand	
stratified gravelly sand to gravelly sandy loam	
stratified gravelly sand to sandy loam	x
stratified gravelly sand to stony sand	
stratified gravelly sandy loam to gravelly loam	
stratified gravelly sandy loam to gravelly loamy sand	
stratified loam to silty clay loam	
stratified loamy fine sand to gravelly coarse sand	x
stratified loamy fine sand to silt loam	x
stratified loamy sand	x
stratified loamy sand to coarse sandy loam	x
stratified loamy very fine sand to silt loam	x
stratified sand to fine sand to loamy sand	x
stratified sand to fine sandy loam	x

stratified sand to loam	x
stratified sand to loamy sand	x
stratified sand to sandy clay loam	x
stratified sand to sandy loam	x
stratified sand to silty clay loam	x
stratified sand to silty loam	x
stratified sandy clay loam	
stratified sandy loam	x
stratified sandy loam to clay loam	x
stratified sandy loam to loam	x
stratified sandy loam to sandy clay loam	x
stratified sandy loam to silty clay loam	x
stratified sandy loam to silty loam	x
stratified silty clay loam, stratified silty loam	
stratified very cobbly clay loam to very gravelly clay	
stratified very cobbly sand to very gravelly sand	
stratified very cobbly sandy loam to very gravelly sandy loam	
stratified very gravelly clay loam to very cobbly clay	
stratified very gravelly coarse sand to gravelly loamy coarse sand	
stratified very stony loamy sand to very stony loam	
unweathered bedrock	
Variable	
very channery clay loam	
very channery loam	
very channery silty clay loam	
very cobbly clay loam	
very cobbly clay loam, very gravelly clay loam, very gravelly sandy clay loam	
very cobbly clay, very gravelly clay	
very cobbly loam	
very cobbly loam, very cobbly sandy loam	
very cobbly loam, very gravelly loam	
very cobbly loam, very gravelly loam, very gravelly sandy loam	
very cobbly loamy sand	
very cobbly loamy sand, very gravelly loamy sand	
very cobbly sandy clay loam	
very cobbly sandy loam	
very cobbly sandy loam, extremely cobbly sandy loam	
very cobbly sandy loam, very gravelly loam, very gravelly sandy loam	
very cobbly sandy loam, very gravelly sandy loam	
very fine sandy loam	
very gravelly clay	
very gravelly clay loam	
very gravelly clay loam, extremely gravelly clay loam	
very gravelly clay loam, very gravelly loam	
very gravelly coarse sand	

very gravelly coarse sand, extremely gravelly coarse sand, extremely gravelly sand	
very gravelly coarse sandy loam	
very gravelly fine sandy loam	**x**
very gravelly loam	
very gravelly loam, extremely gravelly loam	
very gravelly loam, loamy coarse sand	
very gravelly loam, very gravelly sandy clay loam	
very gravelly loam, very gravelly sandy loam	
very gravelly loam, very gravelly sandy loam, very stony loam	
very gravelly loamy sand	**x**
very gravelly loamy sand, extremely gravelly loamy sand	
very gravelly loamy sand, very gravelly sandy loam	
very gravelly sand	
very gravelly sandy clay loam	
very gravelly sandy clay loam, extremely gravelly sandy clay loam	
very gravelly sandy clay loam, very gravelly sandy loam	
very gravelly sandy loam	
very gravelly sandy loam, extremely gravelly sandy loam	
very stony clay loam	
very stony loam	
very stony loamy sand	
very stony sandy loam	
weathered bedrock	


GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
San Emigdio Mtns
Pyramid Lake
Castaic Lake
Topatopa Mtns
Piru Lake
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Puente Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
101
210
405
10
110
105
710
91
605
60
Little Pocket Mouse
(Perognathus longimembris) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Outside Known Historic Habitat
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
0 5 10 15 Km
N

Cactus Mouse (*Peromyscus eremicus*)
Family: Cricetidae
Order: Rodentia
Class: Mammalia

WHR #: M115

Distribution:
The genus *Peromyscus* has an extensive distribution and collectively represents the most widespread rodents in North America (Wilson and Ruff 1999). In addition to *P. eremicus*, 5 other species of *Peromyscus* (*P. boylii, P. californicus, P. crinitus, P. maniculatus, and P. truei*) occur in California, and up to 4 species may be sympatric in some parts of the state (Jameson and Peeters 2004). Seasonal distribution patterns and niche differentiation by habitat structure may allow such coexistence (M'Closkey 1976).

Cactus mice (*P. eremicus*) are found in the Mojave and Sonoran deserts and west to the coast of southern California, as well as on several Channel Islands, at elevations from -75 to 1200 meters (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002, Jameson and Peeters 2004).

Habitat:
Cactus mice prefer sandy areas with some shrubby growth, especially low desert areas, desert riparian, desert scrub, desert wash, Joshua tree (*Yucca brevifolia*), pinyon (*Pinus* spp.)-juniper (*Juniperus* spp.), and palm oasis habitats, as well as rocky foothills, slopes, and plains (Wilson and Ruff 1999, California Interagency Wildlife Task Group 2002, Jameson and Peeters 2004). They may also be found in coastal scrub, chamise (*Adenostoma fasciculatum*)-redshank (*A. sparsifolium*) and mixed chaparral, and sagebrush (*Artemisia* spp.) habitats (California Interagency Wildlife Task Group 2002).

Food:
In general, *Peromyscus* species eat a wide variety of foods, including seeds, leaves, forbs, and insects (Jameson and Peeters 2004), and most species obtain much of their necessary water from their food resources (Wilson and Ruff 1999). They are good climbers and commonly forage in shrubs for berries, fruits, and leaves. Cactus mice feed on green vegetation, seeds, fruits, flowers, and insects (Bradley and Mauer 1973).

Ecology/Behavior:
In general, *Peromyscus* species breed during spring through autumn, and reproduction is dependent on the abundance of food (Jameson and Peeters 2004). Nests are often built under fallen logs or brush (Wilson and Ruff 1999), or in rock crevices or holes in trees for some species (Wilson and Ruff 1999). Some *Peromyscus* species are solitary while others may live in family groups; however, most will be aggressive near their nest (Brylsky and Harris n/d).

Peromyscus species are mostly nocturnal and crepuscular (Wilson and Ruff 1999). They may go into torpor or estivate during cold or extremely hot weather, and this may be due to a lack of moisture or food (Wilson and Ruff 1999, Jameson and Peeters 2004).

In *Peromyscus* species, unlike most other mammals, young females typically disperse farther than males (Wilson and Ruff 1999). Data on dispersal distances for cactus mice were not found; however, male and female *P. californicus* in Monterey County were found to disperse a maximum of 450 and 791 meters, respectively (Ribble 1992).

Home range size of *Peromyscus* species depends on resources, and may vary from a few hundred square meters to over 1 hectare, and male home ranges are typically larger than female home ranges (Wilson and Ruff 1999). The mean home range of cactus mice in California sage scrub was reported to be 0.3 hectares (MacMillen 1964, cited in Brlyski n/d), and home ranges of the related *P. maniculatus* were reported to average 0.1 to 0.2 hectares (Storer et al. 1944). Chew and Chew (1970) reported densities of 0.21 – 3.3 cactus mouse individuals/hectare in Arizona creosote scrub. In coastal sage scrub, densities were 0.2 – 1.6 individuals/hectare (MacMillen 1964, cited in Brlyski n/d).

Cactus mice are preyed upon by a wide variety of snakes, birds, and mammalian predators. Their populations are also likely limited by competition with other rodents (Wilson and Ruff 1999).

Rationale for its use as target species:
The genus *Peromyscus* represents an important prey item for a number of avian and terrestrial predators (Wilson and Ruff 1999). Cactus mice are often sympatric with deer mice (*P. maniculatus*) but are usually much less common even in the most suitable habitat (P. Behrends, personal communication), suggesting that they may serve as a valuable indicator species.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated a habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	X
Non-irrigated Cropland and Improved Pasture Land	X

Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 0.1 hectares (the size of the smallest recorded home range for the related *P. maniculatus*) and those that were both > 1580 meters (approximately twice the furthest recorded dispersal distance) from a second patch and < 5.0 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Bradley, W. G. and R. A. Mauer. 1973. Rodents of a creosote-bush community in southern Nevada. Southwestern Naturalist 17:333-344.

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Chew, R. M. and A. E. Chew. 1970. Energy relationships of the mammals of a desert shrub (*Larrea tridentata*) community. Ecological Monographs 40:1-21.

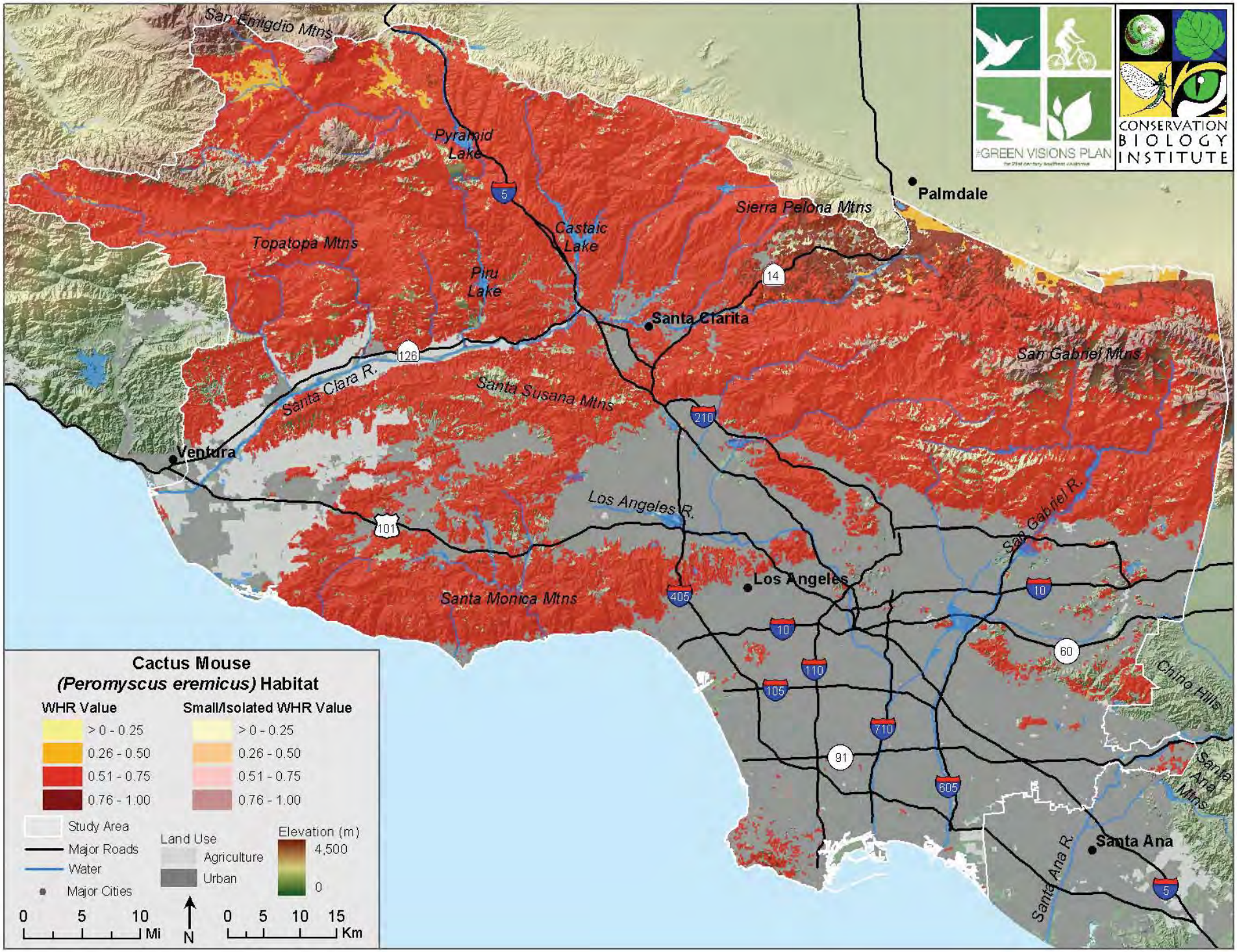
Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

M'Closkey, R. T. 1976. Community structure in sympatric rodents. Ecology 57:728-739.

Ribble, D. O. 1992. Dispersal in a monogamous rodent. Ecology 73:859-866.

Storer, T. I., F. C. Evans, and F. G. Palmer. 1944. Some rodent populations in the Sierra Nevada of California. Ecological Monographs 14:166-192.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Sierra Pelona Mtns
Palmdale
Topatopa Mtns
Piru Lake
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Cactus Mouse
(Peromyscus eremicus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Deer Mouse (*Peromyscus maniculatus)*
Family: Cricetidae
Order: Rodentia
Class: Mammalia

WHR #: M117

Distribution:
The genus *Peromyscus* has an extensive distribution and collectively represents the most widespread rodents in North America (Wilson and Ruff 1999). In addition to *P. maniculatus*, 5 other species of *Peromyscus* (*P. boylii, P. californicus, P. crinitus, P. eremicus,* and *P. truei*) occur in California, and up to 4 species may be sympatric in some parts of the state (Jameson and Peeters 2004). Seasonal distribution patterns and niche differentiation by habitat structure may allow such coexistence (M'Closkey 1976).

Deer mice are found throughout California, at elevations from sea level to 3000 meters (Wilson and Peeters 2004).

Habitat:
Deer mice may be found in a wide variety of habitat types including forests, brush, grassland, chaparral, and often disturbed, early successional sites (Wilson and Ruff 1999, Jameson and Peeters 2004). This species is found in nearly all habitat types and is the most ubiquitous mammal in California (California Interagency Wildlife Task Group 2002).

Food:
In general, *Peromyscus* species eat a wide variety of foods, including seeds, leaves, forbs, and insects (Jameson and Peeters 2004), and most species obtain much of their necessary water from their food resources (Wilson and Ruff 1999). They are good climbers and commonly forage in shrubs for berries, fruits, and leaves. Deer mice may rely heavily on insects, and eat a wide variety of insects including orthopterans and soil-dwelling insect larvae (Jameson and Peeters 2004), as well as fruits, leaves, seeds, and fungi (California Interagency Wildlife Task Group 2002). This species often forages on the ground and caches large amounts of food (California Interagency Wildlife Task Group 2002).

Ecology/Behavior:
In general, *Peromyscus* species breed during spring through autumn, and reproduction is dependent on the abundance of food (Jameson and Peeters 2004). Deer mice may breed year-round, with a peak in March through August (California Interagency Wildlife Task Group 2002). Nests may be built under fallen logs or brush, or in rock crevices or holes in trees (Wilson and Ruff 1999). Some *Peromyscus* species are solitary while others may live in family groups; however, most will be aggressive near their nest (Brylsky and Harris n/d).

Peromyscus species are mostly nocturnal and crepuscular (Wilson and Ruff 1999). These species may go into torpor or estivate during cold or extremely hot weather, and this may be due to a lack of moisture or food (Wilson and Ruff 1999, Jameson and Peeters 2004).

In *Peromyscus* species, unlike most other mammals, young females typically disperse further distances than males (Wilson and Ruff 1999). Data on dispersal distances for deer mice were not found; however, male and female *P. californicus* in Monterey County were found to disperse a maximum of 450 and 791 meters, respectively (Ribble 1992).

Home range size of *Peromyscus* species depends on resources, and may vary from a few hundred square meters to over 1 hectare, and male home ranges are typically larger than female home ranges (Wilson and Ruff 1999). Home ranges of deer mice were reported to average 0.1 to 0.2 hectares (Storer et al. 1944), and densities up to 10-25 individuals/hectare have been reported (California Interagency Wildlife Task Group 2002). Females may defend a territory during the breeding season (California Interagency Wildlife Task Group 2002).

Rationale for its use as target species:
Deer mice are an important prey species for a number of avian and terrestrial predators (Wilson and Ruff 1999). In addition, deer mice may play an important role by feeding on pupae and larvae of insects that are detrimental to trees (California Interagency Wildlife Task Group 2002).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated a habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	
Rural Residential	
Urban Green Space	
Vacant Urban	
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	
Nurseries	
Other agriculture	
Packing Houses and Grain Elevators	
Poultry Operations	

In addition, we identified patches of habitat that were < 0.1 hectares (the size of the smallest recorded home range) and those that were both > 1580 meters (approximately twice the furthest recorded dispersal distance) from a second patch and < 5.0 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

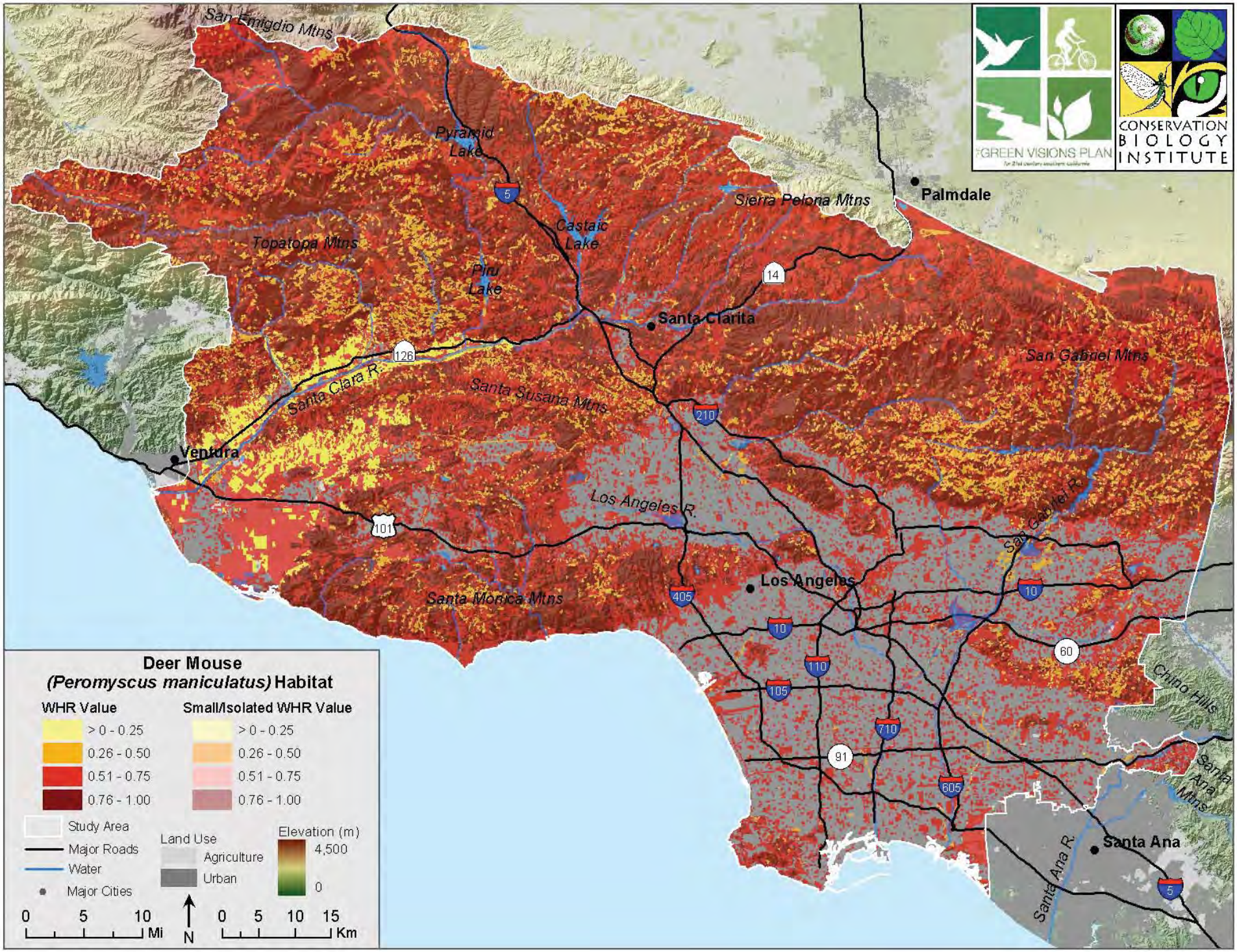
Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

M'Closkey, R. T. 1976. Community structure in sympatric rodents. Ecology 57:728-739.

Ribble, D. O. 1992. Dispersal in a monogamous rodent. Ecology 73:859-866.

Storer, T. I., F. C. Evans, and F. G. Palmer. 1944. Some rodent populations in the Sierra Nevada of California. Ecological Monographs 14:166-192.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Sierra Pelona Mtns
Palmdale
Topatopa Mtns
Piru Lake
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
210
101
405
10
110
105
710
91
605
60
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Deer Mouse
(Peromyscus maniculatus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Mountain Lion (*Puma concolor*)
Family: Felidae
Order: Carnivora
Class: Mammalia

WHR #: M165

Distribution:
Mountain lions are distributed from the Canadian coniferous forests, south to Patagonia in South America. In North America, mountain lions occur in suitable habitat throughout Mexico, in the majority of the western United States and western Canada, and a small population is found in southern Florida (Pierce and Bleich 2003). In recent years, mountain lions have also been observed in Alaska, Minnesota, North Dakota, and Nebraska, suggesting a recolonization of historical habitat (Pierce and Bleich 2003).

Habitat:
Because mountain lions are so widely distributed and use a wide variety of habitat types, it is difficult to generalize their habitat preferences (Pierce and Bleich 2003). Several studies suggest that vegetative and topographic cover, in addition to steep slopes, are preferred for resting, hunting, and denning sites; however, mountain lions do inhabit open and sparsely vegetated habitats, such as the deserts of the southwestern United States (Pierce and Bleich 2003). Mountain lion dens are typically found in rocky terrain or thick vegetation that provide protection and thermal cover for kittens (Beier et al. 1995). Movement patterns of lions monitored in southern California suggest that riparian areas were selected while human-dominated landscapes were avoided (Dickson et al. 2005). Mountain lions will avoid human disturbance when possible, but may inhabit areas near human development (Van Dyke et al. 1986, Torres et al. 1996). Their distribution may be most influenced by adequate prey densities (Pierce et al. 2000).

Food:
Throughout their distribution, mountain lions are believed to prey primarily on mule deer and white-tailed deer (*Odocoileus* spp.; Anderson 1983); however, mountain lions are generalist predators and prey on a wide variety of species including, but not limited to, mountain sheep (*Ovis* spp.), elk (*Cervus elaphus*), moose (*Alces alces*), skunks (e.g., *Mephitis* spp.), bobcats (*Felis rufus*), porcupines (*Erethizon dorsatum*), and domestic animals (Pierce and Bleich 2003, Jameson and Peeters 2004).

Ecology/Behavior:
Mountains lions are polygynous and are solitary except while rearing young or mating (Pierce and Bleich 2003). Males, and sometimes females, mark their home ranges by creating scrapes in the ground, and the sexes rely on auditory and olfactory signals to find each other for mating (Pierce and Bleich 2003). They may reproduce at any time of the year (Robinette et al. 1961).

Mountain lions are nocturnal predators, and are most active during crepuscular hours (Sweanor 1990). Home ranges of males are larger than those of females, and a male home range may overlap several female home ranges (Pierce and Bleich 2003). Home range size varies by sex and by availability of prey, and reported sizes are 187-826 km^2 and 73-685 km^2 for males and females, respectively (Pierce and Bleich 2003). Crooks (2002) found that mountain lions had less than a 50% probability of occurrence in habitat patches smaller than 23 km^2.

Young males are more likely to disperse from their natal range than females are, and typically disperse further. Anderson et al. (1992) reported maximum dispersal distances of 274 and 140 km for males and females, respectively, based on 65 animals from multiple populations, and Logan and Sweanor (2000) reported the maximum known distance of 483 km traveled by an adult male. Lions may live in metapopulations, in which smaller populations are linked by dispersal (Sweanor et al. 2000); however, human development can be an obstacle to dispersal.

Rationale for its use as target species:
Mountain lions require large tracts of lands and adequate populations of large prey which, in turn, also need large expanses of habitat. They are therefore sensitive to habitat loss and fragmentation (Crooks 2002). Mountain lions also limit (through direct or indirect competition and predation) the abundance of mesopredators, thereby influencing the diversity and abundance of smaller species of mammals, birds, and reptiles (Crooks and Soulé 1999, Crooks 2002). The mountain lion is an important top predator that limits the growth of some ungulate species (Pierce and Bleich 2003, Jameson and Peeters 2004).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab). We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	X
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X

Poultry Operations	X

In addition, we identified patches of habitat that were < 73 km^2 large (the size of the smallest recorded home range) and those that were both > 966 km (twice the furthest recorded dispersal distance) from a second patch and < 3650 km^2 (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Anderson, A. E. 1983. A critical review of literature on puma (*Felis concolor*). Special Report No. 54. Colorado Division of Wildlife, Fort Collins.

Anderson, A. E., D. C. Bowden, and D. M. Kattner. 1992. The puma on Uncompahgre Plateau, Colorado. Technical Publication 40. Colorado Division of Wildlife, Fort Collins.

Beier, P., D. Choate, and R. H. Barrett. 1995. Movement patterns of mountain lions during different behaviors. Journal of Mammalogy 76:1056-1070.

Crooks, K. 2002. Relative sensitivities of mammalian carnivores to habitat fragmentation. Conservation Biology 16:488-502.

Crooks, K. R. and M. E. Soulé. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563-566.

Dickson, B. G., J. S. Jenness, and P. Beier. 2005. Influence of vegetation, topography, and roads on cougar movement in southern California. Journal of Wildlife Management 69:264-276.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Logan, K. A. and L. L. Sweanor. 2000. Puma. Pages 347 – 377 *in* Ecology and Management of the Large Mammals in North America. S. Demarais and P. Krausman (eds). Prentice-Hall, Englewood cliffs, New Jersey.

Pierce, B. M. and V. C. Bleich. 2003. Mountain lion. Pages 744-757 *in* Wild Mammals of North America, Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

Pierce, B. M., V. C. Bleich, and R. T. Bowyer. 2000. Social organization of mountain lions: does a land-tenure system regulate population size? Ecology 81:1533-1543.

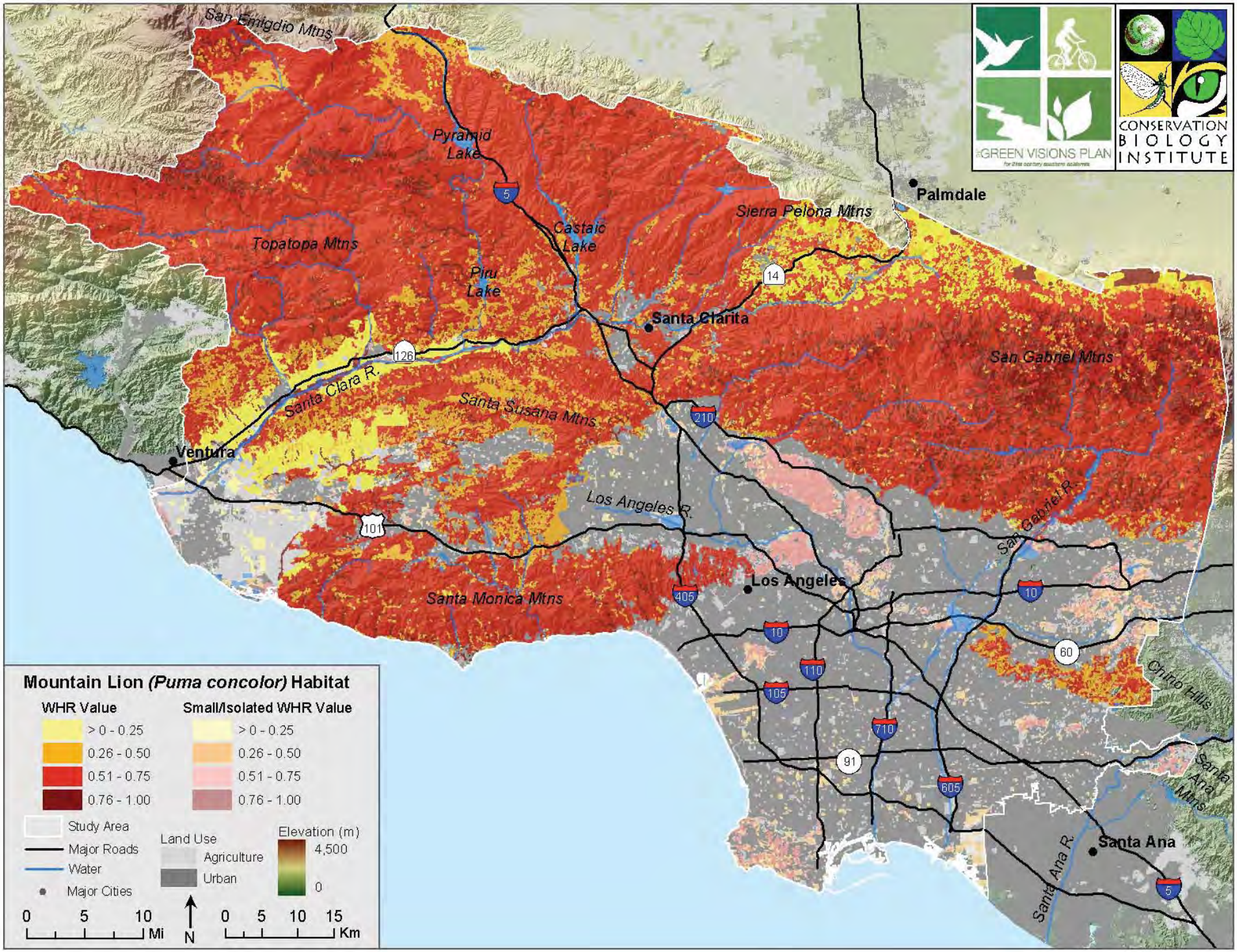
Robinette, W. L., J. S. Gashwiler, and O. W. Morris. 1961. Notes on cougar productivity and life history. Journal of Mammalogy 42:204-217.

Sweanor, L. L. 1990. Mountain lion social organization in a desert environment. M.S. Thesis, University of Idaho, Moscow.

Sweanor, L. L., K. A. Logan, and M. G. Hornocker. 2000. Cougar dispersal patterns, metapopulation dynamics, and conservation. Conservation Biology 14:798-808.

Torres, S., T. M. Mansfield, J. E. Foley, T. Lupo, and A. Brinkhaus. 1996. Mountain lion and human activity in California: testing speculations. Wildlife Society Bulletin 24:451-460.

Van Dyke, F. G., R. H. Brocke, H. G. Shaw, B. B. Ackerman, T. P. Hemker, and F. G. Lindzey. 1986. Reactions of mountain lions to logging and human activity. Journal of Wildlife Management 50:95-102.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Piru Lake
Topatopa Mtns
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
101
210
405
10
110
105
710
91
605
60
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Mountain Lion (Puma concolor) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

American Badger (*Taxidea taxus*)

Family: Mustelidae
Order: Carnivora
Class: Mammalia

WHR #: M160

Distribution:
The American badger is distributed from south-central Canada over the western and central United States to central Mexico (Jameson and Peeters 2004). The eastern boundary of its distribution is a line running roughly from central Texas to the Great Lakes (Lindzey 2003). Badgers are common in the Great Basin region of California, Oregon, and Washington (Jameson and Peeters 2004), and occur at elevations from below sea level (in Death Valley) to over 3600 meters (Lindzey 2003).

Habitat:
The American badger is typically found in treeless areas such as prairies, parklands, drained marshes, grassy meadows, riparian habitats, and deserts (Wilson and Ruff 1999, Lindzey 2003, Jameson and Peeters 2004), but may also be found in dry, open stages of shrub (including chaparral) and forest communities. They are most abundant in areas with friable soils (California Interagency Wildlife Task Group 2002).

Food:
Badgers eat primarily ground squirrels and pocket gophers (*Thomomys* spp.; Jameson and Peeters 2004), but will also eat other small rodents, birds, reptiles, amphibians, and insects (Wilson and Ruff 1999, Lindzey 2004). On occasion, badgers will eat vegetation such as corn or oats (Wilson and Ruff 1999). Badgers will eat carrion and will cache food items, frequently in old dens (Lindzey 2003).

Ecology/Behavior:
Badgers have a promiscuous mating system (Lindzey 2003). Mating takes place in late summer and young are born in March and April, after a gestation lengthened by delayed implantation (Jameson and Peeters 2004). Young are born in an extensive burrow system (Jameson and Peeters 2004).

Badgers dig extensive dens which provide cover during the day and for parturition, and provide a site for food storage and as foci for foraging excursions (Lindzey 2003). They are primarily nocturnal, foraging during the night and staying underground during the day (Lindzey 2003). In cold climates, badgers may go into torpor during much of the winter (Wilson and Ruff 1999).

Badgers are solitary and somewhat secretive, and may exhibit territorial behavior in some populations but not in others, suggesting that their behavior is plastic and influenced by resources (Lindzey 2003). Home range sizes vary greatly from population to population and by year. Reported home range sizes for two adult females in Minnesota were 8.5 km^2 and 17 km^2

(Sargeant and Warner 1972, Lampe and Sovada 1981). Average home ranges for males and females were reported to be 5.8 km^2 and 2.4 km^2, respectively, in Utah (Lindzey 1978), 12.3 km^2 and 3.4 km^2, respectively, in southeastern Wyoming (Goodrich and Buskirk 1998), and 8.4 km^2 and 2.8 km^2, respectively, in northwestern Wyoming (Minta 1993). Badger densities of 0.8-1.1 individuals per km^2 were observed in Wyoming while 5 individuals per km^2 were observed in Idaho (Lindzey 2003).

Male badgers move greater straight-line distances than females do (Lindzey 2003). Young badgers have been recorded to move large distances during dispersal, sometimes moving through areas devoid of other badgers and areas that could be classified as unsuitable habitat (Lindzey 2003). One juvenile female moved 52.1 km from her natal range and another young badger was trapped 110 km from its original capture site after 5 months (Lindzey 2003). Badgers have been observed to swim (Lindzey 2003).

Bears (*Ursus* spp.), coyotes (*Canis latrans*), wolves (*Canis lupus*), and pumas (*Puma concolor*) may prey on badgers (Lindzey 2003), with young badgers having the highest risk of predation (Wilson and Ruff 1999).

Rationale for its use as target species:
Badgers may act as keystone species by limiting small mammal populations (California Interagency Wildlife Task Group 2002). Once a fairly widespread resident throughout open habitats of California, badgers are now uncommon throughout the state. Badgers are threatened by humans due to trapping, hunting, and automobile collisions (Wilson and Ruff 1999). Attempts to eradicate or reduce ground squirrel and gopher populations, especially involving the use of poisons, can have negative impacts on badgers near urban and ranchland areas (Lindzey 2003). In addition, badgers are sensitive to habitat fragmentation (Crooks 2002).

Habitat modeling approach:

Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we only included habitat with soils listed in the attached soils list, and excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	

Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 2.4 km^2 large (the size of the smallest recorded home range) and those that were both > 220 km (twice the furthest recorded dispersal distance) from a second patch and < 120 km^2 (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Crooks, K. 2002. Relative sensitivities of mammalian carnivores to habitat fragmentation. Conservation Biology 16:488-502.

Goddrich, J. M. and S. W. Buskirk. 1998. Spacing and ecology of North American badgers (*Taxidea taxus*) in a prairie dog (*Cynomys leucurus*) complex. Journal of Mammalogy 79:171-179.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Lampe, R. P. and M. A. Sovada. 1981. Seasonal variation in home range of a female badger (*Taxidea taxus*). Prairie Naturalist 13:55-58.

Lindzey, F. G. 2003. Badger. Pages 683-691 in Wild Mammals of North America, Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

Lindzey, F. G. 1978. Movement patterns of badgers in northwestern Utah. Journal of Wildlife Management 42:418-422.

Minta, S. C. 1993. Sexual differences in spatio-temporal interactions among badgers. Oecologia 96:402-409.

Sargeant, A. B. and D. W. Warner. 1972. Movements and denning habits of a badger. Journal of Mammalogy 53:207-210.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.

Soil Categories Included in Badger Habitat (checked soil types are included)

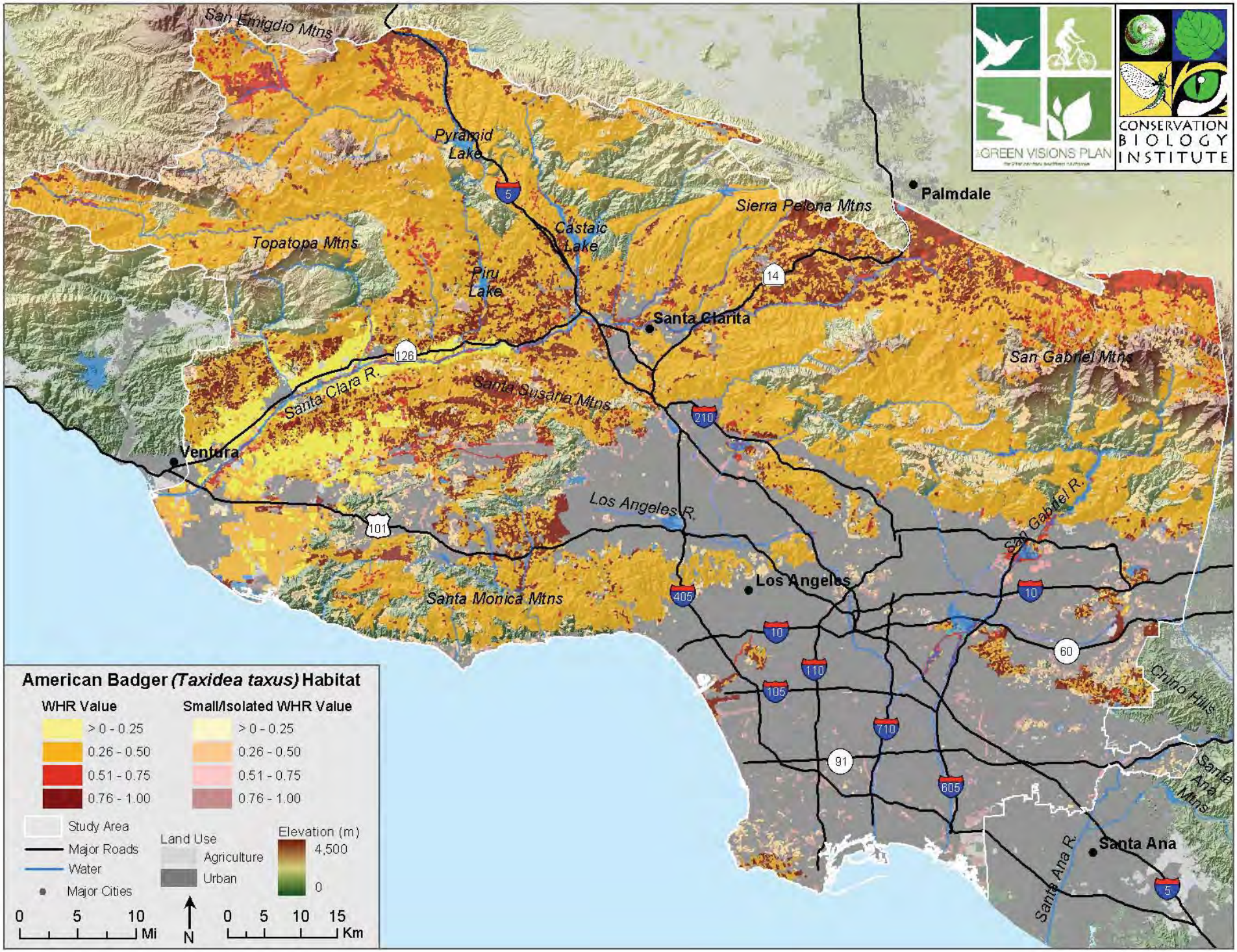
channery clay loam	x
channery loam	x
channery silty clay loam	x
channery silty clay, silty clay	x
clay	x
clay loam	x
clay loam, gravelly clay loam	x
clay loam, loam	x
clay loam, loam, sandy clay loam	x
clay loam, sandy clay	x
clay loam, sandy clay loam	x
clay loam, sandy clay loam, sandy loam	x
clay loam, silty clay loam	x
clay, clay loam	x
clay, clay loam, sandy clay	x
clay, clay loam, silty clay	x
clay, silty clay	x
coarse sand	x
coarse sand, fine sand, sand	x
coarse sand, sand	x
coarse sandy loam	x
coarse sandy loam, fine sandy loam	x
coarse sandy loam, fine sandy loam, sandy loam	x
coarse sandy loam, gravelly coarse sandy loam	x
coarse sandy loam, loamy sand, sandy loam	x
coarse sandy loam, sandy loam	x
cobbly clay loam	x
cobbly clay loam, cobbly loam, cobbly sandy clay loam	x
cobbly clay loam, gravelly clay loam, gravelly loam	x
cobbly clay, gravelly clay	x
cobbly loam	x
cobbly loam, cobbly silt loam	x
cobbly loamy sand	x
cobbly sand, very gravelly sand	x
cobbly sandy clay loam	x
cobbly sandy clay loam, gravelly sandy clay loam	x
cobbly sandy loam	x
cobbly sandy loam, gravelly sandy loam	x
extremely cobbly coarse sand	x
extremely cobbly loam, very gravelly sandy loam	x
extremely cobbly sandy loam, extremely stony sandy loam	x
extremely cobbly sandy loam, very gravelly sandy loam	x
extremely gravelly coarse sand	x
extremely gravelly sand	x

extremely stony	x
extremely stony coarse sand	x
fine sand	x
fine sand, sand	x
fine sandy loam	x
fine sandy loam, loam, sandy clay loam	x
fine sandy loam, loam, sandy loam	x
fine sandy loam, sandy loam	x
fine sandy loam, silt loam, very fine sandy loam	x
gravelly clay	x
gravelly clay loam	x
gravelly clay loam, gravelly loam	x
gravelly clay loam, gravelly loam, gravelly sandy clay loam	x
gravelly clay loam, gravelly sandy clay loam	x
gravelly clay loam, sandy clay loam	x
gravelly coarse sand	x
gravelly coarse sandy loam	x
gravelly coarse sandy loam, gravelly fine sandy loam, gravelly sandy loam	x
gravelly coarse sandy loam, gravelly loamy coarse sand	x
gravelly coarse sandy loam, gravelly sandy loam	x
gravelly loam	x
gravelly loam, gravelly sandy loam	x
gravelly loam, gravelly sandy loam, sandy loam	x
gravelly loam, gravelly silt loam	x
gravelly loam, gravelly very fine sand	x
gravelly loam, sandy clay loam	x
gravelly loamy coarse sand	x
gravelly loamy coarse sand, gravelly loamy sand	x
gravelly loamy sand	x
gravelly sandy clay	x
gravelly sandy clay	x
gravelly sandy clay loam	x
gravelly sandy clay loam, gravelly sandy loam	x
gravelly sandy clay loam, very gravelly sandy clay loam, very gravelly sandy loam	x
gravelly sandy loam	x
gravelly sandy loam, sandy loam	x
gravelly sandy loam, very gravelly sandy loam	x
gravelly silt loam	x
gravelly very fine sandy loam	x
indurated	x
loam	x
loam, sandy loam	x
loamy coarse sand	x
loamy coarse sand, loamy sand	x
loamy fine sand	x

loamy fine sand, loamy sand, sand	x
loamy sand	x
moderately decomposed plant material	x
mucky clay	
mucky clay, mucky silty clay	
mucky peat, muck	
sand	x
sandy clay	x
sandy clay loam	x
sandy clay loam, sandy loam	x
sandy loam	x
silty clay	x
silty clay loam	x
silty clay loam, silty loam	x
silty loam	x
slightly decomposed plant material	x
stony clay loam	x
stony clay loam, stony sandy clay loam	x
stony fine sandy loam	x
stony loam	x
stony sandy loam	x
stratified clay loam	x
stratified coarse sand to sandy loam	x
stratified extremely bouldery coarse sand to extremely cobbly coarse sand	x
stratified extremely stony coarse sand to very gravelly loamy sand	x
stratified fine sandy loam	x
stratified gravelly loamy coarse sand to loamy coarse sand	x
stratified gravelly loamy coarse sand to very fine sandy loam	x
stratified gravelly loamy sand to cobbly sandy loam	x
stratified gravelly sand to gravelly loam	x
stratified gravelly sand to gravelly loamy coarse sand	x
stratified gravelly sand to gravelly sandy loam	x
stratified gravelly sand to sandy loam	x
stratified gravelly sand to stony sand	x
stratified gravelly sandy loam to gravelly loam	x
stratified gravelly sandy loam to gravelly loamy sand	x
stratified loam to silty clay loam	x
stratified loamy fine sand to gravelly coarse sand	x
stratified loamy fine sand to silt loam	x
stratified loamy sand	x
stratified loamy sand to coarse sandy loam	x
stratified loamy very fine sand to silt loam	x
stratified sand to fine sand to loamy sand	x
stratified sand to fine sandy loam	x
stratified sand to loam	x

stratified sand to loamy sand	x
stratified sand to sandy clay loam	x
stratified sand to sandy loam	x
stratified sand to silty clay loam	x
stratified sand to silty loam	x
stratified sandy clay loam	x
stratified sandy loam	x
stratified sandy loam to clay loam	x
stratified sandy loam to loam	x
stratified sandy loam to sandy clay loam	x
stratified sandy loam to silty clay loam	x
stratified sandy loam to silty loam	x
stratified silty clay loam, stratified silty loam	x
stratified very cobbly clay loam to very gravelly clay	x
stratified very cobbly sand to very gravelly sand	x
stratified very cobbly sandy loam to very gravelly sandy loam	x
stratified very gravelly clay loam to very cobbly clay	x
stratified very gravelly coarse sand to gravelly loamy coarse sand	x
stratified very stony loamy sand to very stony loam	x
unweathered bedrock	
variable	x
very channery clay loam	x
very channery loam	x
very channery silty clay loam	x
very cobbly clay loam	x
very cobbly clay loam, very gravelly clay loam, very gravelly sandy clay loam	x
very cobbly clay, very gravelly clay	x
very cobbly loam	x
very cobbly loam, very cobbly sandy loam	x
very cobbly loam, very gravelly loam	x
very cobbly loam, very gravelly loam, very gravelly sandy loam	x
very cobbly loamy sand	x
very cobbly loamy sand, very gravelly loamy sand	x
very cobbly sandy clay loam	x
very cobbly sandy loam	x
very cobbly sandy loam, extremely cobbly sandy loam	x
very cobbly sandy loam, very gravelly loam, very gravelly sandy loam	x
very cobbly sandy loam, very gravelly sandy loam	x
very fine sandy loam	x
very gravelly clay	x
very gravelly clay loam	x
very gravelly clay loam, extremely gravelly clay loam	x
very gravelly clay loam, very gravelly loam	x
very gravelly coarse sand	x
very gravelly coarse sand, extremely gravelly coarse sand, extremely gravelly sand	x

very gravelly coarse sandy loam	**x**
very gravelly fine sandy loam	**x**
very gravelly loam	**x**
very gravelly loam, extremely gravelly loam	**x**
very gravelly loam, loamy coarse sand	**x**
very gravelly loam, very gravelly sandy clay loam	**x**
very gravelly loam, very gravelly sandy loam	**x**
very gravelly loam, very gravelly sandy loam, very stony loam	**x**
very gravelly loamy sand	**x**
very gravelly loamy sand, extremely gravelly loamy sand	**x**
very gravelly loamy sand, very gravelly sandy loam	**x**
very gravelly sand	**x**
very gravelly sandy clay loam	**x**
very gravelly sandy clay loam, extremely gravelly sandy clay loam	**x**
very gravelly sandy clay loam, very gravelly sandy loam	**x**
very gravelly sandy loam	**x**
very gravelly sandy loam, extremely gravelly sandy loam	**x**
very stony clay loam	**x**
very stony loam	**x**
very stony loamy sand	**x**
very stony sandy loam	**x**
weathered bedrock	


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Piru Lake
Topatopa Mtns
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
American Badger (Taxidea taxus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Common Gray Fox (*Urocyon cinereoargenteus*)
Family: Canidae
Order: Carnivora
Class: Mammalia

WHR #: M149

Distribution:
The common gray fox is the most widely distributed fox in the western United States (Jameson and Peeters 2004). It is found in southern Canada, throughout much of the United States, except the Rocky Mountains, and in northern South America (Cypher 2003, Jameson and Peeters 2004).

Habitat:
The gray fox is considered primarily a woodland species (Cypher 2003) but it may also be found in shrubland habitats, as well as in cultivated land (Jameson and Peeters 2004). In the western United States they may use oak woodlands, chaparral, pinyon-juniper woodlands, brushy washes and meadows, and riparian forests (Cypher 2003). In California, they were found to use riparian and old field habitats greater than expected (based on availability) and agricultural lands less than expected (Fuller 1978). Fedriani et al. (2000) suggested that foxes in the Santa Monica Mountains of southern California exhibited a selective distribution relative to vegetation types, being captured only in coastal sage scrub, northern mixed chaparral, chamise chaparral, and coast live oak habitat. A mosaic of vegetation types may provide the best quality habitat, with open areas used more for foraging and densely vegetated areas providing daytime cover and den sites (Cypher 2003). Daytime resting areas for gray foxes are commonly located in dense vegetation or under boulders (Cypher 2003). It is also likely that avoidance of coyotes (*Canis latrans*) influences fox habitat selection (Fedriani et al. 2000). Harrison (1997) found that foxes in a New Mexico population avoided residential areas where housing density exceeded 128 residences/km^2, and suggested that avoidance may begin at lower densities.

Food:
Gray foxes are opportunistic foragers and their diet may include small rodents, birds, fruits, nuts, insects, and fungi (Cypher 2003, Jameson and Peeters 2004). Their good climbing abilities may help provide access to a wide variety of food items.

Ecology/Behavior:
The common gray fox mates in late winter, possibly as late as April, and most litters are born in April or May (Cypher 2003, Jameson and Peeters 2004). These foxes are primarily monogamous, although occasionally polygynous, and the male remains with the female while she is raising young (Cypher 2003, Jameson and Peeters 2004). Gray foxes give birth in sheltered dens that are usually earthen dens, but may also be found in trees, fallen logs, brush piles, or even under houses (Cypher 2003).

Gray foxes are primarily nocturnal and crepuscular (Wilson and Ruff 1999). Average distances moved per night by males and females in Utah were 475.5 and 600.5 meters, respectively (Trapp

1973, cited in Cypher 2003). As in other fox species, dispersal is primarily male-biased (Cypher 2003). Wilson and Ruff (1999) reported a dispersal distance of up to 84 km; however, the mean dispersal distance for the related kit fox in California was 7.8 km, with similar distances for males and females (Scrivner et al. 1987, cited in Cypher 2003).

Gray foxes are not believed to be strongly territorial (Cypher 2003) and densities of 1-2 adults per km^2 have been reported (Wilson and Ruff 1999). Home range size is influenced by factors such as gender, season, prey availability, and presence of young, and, according to Cypher (2003), "….varies immensely" in gray fox. In California, home ranges of 4 females averaged 122 hectares (Fuller 1978) but throughout the United Sates home ranges of 97 to 493 hectares have been reported (Cypher 2003).

Gray foxes may be killed by golden eagles (*Aquila chrysaetos*), bobcats (*Lynx rufus*), mountain lions (*Puma concolor*), and coyotes (Fedriani et al. 2000, Cypher 2003), and abundance estimates of gray foxes and coyotes were inversely related in California (Crooks and Soulé 1999). They also suffer mortality due to disease and vehicular collision.

Rationale for its use as target species:
This species can occur in a wide variety of habitats and is an opportunistic forager. However, it is sensitive to high-density residential subdivisions and is impacted by species compositional changes caused by fragmentation (Harrison 1997, Crooks and Soulé 1999).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	
Urban Green Space	
Vacant Urban	
Orchards and Vineyards (active and abandoned)	
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	
Other agriculture	
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 97 hectares (0.97 km^2; the size of the smallest recorded home range) and those that were both > 168 km (twice the furthest recorded dispersal distance) from a second patch and < 4850 hectares (48.5 km^2; approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Crooks, K. R. and M. E. Soulé. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563-566.

Cypher, B. L. 2003. Foxes. Pages 511-546 in Wild Mammals of North America, Biology, Management, and Conservation. G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, (eds). The John Hopkins University Press, Baltimore. 1216pp.

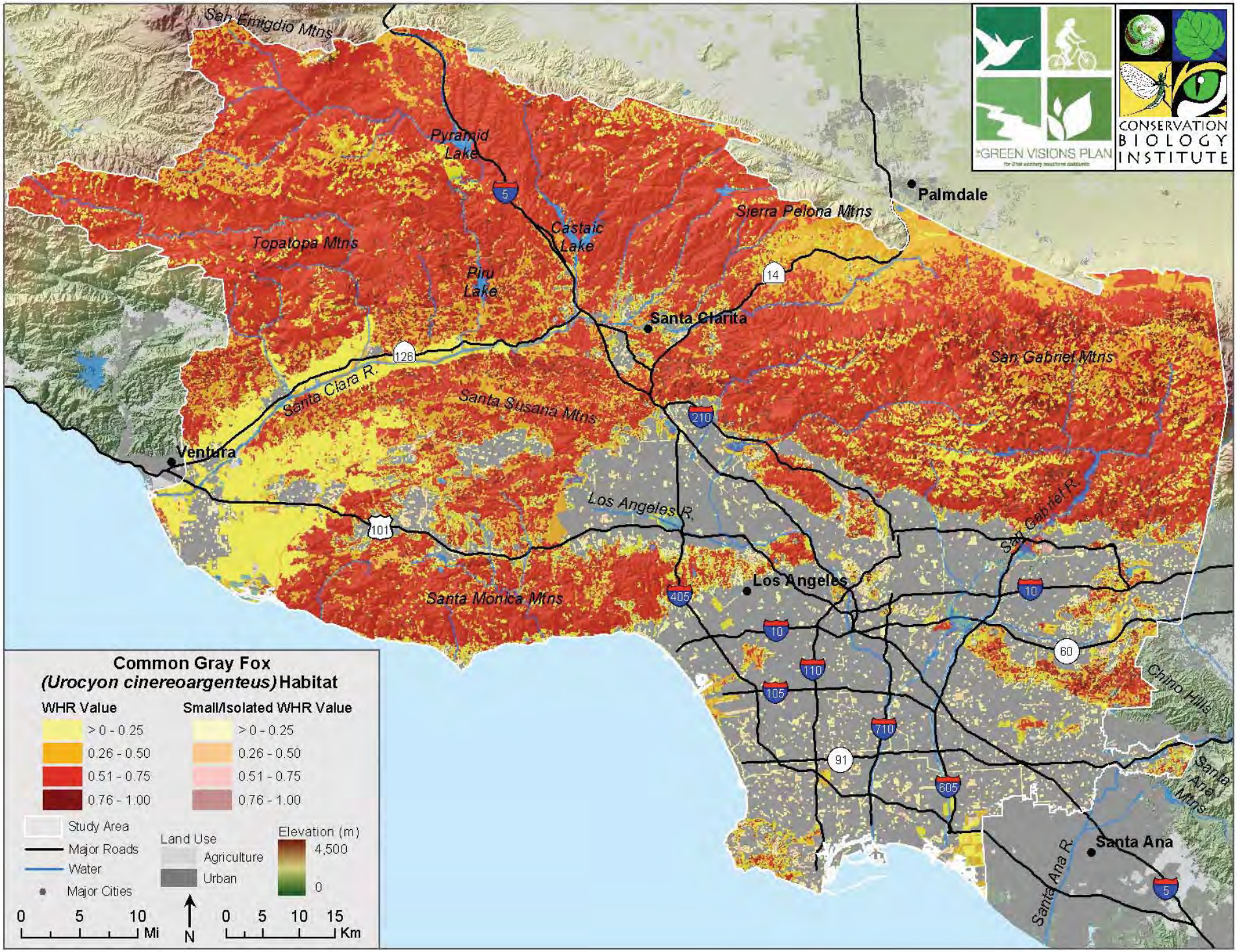
Fedriani, J. M, T. K. Fuller, R. M. Sauvajot, and E. C. York. 2000. Competition and intraguild predation among three sympatric carnivores. Oecologia 125:258-270.

Fuller, T. K. 1978. Variable home range sizes of female gray foxes. Journal of Mammalogy 59:446-449.

Harrison, R. L. 1997. A comparison of gray fox ecology between residential and undeveloped rural landscapes. Journal of Wildlife Management 61:112-122.

Jameson, E. W., Jr., and H. J. Peeters. 2004. Mammals of California (Revised Edition). University of California Press, Berkeley. 428pp.

Wilson, D. E. and S. Ruff (eds). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington. 750pp.


GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
San Emigdio Mtns
Pyramid Lake
Castaic Lake
Piru Lake
Topatopa Mtns
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
101
210
405
10
110
105
710
91
605
60
Common Gray Fox
(Urocyon cinereoargenteus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Species Accounts: Birds

In alphabetical order by Latin name:

Red-winged Blackbird	**(*Agelaius pheniceus*)**
Rufous-crowned Sparrow	**(*Aimophila ruficeps*)**
Sage Sparrow	**(*Amphispiza belli*)**
Burrowing Owl	**(*Athene cunicularia*)**
California Quail and Mountain Quail	**(*Callipepla californica, Oreortyx pictus*)**
Lark Sparrow	**(*Chondestes grammacus*)**
Northern Harrier	**(*Circus cyaneus*)**
Marsh Wren	**(*Cistothorus palustris*)**
White-tailed Kite	**(*Elanus leucurus*)**
Yellow-breasted Chat	**(*Icteria virens*)**
Loggerhead Shrike	**(*Lanius ludovicianus*)**
Belding's Savannah Sparrow	**(*Passerculus sandwichensis beldingi*)**
Spotted Owl	**(*Strix occidentalis*)**
Western Meadowlark	**(*Sturnella neglecta*)**

Red-winged Blackbird (*Agelaius phoeniceus*)
Family: Icteridae
Order: Passeriformes
Class: Aves

WHR #: B519

Distribution:
Red-winged blackbirds are distributed widely, from Canada and Alaska south to the West Indies and Costa Rica (Peterson 1961). They breed from central British Columbia south throughout much of the United States, and winter from southern British Columbia, northern Idaho, and Wyoming south (Peterson 1961). In California, they are widespread throughout the state in suitable habitat, with a shift to more southerly and low elevations, including desert oases, during the winter (Garrett and Dunn 1981, Small 1994).

Habitat:
Red-winged blackbirds breed in freshwater and saltwater marshes, swamps, hayfields, and wet mountain meadows, and forage in nearby cultivated land, especially near water (Peterson 1961, Yasukawa and Searcy 1995). They prefer freshwater or brackish-water marshes, and the margins of lakes, ponds, and sloughs overgrown with emergent aquatic vegetation, and can also be found at the edges of riparian woodlands, small creeks, ranch ponds, and other wet, brushy, and weedy vegetation (Small 1994). Outside of the breeding season, this species ranges more widely and may be found foraging in agricultural lands, cattle feedlots, horse pastures, and suburban areas such as parks and gardens (Small 1994).

Food:
Red-winged blackbirds feed primarily on insects, seeds, and grain crops (including rice, *Oryza sativa*), and typically feed in large flocks, gleaning food from the ground and low vegetation (Verner et al. 1980, California Interagency Wildlife Task Group 2002).

Ecology/Behavior:
The breeding season of the red-winged blackbird is mid-March to late July (Unitt 2004). Characteristics of nest sites are extremely variable, but nests are often found in dense stands of cattails or other emergent vegetation, or in other low dense vegetation such as willows, thickets, or grain fields (Verner et al. 1980, Yasukawa and Searcy 1995). This species is strongly polygynous, with up to 15 females per male territory (Yasukawa and Searcy 1995). Although often described as a "colonial" nester, aggregations of nesting birds may be due more to distribution of nesting habitat than to gregarious behavior (Yasukawa and Searcy 1995). The breeding cycle within a group of nesting birds is synchronized, with the breeding marsh abandoned after the breeding period (Small 1994). Outside of the breeding season, this species may become nomadic, often joining other blackbirds, European starlings (*Sturnus vulgaris*), and brown-headed cowbirds (*Molothrus ater*) in feeding and roosting aggregations (Small 1994).

Red-winged blackbirds in southern California are not migratory but may exhibit seasonal shifts to more southerly habitats or lower elevations during winter (Dolbeer 1982, California Interagency Wildlife Task Group 2002). Breeding individuals have been documented to travel as far as 6.4 km from nest sites during foraging, and non-breeding individuals have been reported to forage up to 80 km from roosts during winter (Meanley 1965). Males defend territories during the breeding season, but the existence of female territoriality is controversial (Yasukawa and Searcy 1995). In northern California, breeding territories averaged 0.06 hectares (Orians 1961, cited in Verner et al. 1980) but home ranges are likely much larger. Colonies (as a whole) of the related tricolored blackbird (*A. tricolor*) have been documented to forage over about 78 km^2 (Orians 1961, cited in Verner et al. 1980).

The eggs and fledglings may be preyed upon by raccoons (*Procyon lotor*), skunks (e.g., *Mephitis mephitis*), minks (*Mustela vison*), other small mammals, and snakes (California Interagency Wildlife Task Group 2002). This species is also parasitized by brown-headed cowbirds, but their colonial behavior may limit parasitism because groups of blackbirds drive away brown-headed cowbirds (Friedmann 1963). Birds nesting in areas of high nest density experience a lower rate of nest parasitism than do birds nesting in areas of low nest density (Yasukawa and Searcy 1995).

Rationale for its use as target species:
Red-winged blackbirds have been negatively affected by habitat loss and drainage of marshes (Small 1994). Both primary habitat types used by this species (marshes for breeding and open uplands for foraging) have been greatly impacted by urbanization (Unitt 2004). Although often regarded as an agricultural pest due to their consumption of grains, red-winged blackbirds may also play a beneficial role to agriculture by consuming insect pests and weed seeds (Yasukawa and Searcy 1995).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project and as based on literature review. For example, we added "Pasture" as suitable habitat, with a low-moderate rating of 0.33. We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	
Urban Green Space	
Vacant Urban	

Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	
Dairy, Intensive Livestock, and Associated Facilities	
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 0.06 hectares large (the mean size of recorded territories), and those that were both > 160 km (twice the furthest recorded dispersal distance) from a second patch and < 3.0 hectares (approximately 50 territories) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Dolbeer, R. A. 1982. Migration patterns for sex and age classes of blackbirds and starlings. Journal of Field Ornithology 53:28-46.

Friedmann, H. 1963. Host relations of the parasitic cowbirds. United States National Museum Bulletin 233. 276pp.

Garrett, K. and J. Dunn. 1981. Birds of Southern California: Status and Distribution. Los Angeles Audubon Society, California. 408 pp.

Meanley, B. 1965. The roosting behavior of the red-winged blackbird in the southern United States. Wilson Bulletin 77:217-228.

Peterson, R. T. 1961. A Field Guide to Western Birds. Houghton Mifflin Company, Boston. 309 pp.

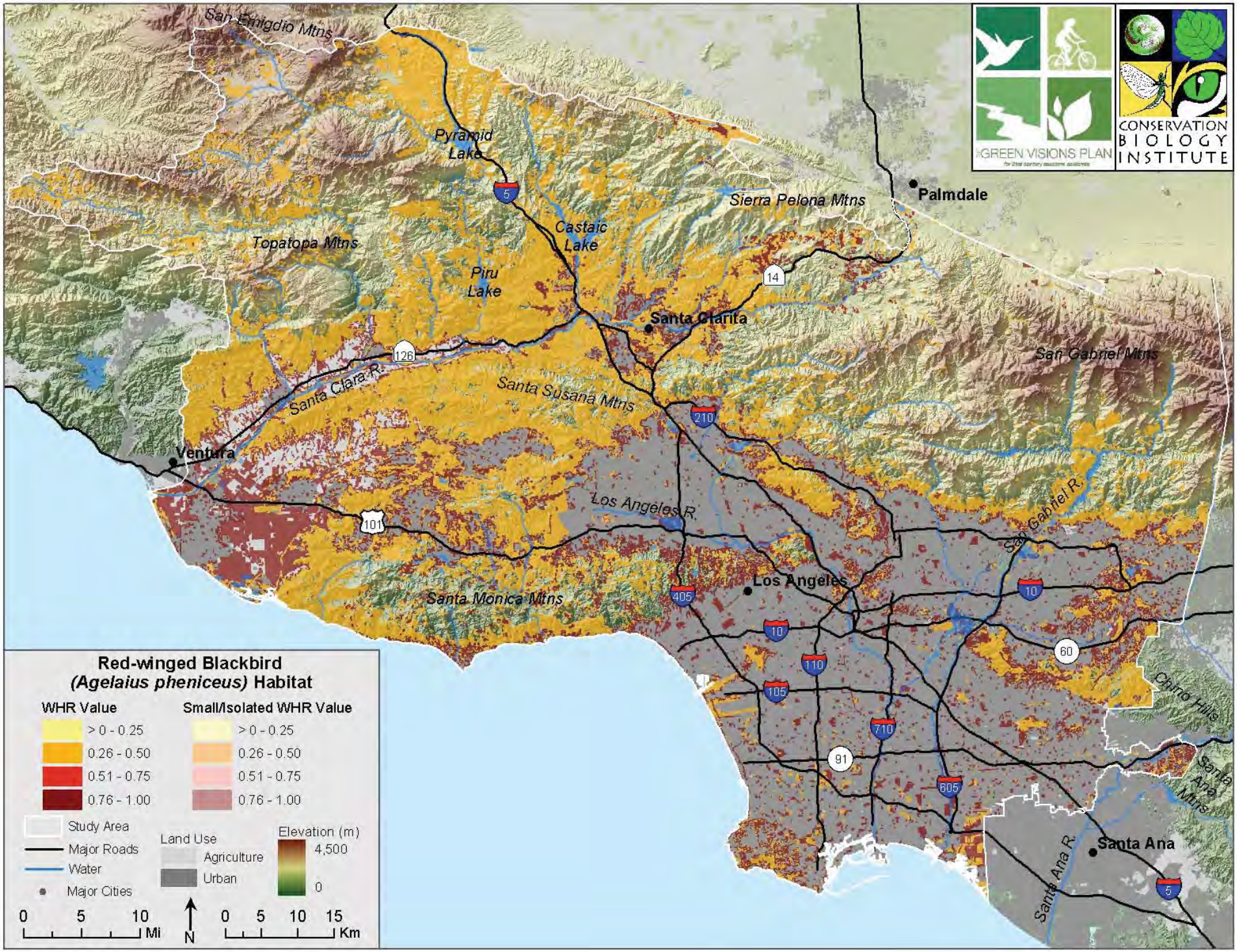
Small, A. 1994. California Birds: Their Status and Distribution. Ibis Publishing Company, Vista, California. 342 pp.

Unitt, P. 2004. San Diego County Bird Atlas. San Diego Natural History Museum. San Diego, California. 645pp.

Verner, J., E. C. Beedy, S. L. Granholm, L. V. Ritter, and E. F. Toth. 1980. Birds. Pages 75-320 *in* California Wildlife and Their Habitats: Western Sierra Nevada. Verner, J. and A. S. Boss (Technical coordinators). Gen. Tech. Rep. PSW-37. Pacific Southwest Forest

and Range Exp. Station, Forest Service, U. S. Dept. of Agriculture, Berkeley, California. 439pp.

Yasukawa, K., and W. A. Searcy. 1995. Red-winged Blackbird (*Agelaius phoeniceus*). *In* The Birds of North America, No. 184 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.


GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
San Emigdio Mtns
Pyramid Lake
Castaic Lake
Piru Lake
Topatopa Mtns
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
210
101
405
10
110
105
710
91
605
60
Red-winged Blackbird
(Agelaius pheniceus) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Rufous-crowned Sparrow (*Aimophila ruficeps*)
Family: Emberizidae
Order: Passeriformes
Class: Aves

WHR #: B487

Distribution:
Rufous-crowned sparrows breed from north-central California, northern Arizona, southern New Mexico, southeastern Colorado (rarely), and western Oklahoma south to southern Mexico. They are largely resident in these areas except in northern Arizona, Colorado, and Oklahoma (Peterson 1961). The Ashy rufous-crowned sparrow (*A. r. canescens*) is found from Santa Barbara County south to northwestern Baja California and is a year-round resident (Stephenson and Calcarone 1999, Unitt 2004). In southern California, this species is found primarily at low elevations on the coastal sides of the mountains, but is occasionally also found on the desert side of the mountains near the San Jacinto Mountains (Riverside County) and in southern San Diego Counties (Stephenson and Calcarone 1999). It has been observed at elevations of 1220 meters in the Sierra Nevada (Verner et al. 1980).

Habitat:
In southern California, the distribution of rufous-crowned sparrows is closely tied to the presence of coastal sage scrub, and it is rarely seen far from this habitat, in which it breeds (Unitt 2004). However, it may also be found in broken or burned chaparral and in grasslands with scattered shrubs (Unitt 2004), and in foothill scrub-chaparral transition zones (Stephenson and Calcarone 1999). This species prefers slopes that face south and have sparse brush, bunch grasses, and large rocks (Stephenson and Calcarone 1999). Both gentle and steep slopes may be used, especially slopes that have about 50% cover of low shrubs (Unitt 2004). This species does not typically occupy dense chaparral, but it can be found in recently burned chaparral and along edges of chaparral, especially where grasses and large rocks are also present (Stephenson and Calcarone 1999, Unitt 2004). It avoids flat valley floors and floodplains, dense chaparral, woodland, and developed areas (Unitt 2004). In the western Sierra Nevada Mountains, this species breeds in shrublands associated with blue oak (*Quercus* spp.) savannahs, pine (*Pinus* spp.)-oak woodlands, and chaparral zones, with some seasonal occurrence in ponderosa pine forests (Verner et al. 1980).

Food:
Rufous-crowned sparrows feed on insects, seeds, spiders, and grass and forb shoots by searching on the ground and among grasses, and by gleaning insects off shrubs (Verner et al. 1980, California Interagency Wildlife Task Group 2002).

Ecology/Behavior:
Rufous-crowned sparrows are monogamous; however, they are a gregarious species and may be semicolonial nesters, with breeding territories occurring in groups (Pemberton 1910, cited in California Interagency Wildlife Task Group 2002, Verner et al. 1980). In southern California,

nesting typically occurs during March – June (Unitt 2004). Nests are typically on the ground in grassy areas, often at the base of shrubs (Verner et al. 1980).

Information on home range sizes is scant; however, 14 territories in southern California coastal sage scrub had a mean size of 0.9 hectares (range 0.4 - 1.5 hectares; Bent 1968 cited in Verner et al. 1980). Cody (1974, cited in California Interagency Wildlife Task Group 2002) used nesting density to estimate home range size at about 1.5 hectares in southern California chaparral. Balda (1969, 1970, cited in California Interagency Wildlife Task Group 2002) reported densities of 6-11 pairs per 40 hectare in Arizona oak woodland. Rufous-crowned sparrows are a sedentary species and adults may remain on their territories for life (Unitt 2004). Little data on dispersal was found; however, Unitt (2004) reported that juveniles may only disperse a few miles from where they hatched.

This species is sensitive to habitat fragmentation, and a number of studies suggested that it may not survive well in small habitat fragments (e.g., Bolger et al. 1997). Lovio (1996, cited in Unitt 2004) found that rufous-crowned sparrows in his study were found consistently only in patches of scrub at least 17 hectares.

Rufous-crowned sparrows are preyed upon by a variety of snakes and small mammals, with the eggs and nestlings being most at risk (Bent 1968, cited in California Interagency Wildlife Task Group 2002). This species is also parasitized by cowbirds (*Molothrus ater,* California Interagency Wildlife Task Group 2002).

Rationale for its use as target species:
The Ashy rufous-crowned sparrow (*A. r. canescens*) is a California Species of Special Concern (Stephenson and Calcarone 1999). Coastal sage scrub habitat, especially the favored coastal sage scrub on gently rolling hillsides (Unitt 2004), is rapidly being developed (Stephenson and Calcarone 1999). In addition, this species does not disperse across wide distances and is therefore sensitive to habitat fragmentation.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab). We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X

Irrigated Cropland and Improved Pasture Land	X
Non-irrigated Cropland and Improved Pasture Land	X
Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 0.4 hectares large (the size of the smallest recorded home range) and those that were both > 20 km (twice the roughly approximated dispersal distance) from a second patch and < 20 hectares (approximately 50 home ranges) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

Bolger, D. T., T. A. Scott, and J. T. Rotenberry. Breeding bird abundance in an urbanizing landscape in coastal Southern California. Conservation Biology 11:406-421.

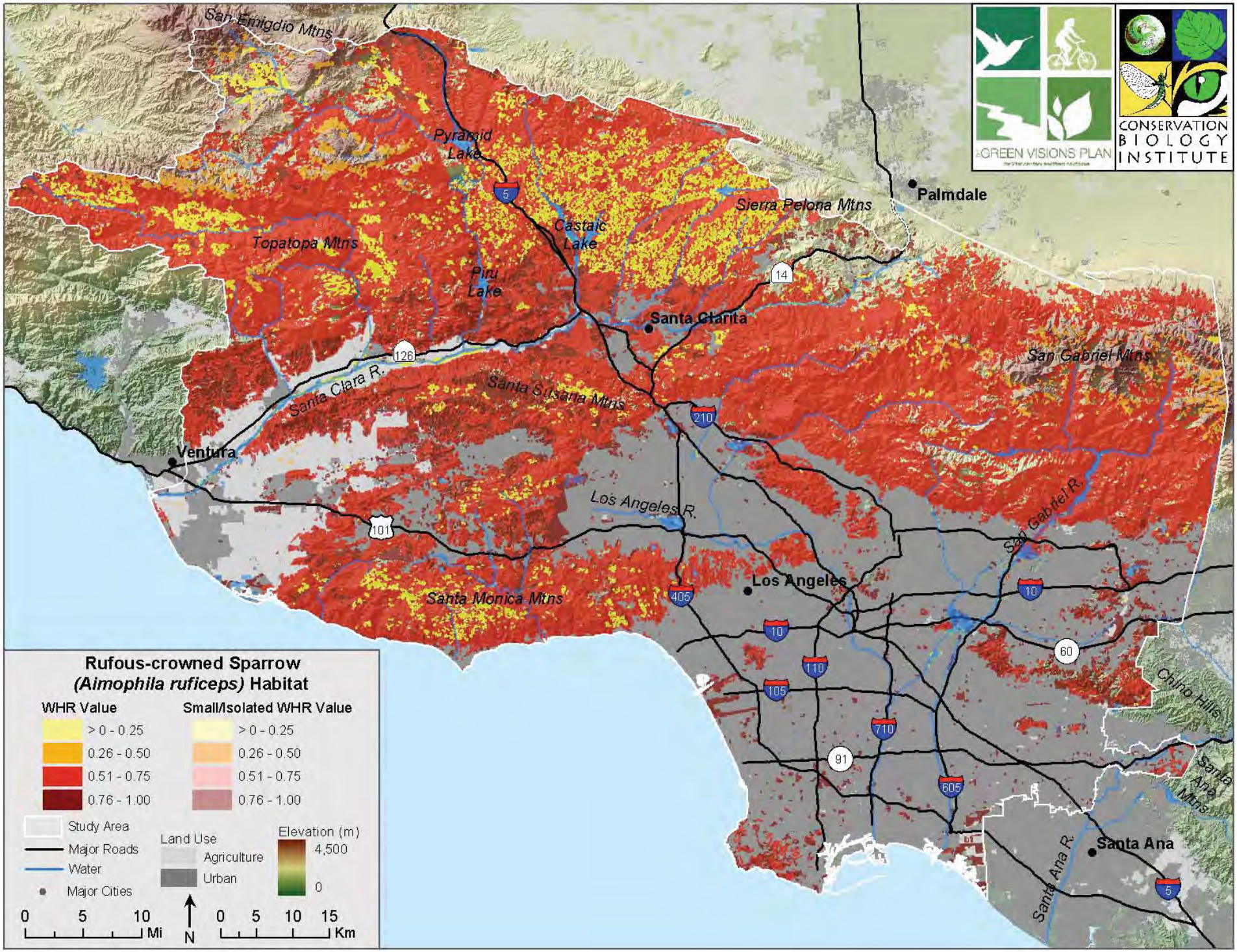
California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Peterson, R. T. 1961. A Field Guide to Western Birds. Houghton Mifflin Company, Boston. 309 pp.

Stephenson, J. R. and G. M. Calcarone. 1999. Southern California Mountains and Foothills Assessment: Habitat and Species Conservation Issues. Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture, Albany, California. 401pp.

Unitt, P. 2004. San Diego County Bird Atlas. San Diego Natural History Museum. San Diego, California. 645pp.

Verner, J., E. C. Beedy, S. L. Granholm, L. V. Ritter, and E. F. Toth. 1980. Birds. Pages 75-320 *in* California Wildlife and Their Habitats: Western Sierra Nevada. Verner, J. and A. S. Boss (Technical coordinators). Gen. Tech. Rep. PSW-37. Pacific Southwest Forest and Range Exp. Station, Forest Service, U. S. Dept. of Agriculture, Berkeley, California. 439pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Topatopa Mtns
Piru Lake
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana R.
Santa Ana
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Rufous-crowned Sparrow
(Aimophila ruficeps) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Sage Sparrow (*Amphispiza belli*)
Family: Emberizidae
Order: Passeriformes
Class: Aves

WHR #: B497

Distribution:
Sage sparrows breed from eastern Washington, southern Idaho, and western Wyoming south to Baja California, southern Nevada, northern Arizona, and northwestern New Mexico. They winter from central California, central Nevada, southwestern Utah, and central New Mexico south to northern Mexico (Peterson 1961). Three subspecies (*A. b. belli, A. b. canescens, A. b. nevadensis*) are found on the southern California mainland and San Clemente Island is inhabited by *A. b. clementeae*. On the mainland, Bell's sage sparrow (*A. b. belli*) is primarily resident while *A. b. canescens* possibly breeds in northern parts of the range (Unitt 2004, Chase and Carlson 2002). Subspecies *nevadensis* is largely migratory and is found in southern California during the winter (Unitt 2004). Sage sparrows have been documented to breed at elevations of 5600 ft in southern California (Unitt 2004).

Habitat:
The two subspecies of sage sparrow primarily found in southern California mainland have different habitat use patterns and preferences (Unitt 2004). Bell's sage sparrow is resident in chamise (*Adensostoma fasciculatum*) associations (Chase and Carlson 2002), in dry chaparral in interior foothills, and in coastal sage scrub (Stephenson and Calcarone 1999). This subspecies tends to be more common in semi-open or recently burned chaparral than in dense chaparral, and may prefer some bare ground free of heavy leaf litter (Stephenson and Calcarone 1999). Boyd and Stephenson (1997, cited in Stephenson and Calcarone 1999) reported that a chaparral age-class mosaic interspersed with open, young stands is important habitat for this species, while Unitt (2004) reported that south-facing slopes, and areas where chaparral is stunted due to magnesium-laden gabbro soil, may also provide ideal habitat for this subspecies.

A. b. canescen is a winter visitor to southern California's desert areas, and seeks halophytic scrub on the valley floors in these areas (Unitt 2004). In desert regions, sage sparrows may be found in saltbush (*Atriplex* spp.), iodine bush (*Allenrolfea occidentalis*), bitterbrush (*Purshia* spp.), big sagebrush (*Artemisia tridentate*), shadscale (*Atriplex* spp.), and creosote (*Larrea tridentata*)-goldenhead (*Acamptopappus* spp.) scrub on valley floors and sinks, and in broad sandy washes with more diverse shrub types (Unitt 2004). In the northern extent of its range, this subspecies and *A. b. nevadensis* are often found in sagebrush habitat (Chase and Carlson 2002).

Food:
This species eats insects, seeds, small fruits, and succulent vegetation, which may provide sufficient water (Verner et al. 1980, Chase and Carlson 2002). It forages on the ground and in low shrubs (Verner et al. 1980).

Ecology/Behavior:
Sage sparrows exhibit breeding behavior during February through June in southern California (Unitt 2004). Nests are built on or near the ground under overhanging shrubs such as *Artemisia* (Verner et al. 1980). In southern California, nests were often found in association with chamise (*Adenostoma fasciculatum)*, Cleveland sage (*Salvia* sp.), and big sagebrush (Unitt 2004), but nests of *A. b. belli* may also be found near brittlebush (*Encelia farinosa*), black sage, California buckwheat (*Eriogonum fasciculatum*), bush mallow (*Malva* spp.), white sage, cholla cactus (*Opuntia* spp.), ceonothus, willow (*Salix* spp.), and bunchgrasses while the nests of *A. b. canescens* may also be found in or around saltbush (*Atriplex* spp.) and rabbitbrush (*Chrysothamnus* sp.; Chase and Carlson 2002).

Sage sparrows are monogamous and territorial (Chase and Carlson 2002). Bent 1968 (cited in Verner et al. 1980) reported that territories in Tehama County were about 46 meters apart. Data on home range sizes is scant. Lovio (1993, 1995, cited in Chase and Carlson 2002) reported that territories of *A. b. belli* in Riverside and San Diego Counties varied from 0.75 to 5.7 hectares. Reported densities range between 27 and 85 individuals per 40 hectares (California Interagency Wildlife Task Group 2002). Bell's sage sparrow is sedentary with limited dispersal. However, Unitt (2004) reported that dispersal distances of at least one mile have been reported.

Rationale for its use as target species:
The Bell's sage sparrow (*A. b. belli*) is a California Species of Special Concern (Stephenson and Calcarone 1999). Sage sparrows are extremely sensitive to habitat fragmentation (Knick and Rotenberry 2002, Unitt 2004), and may be negatively affected by fire management programs that result in reduced mosaics of shrub habitat (Chase and Carslon 2002). Much of their habitat is threatened with urban development.

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab). We generated one habitat map which included all pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	X
Non-irrigated Cropland and Improved Pasture Land	X
Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X

Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 0.75 hectares large (the size of the smallest recorded territory) and those that were both > 5 km (twice the roughly approximated dispersal distance) from a second patch and < 37.5 hectares (approximately 50 territories) as those less likely to be occupied as compared to larger and less isolated patches.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Chase, M. K. and B. A. Carlson. 2002. Sage Sparrow (*Amphispiza belli*). *In* The Coastal Scrub and Chaparral Bird Conservation Plan: a strategy for protecting and managing coastal scrub and chaparral habitats and associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/htmldocs/scrub.html

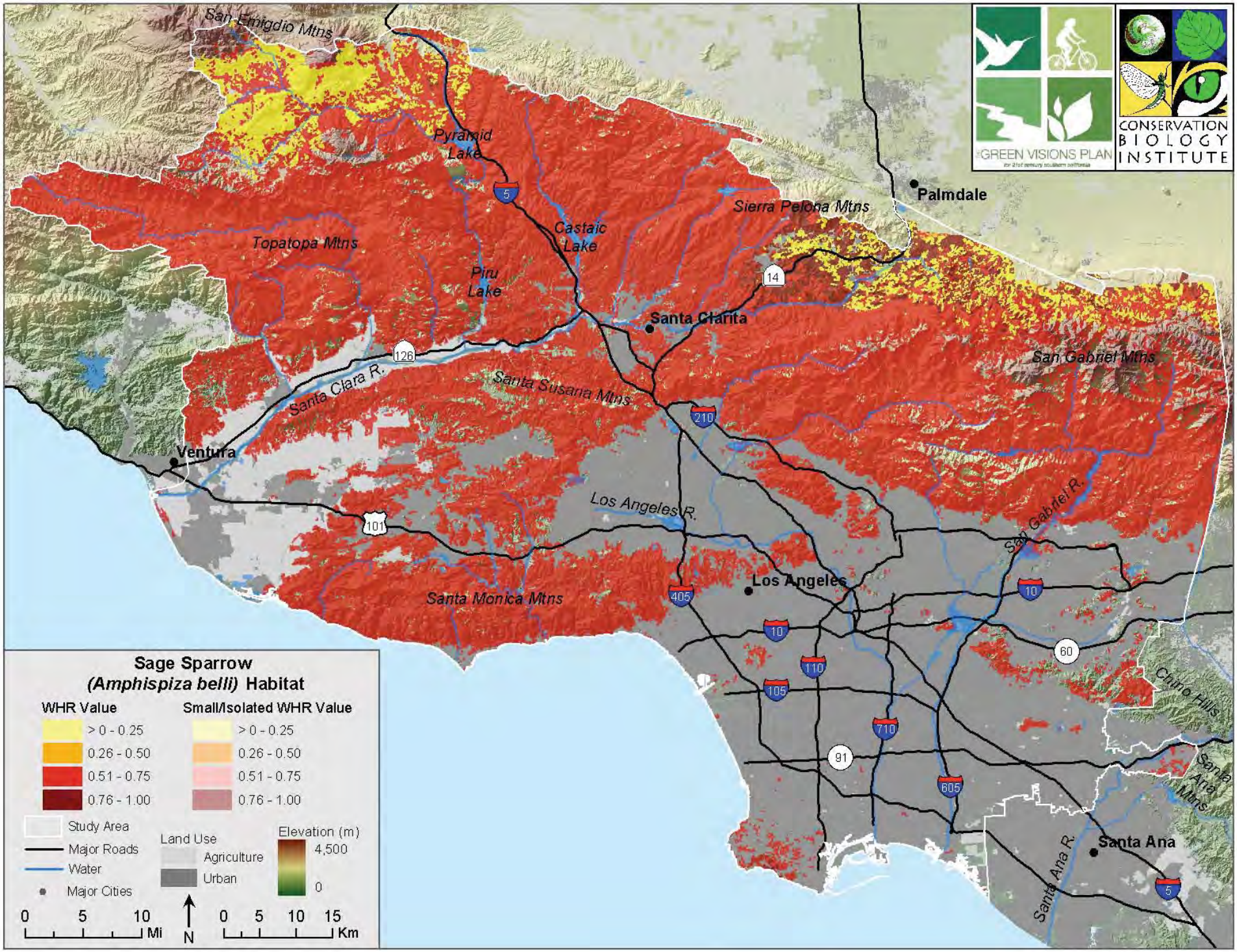
Knick, S. T. and J. T. Rotenberry. 2002. Effects of habitat fragmentation on passerine birds breeding in Intermountain shrubsteppe. Studies in Avian Biology 25:130-140.

Peterson, R. T. 1961. A Field Guide to Western Birds. Houghton Mifflin Company, Boston. 309 pp.

Stephenson, J. R. and G. M. Calcarone. 1999. Southern California Mountains and Foothills Assessment: Habitat and Species Conservation Issues. Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture, Albany, California. 401pp.

Unitt, P. 2004. San Diego County Bird Atlas. San Diego Natural History Museum. San Diego, California. 645pp.

Verner, J., E. C. Beedy, S. L. Granholm, L. V. Ritter, and E. F. Toth. 1980. Birds. Pages 75-320 *in* California Wildlife and Their Habitats: Western Sierra Nevada. Verner, J. and A. S. Boss (Technical coordinators). Gen. Tech. Rep. PSW-37. Pacific Southwest Forest and Range Exp. Station, Forest Service, U. S. Dept. of Agriculture, Berkeley, California. 439pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Sierra Pelona Mtns
Palmdale
Topatopa Mtns
Piru Lake
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
5
14
126
210
101
405
10
110
105
710
91
605
60
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Sage Sparrow
(Amphispiza belli) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km

Burrowing Owl (*Athene cunicularia*)
Family: Strigidae
Order: Strigiformes
Class: Aves

WHR #: B269

Distribution:
Burrowing owls are found from southwestern Canada, south to Tierra del Fuego, and they are migratory in the northern part of this range (Peterson 1961). This species breeds in appropriate habitat from southern British Columbia, southern Alberta, and south-central Saskatchewan south through central Argentina (Haug et al. 1993).

Within California, burrowing owls are often resident although some seasonal movement occurs within the state during fall and winter (Small 1994). They are rare along the coast north of Marin County and east of the Sierra Nevada crest. They were formerly common in central and southern California coastal areas, interior valleys, and in the Central Valley, but their distribution has become more restricted and fragmented due to urbanization and agriculture (Small 1994). Breeding populations have apparently been extirpated throughout much of the study area, and no burrowing owls were observed in the Santa Monica Mountains or the Palos Verdes Peninsula during recent surveys (P. Bloom, Western Foundation of Vertebrate Zoology, personal communication). Burrowing owls are occasionally found on the Channel Islands off the coast of California (Small 1994).

Habitat:
Burrowing owls are often found in open, usually dry, grasslands, prairies, dikes, deserts areas including desert scrub, and agricultural areas (Peterson 1961, Stephenson and Calcarone 1999), and may also occur in open shrub stages of pinyon (*Pinus* spp.)-juniper (*Juniperus* spp.) and ponderosa pine (*P. ponderosa*) habitats (California Interagency Wildlife Task Group 2002). They are also often found in open bare terrain with gullies and arroyos. In the Imperial Valley they may be found along the earthen borders and dikes along the edges of irrigation channels, and along the coast they have occasionally been found on bluffs (Small 1994).

Burrowing owls occur primarily in low elevation valleys but have been recorded at elevations as high as 1615 meters (Stephenson and Calcarone 1999), and migratory individuals have been documented at elevations of 3658 meters in the Cascade and Sierra Nevada Mountains (Small 1994).

Food:
Burrowing owls consume primarily arthropods, which they capture in the air or on the ground, but they commonly also eat small birds, mammals, reptiles, and carrion (Verner et al. 1980, California Interagency Wildlife Task Group 2002).

Ecology/Behavior:

The nests of burrowing owls are often found in rodent burrows, most commonly in those of California and round-tailed ground squirrels (*Spermophilus* spp.; Stephenson and Calcarone 1999), but they have been documented to dig their own burrows (Verner et al. 1980). Pipes, culverts, and human-provided nest boxes have also been used for nesting (California Interagency Wildlife Task Group 2002). In the western Sierra Nevada Mountains, they breed during March – August, with a peak in April – May (Verner et al. 1980), and records from San Diego County suggest a breeding season of at least March to June (Unitt 2004)..

Burrowing owls hunt primarily at night (Verner et al. 1980), but may hunt and be active during the day (California Interagency Wildlife Task Group 2002). Their nesting and roosting behavior can be described as semicolonial, and they are possibly the most gregarious owl in North America (California Interagency Wildlife Task Group 2002).

Home ranges of adult burrowing owls averaged 240 hectares (range 14-480 hectares) in Canada (Haug and Oliphant 1990), and the estimated home ranges of 6 radio-tagged males tracked during a 3-month period in the Imperial Valley of California ranged from 73 to 491 hectares (95% adaptive kernel method; Rosenberg and Haley 2004). Much smaller home ranges, averaging 0.8 hectares (range 0.04 – 1.6 hectares), were reported for burrowing owls at Oakland Municipal Airport (Thomsen 1971, cited in Verner et al. 1980). However, it is likely that the latter estimates greatly underestimate actual home range sizes since they may only represent diurnal space use patterns (P. Bloom, Western Foundation of Vertebrate Zoology, personal communication). The minimum area required by an individual bird at an over-wintering site is approximately 8.1 hectares (20 acres) while nesting birds would require a much large area (P. Bloom, Western Foundation of Vertebrate Zoology, personal communication).

Although many individuals in southern California are residents, some are migratory, with noticeably higher numbers of individuals observed during winter than summer in San Diego County (Unitt 2004). Dispersal distances up to 53 kilometers have been documented in this species (Rosier et al. 2006).

Burrowing owls are preyed upon by larger birds of prey, foxes, coyotes, and domestic dogs and cats (Martin 1973).

Rationale for its use as target species:
Burrowing owl numbers have decreased dramatically over the past decades and are now a California Species of Special Concern (Stephenson and Calcarone 1999, Unitt 2004). Though once widespread in California, their distribution is now much more restricted and fragmented, especially in coastal areas (Stephenson and Calcarone 1999). They are susceptible to habitat destruction and pesticides used to control ground squirrels (Stephenson and Calcarone 1999).

Habitat modeling approach:
Our habitat model for this species was based on habitat suitability ratings identified in the California Wildlife Habitat Relationships system (WHR, http://www.dfg.ca.gov/whdab), as modified by species experts for this project. We generated a habitat map which included all

pixels with a WHR rating > 0. However, we excluded the following (checked) areas, as identified in our composite SCAG/CALVEG landcover:

Commercial/Industrial	X
High Density Residential	X
Low Density Residential	X
Rural Residential	X
Urban Green Space	X
Vacant Urban	X
Orchards and Vineyards (active and abandoned)	X
Irrigated Cropland and Improved Pasture Land	
Non-irrigated Cropland and Improved Pasture Land	
Horse Ranches	X
Dairy, Intensive Livestock, and Associated Facilities	X
Nurseries	X
Other agriculture	X
Packing Houses and Grain Elevators	X
Poultry Operations	X

In addition, we identified patches of habitat that were < 20 hectares large (the minimum area likely required by an over-wintering individual) as those less likely to be occupied as compared to larger patches. Because burrowing owls are reported to be migratory in at least some portions of the state, and are know to disperse up to 53 kilometers, we assumed that they could reach all patches of potential habitat in the study area.

Bibliography:

California Interagency Wildlife Task Group. 2002. CWHR version 8.0 personal computer program. California Department of Fish and Game, Sacramento.

Haug, E. A. and L. W. Oliphant. 1990. Movements, activity patterns, and habitat use of burrowing owls in Saskatchewan. Journal of Wildlife Management 54:27-35.

Haug, E. A., B. A. Millsap, and M. S. Martell. 1993. Burrowing Owl (*Athene cunicularia*). *In* The Birds of North America, No. 61 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Martin, D. C. 1973. Selected aspects of burrowing owl ecology and behavior. Condor 75:446-456.

Peterson, R. T. 1961. A Field Guide to Western Birds. Houghton Mifflin Company, Boston. 309 pp.

Rosenberg, D. K. and K. L. Haley. 2004. The ecology of burrowing owls in the agroecosystem of the Imperial Valley, California. Studies in Avian Biology 27:120-135.

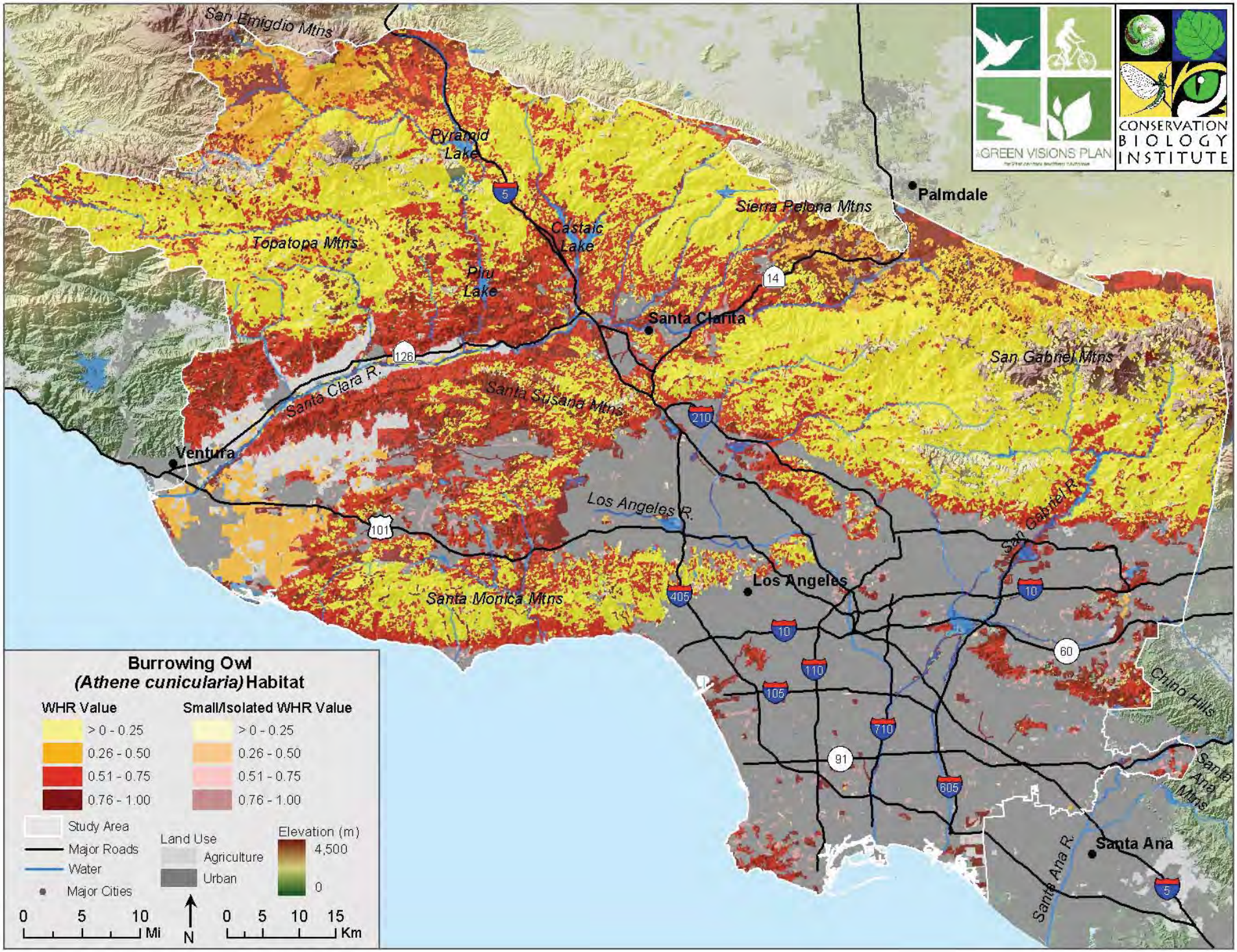
Rosier, J. R., N. A. Ronan, and D. K. Rosenberg. 2006. Post-breeding dispersal of burrowing owls in an extensive California grassland. American Midland Naturalist 155:162-167.

Small, A. 1994. California Birds: Their Status and Distribution. Ibis Publishing Company, Vista, California. 342 pp.

Stephenson, J. R. and G. M. Calcarone. 1999. Southern California mountains and foothills assessment: habitat and species conservation issues. General Technical Report GTR-PSW-172. Albany, CA: Pacific Southwestern Research Station, Forest Service, U.S. Department of Agriculture. 402pp.

Unitt, P. 2004. San Diego County Bird Atlas. San Diego Natural History Museum. San Diego, California. 645pp.

Verner, J., E. C. Beedy, S. L. Granholm, L. V. Ritter, and E. F. Toth. 1980. Birds. Pages 75 – 320 *in* California Wildlife and Their Habitats: Western Sierra Nevada. Verner, J., and A. S. Boss (technical coordinators). General Technical Report PSW-37. Pacific Southwest Forest and Range Experimental Station, Forest Service, U. S. Department of Agriculture, Berkeley, California. 439 pp.


San Emigdio Mtns
Pyramid Lake
Castaic Lake
Piru Lake
Topatopa Mtns
Sierra Pelona Mtns
Palmdale
Santa Clarita
San Gabriel Mtns
Santa Clara R.
Santa Susana Mtns
Ventura
Los Angeles R.
San Gabriel R.
Los Angeles
Santa Monica Mtns
Chino Hills
Santa Ana Mtns
Santa Ana
Santa Ana R.
GREEN VISIONS PLAN
CONSERVATION BIOLOGY INSTITUTE
Burrowing Owl
(Athene cunicularia) Habitat
WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Small/Isolated WHR Value
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
0.76 - 1.00
Study Area
Major Roads
Water
Major Cities
Land Use
Agriculture
Urban
Elevation (m)
4,500
0
0 5 10 Mi
N
0 5 10 15 Km