EXHIBIT 2

April 4, 2013

Ms. Cathy D. Lee
Lozeau-Drury, LLP
410 12th Street, Suite 250
Oakland, CA 94607

Subject: Comments on the Draft Environmental Impact Report prepared for the World Logistics Center Project

Dear Ms. Lee:

This letter contains my comments on the Draft Environmental Impact Report ("DEIR") prepared for the World Logistics Center Project ("Project"). Highland Fairview Operating Company ("Applicant") is proposing the World Logistics Center Specific Plan for 3,918 acres in the Rancho Belago area of the City of Moreno Valley. The Project entails a General Plan Amendment, which would redesignate approximately 71 percent of the area (2,710 acres) for logistics warehousing and the remaining 29 percent (1,104 acres) for permanent open space and public facilities.

I am an environmental biologist with 20 years of professional experience in wildlife ecology, forestry, and natural resource management. I have served as a biological resources expert for over 50 development projects. My experience in this regard includes testifying before the California Energy Commission and California Public Utilities Commission, and assisting various clients with evaluations of biological resource issues. My educational background includes a B.S. in Resource Management from the University of California at Berkeley, and a M.S. in Wildlife and Fisheries Science from the Pennsylvania State University.

I am on Riverside County's list of Authorized Biological Consultants. I have gained particular knowledge of the biological resource issues associated with the Project through studies I have conducted in Riverside County, and through my work on other projects in the Project region. The subsequent comments are based on my review of the environmental documents prepared for the Project, a review of scientific literature pertaining to biological resources known to occur in the Project area, consultations with biological resource experts, and the knowledge and experience I have acquired during more than 20 years of working in the field of natural resources management.

THE DEIR'S FAILURE TO ESTABLISH EXISTING CONDITIONS PRECLUDES A THOROUGH ASSESSMENT OF PROJECT IMPACTS TO SENSITIVE BIOLOGICAL RESOURCES

The DEIR Fails to Accurately Disclose the Value of the Project Site to Raptors

The DEIR identifies the Project site as providing "marginal foraging habitat for some raptors species."[1] This statement is not substantiated by survey data. Indeed, two different studies that were conducted in the Project area demonstrate (or strongly suggest) that the Project site provides very important habitat for raptors.

McCrary et al. (1985) conducted a 2-year fall and winter study of raptors in the San Jacinto Valley to provide baseline data on populations in southern California and to quantify the importance of the valley as a wintering area for raptors.[2] The study area was predominately agricultural lands (alfalfa and grain crops) and dairy farms, and it included the southern half of the Project site.[3] The investigators detected 14 raptor species during their study, and raptor densities were 5 to 17 times higher than those reported for other regions. This led the authors to conclude that "*the San Jacinto Valley and similar surrounding areas are of major importance to wintering birds of prey*."[4]

Beckman et al. (2011) replicated the raptor surveys between 2005 and 2009 and derived a comparable conclusion regarding the importance of the region to raptor species.[5] Furthermore, both studies indicate the San Jacinto Valley provides important wintering grounds for the white-tailed kite, northern harrier, ferruginous hawk, golden eagle, and prairie falcon—all of which are special-status species. The State of California indicates 22 overwintering raptor species are known to utilize the San Jacinto Valley, and that the San Jacinto Valley consistently ranks in the top one to two percent in species diversity for the North American Christmas Bird Counts.[6]

Burrowing Owl Surveys Were Incomplete and Did Not Adhere to Survey Protocols

The Western Riverside County Multiple Species Habitat Conservation Plan ("MSHCP") identifies the Project site as being within an area requiring focused surveys for burrowing owls. The Applicant did not conduct surveys throughout all portions of the Project site that provide suitable habitat for burrowing owls, nor did it conduct surveys according to

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[1] DEIR, p. 4.4-28.
[2] McCrary MD, RL McKernan, WD Wagner, RE Landry. 1986. Roadside raptor census in the San Jacinto Valley of southern California. Western Birds 17:123-130. (Attachment A).
[3] *Ibid*, p. 123 and Figure 1.
[4] *Ibid.* [emphasis added].
[5] Beckman A, S Hoffman, R Zembal, and others. 2011. Roadside Raptor Surveys of the Santa Ana River Watershed in Riverside and San Bernardino Counties, California, 2005-2009 [Abstract]. 2011 Annual Conference of the Western Section of the Wildlife Society, Riverside, California. (Attachment B).
[6] State of California. 2008. San Jacinto Wildlife Area, Expansion 31, Riverside County [internet]. Available at: http://bondaccountability.resources.ca.gov/NewsArticle.aspx?pid=4&id=133

the protocol established by the MSHCP.[7]

Burrowing owls occur in open habitat types (e.g., grassland, shrub steppe, desert, agriculture, and ruderal, among others) if the vegetation structure is suitable and there are useable burrows and foraging habitat in proximity.[8] As the DEIR acknowledges, almost all of the Project site and surrounding buffer area provide potentially suitable habitat for burrowing owls.[9] The DEIR suggests protocol surveys for the burrowing owl were conducted throughout the entire Project site, and that much of the Project site has been subject to several years of protocol-level surveys. To the contrary, the survey reports that accompany the DEIR suggest the burrowing owl surveys were cursory, and that some portions of the Project site providing suitable burrowing owl habitat were never surveyed.

<u>2005 Surveys</u>

In 2005, the Applicant's consultants used aerial photographs to categorize the potential (i.e., low, moderate, and high potential) for burrowing owls to occur in various portions of the 1,778-acre Bel Lago Property (a subset of the Project site). The consultants then conducted four surveys "on foot and by vehicle within suitable habitat on the Project site and within a 100-foot buffer around the suitable habitat."[10] In my opinion, those surveys were insufficient for documenting habitat suitability; and the presence, abundance, and distribution of burrowing owls in the survey area.

First, the presence and abundance of suitable burrows is an essential element of burrowing owl habitat, and thus, the suitability of the habitat as a whole. It would have been impossible for the Applicant's consultants to use aerial photographs to map the presence of burrows. This issue is confounded because the conclusions in the survey report pertaining to habitat suitability are internally inconsistent and/or are not supported by scientific literature. For example, the report first states habitat within the "low potential" area had little to no vegetation, but it subsequently states "low potential" habitat typically contained 100% vegetation coverage that provided poor habitat for burrowing owls due to limited visibility of ground dwelling species.[11]

Second, the surveys did not adhere to the methods described in the California Department of Fish and Wildlife's ("CDFW") Staff Report on Burrowing Owl Mitigation, as required by the MSHCP. CDFW's 2005 Staff Report states: "[s]urveys should be conducted by *walking* suitable habitat on the entire project site and (where possible) in areas within 150 meters (approx. *500 ft.*) of the project impact zone."[12] Indeed, administrators of the

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[7] Regional Conservation Authority. 2006. Burrowing Owl Survey Instructions for the Western Riverside Multiple Species Habitat Conservation Plan Area. Available at: http://www.wrc-rca.org/library.asp#id164.
[8] CDFG. 2012. Staff Report on Burrowing Owl Mitigation. Available at: www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf.
[9] DEIR, p. 4.4-29.
[10] *Ibid*, Appendix E. Michael Brandman Associates. 2005 Sep 12. DRAFT Focused Burrowing Owl Survey Report for the 1,778-acre Bel Lago Property, p. 6.
[11] *Ibid*, pp. 6 and 10.
[12] California Department of Fish and Game. 1995. Staff Report on Burrowing Owl Mitigation. [emphasis added].

MSHCP have established that burrowing owl surveys that are conducted while driving are unacceptable.[13] Although the surveyors detected a breeding pair of burrowing owls on the Project site they did not conduct additional surveys to identify the location of the nest site.[14]

2007 Surveys

The Applicant's consultant conducted additional surveys for burrowing owls in 2007. However, the surveys were limited to the site for the 158.4-acre Highland Fairview Corporate Park and the surrounding 500-foot buffer zone.[15] The surveys did not encompass the location where burrowing owls were detected in 2005, and thus they were incapable of determining continued use of the site by the breeding pair.[16]

2010 Surveys

In 2010, the Applicant's consultant conducted surveys within the 4,321-acres Highlands Specific Plan area. According to the survey report, a single biologist conducted the burrow survey (Part A of the protocol) and first focused burrowing owl survey (Part B of the protocol) between 0630 and 0730 hours on June 9, 2010.[17] Only areas identified in the initial survey as having potential burrows and adjacent foraging habitat for owls were surveyed during the remaining three surveys.[18] As a result, the survey effort was limited to four drainages within the entire Project site and surrounding buffer zone.[19] Such an effort would have been insufficient for documenting the presence, abundance, and distribution of burrowing owls within the Project site.

First, it would have been impossible for a single biologist to identify the presence of potentially suitable burrows across several thousand acres of potentially suitable habitat within one hour. Furthermore, the "Sensitive Plant Focused Survey" report indicates the biologist was conducting sensitive plant surveys within four drainages at the exact same time and date. Consequently, he could not have been conducting the burrow and burrowing owl survey across the entire Project site and buffer—as the report indicates.

Second, each of the remaining three focused surveys was limited to two biologists conducting surveys for one hour per day.[20] At the same time, one of the two biologists

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[13] Regional Conservation Authority. 2006. Burrowing Owl Survey Instructions for the Western Riverside Multiple Species Habitat Conservation Plan Area. Available at: http://www.wrc-rca.org/library.asp#id164.
[14] DEIR, Appendix E. Michael Brandman Associates. 2005 Sep 12. DRAFT Focused Burrowing Owl Survey Report for the 1,778-acre Bel Lago Property, p. 6.
[15] *Ibid*. Michael Brandman Associates. 2008 Feb 5. Burrowing Owl Focused Survey: Highland Fairview Corporate Park.
[16] *Ibid,* Exhibit 4. *See also* DEIR, Appendix E. Michael Brandman Associates. 2005 Sep 12. DRAFT Focused Burrowing Owl Survey Report for the 1,778-acre Bel Lago Property, Exhibit 4.
[17] DEIR, Appendix E. Michael Brandman Associates. 2010 Dec 13. Burrowing Owl Focused Survey: Highlands Specific Plan, p. 18.
[18] *Ibid,* p. 13.
[19] *Ibid,* Exhibit 4.
[20] *Ibid,* Table 2.

was reported to have been conducting surveys for sensitive plant species.[21] It would have been impossible for the biologists to reliably survey the four drainages for burrowing owls and sensitive plants during such a short period of time, especially given that there were numerous burrows throughout the survey area.[22]

The survey report indicates: "[t]here is no additional suitable habitat within 500 feet surrounding the project site. Therefore, although evaluated, protocol burrowing owl surveys were not conducted within the 500-foot buffer area."[23] This statement is misleading and undermines the information presented in the DEIR. First, it is clear the Applicant's consultant did not walk through (evaluate) the entire Project site and 500-foot buffer zone to determine the presence of potentially suitable burrows for burrowing owls. Second, the survey area appears to have been dictated by habitat suitability for sensitive plant species, which does not necessarily coincide with that for burrowing owls.[24] Third, the consultant's statement conflicts with information presented in its 2005 survey report, which identifies most of the Project site as having "moderate potential habitat" for burrowing owls.[25] Fourth, the consultant's statement conflicts with: (a) its map of vegetation communities; (b) imagery available through Google Earth (Figures 1 and 2); and (c) information provided in the DEIR.[26] These sources suggest there is considerably more suitable habitat for burrowing owls than suggested in the consultant's 2010 survey report.

2007 and 2012 Surveys

The DEIR indicates focused burrow and burrowing owls surveys also were conducted in 2006 (750 acres) and 2012 (3,300 acres).[27] However, the DEIR does not provide survey reports or any other information that describes and documents the survey efforts. As a result, I am unable to evaluate the value of those survey efforts in providing information pertaining to the burrowing owl.

A single burrowing owl was observed within the temporary detention basin located south of the Highland Fairview Corporate Park during a March 2012 site visit associated with the Jurisdictional Delineation.[28] Although this observation was important given the scarcity of owls in the MSHCP plan area, the Applicant's consultant apparently made no attempt to determine the breeding status of the owl.

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[21] DEIR, Appendix E. Michael Brandman Associates. 2010 Dec 13. Sensitive Plant Focused Survey: Highlands Specific Plan, Table 3.
[22] *Ibid*. Michael Brandman Associates. 2010 Dec 13. Burrowing Owl Focused Survey: Highlands Specific Plan, p. 18.
[23] *Ibid*.
[24] *Ibid*, Exhibit 4. *See also* DEIR, Appendix E. Michael Brandman Associates. 2010 Dec 13. Sensitive Plant Focused Survey: Highlands Specific Plan, p. 10 and Exhibit 5.
[25] DEIR, Appendix E. Michael Brandman Associates. 2005 Sep 12. DRAFT Focused Burrowing Owl Survey Report for the 1,778-acre Bel Lago Property, Exhibit 4.
[26] *Ibid*, p. 4.4-29.
[27] *Ibid*.
[28] *Ibid*, Appendix E, p. 46.

The Applicant's consultant has concluded the burrowing owl "is not considered a permanent resident within the entire study area." [29] The consultant has no basis for its conclusion because it did not conduct any surveys to evaluate winter residency. Moreover, it appears that at least one burrowing owl was detected south of the Highland Fairview Corporate Park (Skecher's Logistic Center) each time the area was surveyed.[30] This information, and the knowledge that burrowing owls have high site fidelity, strongly suggests that the burrowing owl is a breeding season resident on the Project site.

Figure 1. Potentially suitable burrowing owl habitat at proposed debris basin site east of Gilman Springs Road.

[29] *Ibid.*
[30] *Ibid.*

Figure 2. Potentially suitable burrowing owl habitat at proposed debris basin site east of Gilman Springs Road.

The DEIR Fails to Establish Existing Conditions Pertaining to Special-Status Plant Species That May Be Impacted by the Project

<u>Protocol-Level Plant Surveys Were Not Conducted</u>

Failure to survey the entire Project area and buffer-

The Applicant's consultant conducted rare plant surveys in June 2010. These surveys, however, were based on the footprint for the Highlands Specific Plan, and they were limited to four drainages within the Project site.[31] The Applicant's consultant did not survey any other portions of the Project area, including the Riversidean Sage Scrub communities, which the DEIR identifies as having the potential to support rare plant species that are not covered by the MSHCP.[32]

CDFW survey guidelines indicate focused botanical surveys should be conducted *whenever natural or naturalized vegetation occurs on a project site* and the project has

[31] DEIR, Appendix E. Michael Brandman Associates. 2010 Dec 13. Sensitive Plant Focused Survey: Highlands Specific Plan, p. 2. and Exhibit 5.
[32] *Ibid*, pp. 4.4-26 and -27.

the potential for direct or indirect effects on vegetation.[33] Natural and naturalized vegetation occur on and adjacent to the Project site, and the Project will have direct and indirect impacts on that vegetation.[34] Therefore, to establish existing conditions and comply with CDFW guidelines, the Applicant needs to conduct appropriately timed botanical surveys throughout all portions of the Project area and buffer zone containing natural or naturalized vegetation. Data from those surveys are required to fully assess existing conditions, analyze Project impacts, and formulate appropriate mitigation for impacts to sensitive botanical resources.

Inappropriate methodology-

The methods used to survey special-status plants on the Project site had numerous flaws that have resulted in unreliable information on baseline conditions and Project impacts.

The Applicant's consultant concluded that three sensitive plant species have a "moderate" potential to occur on the Project site. The sensitive plant surveys were limited to a search for those three species.[35] The "list approach" implemented by the Applicant's consultant is not an accepted technique for disclosing and analyzing the impacts of a project. Indeed, the CDFW specifically advises against the "list approach" for botanical inventories. Its survey guidance states:

> This list [of special-status plants with potential to occur within a particular region] can serve as a tool for the investigators and facilitate the use of reference sites; however, special status plants on site might not be limited to those on the list. Field surveys and subsequent reporting should be comprehensive and floristic in nature and *not restricted to or focused only on this list*…"Focused surveys" that are limited to habitats known to support special status species or are restricted to lists of likely potential species are not considered floristic in nature and **are not adequate** to identify all plant taxa on site to the level necessary to determine rarity and listing status.[36]

As the survey report acknowledges, "[t]he focused plant survey…is not considered a comprehensive botanical survey to record all observed species within the survey areas."[37]

According to the survey report, the 2010 surveys were conducted within the known flowering period of the special-status species potentially occurring within the Project footprint.[38] However, the phenology of plants can vary considerably within the known

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[33] CDFG. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Available at: http://www.dfg.ca.gov/wildlife/nongame/survey_monitor.html#Plants.
[34] DEIR, Figure 4.4-1.
[35] *Ibid*, Appendix E. Michael Brandman Associates. 2010 Dec 13. Sensitive Plant Focused Survey: Highlands Specific Plan, p. 1.
[36] CDFG. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Available at: http://www.dfg.ca.gov/wildlife/nongame/survey_monitor.html#Plants. [emphasis added].
[37] DEIR, Appendix E. Michael Brandman Associates. 2010 Dec 13. Sensitive Plant Focused Survey: Highlands Specific Plan, p. 9.
[38] *Ibid.*

flowering period depending on environmental conditions. Contrary to guidance issued by the CDFW, the Applicant's biologist did not visit reference sites to determine the phenology of the target species and to confirm they were identifiable at the time of the surveys.[39]

The sensitive plant surveys were limited to seven man-hours, during which time the biologist was also searching for burrowing owls.[40] In my opinion, it would have been impossible for the biologist to reliably survey the four drainages for burrowing owls <u>and</u> sensitive plants during such a short period of time.

Due to the issues described above, the DEIR lacks reliable information on existing conditions, and it is not possible for the City of Moreno Valley ("City") to conclude special-status plant species are absent from the Project site.

The DEIR Fails to Establish Existing Conditions Pertaining to the Los Angeles Pocket Mouse

The Los Angeles pocket mouse is a state listed Species of Special Concern and a MSHCP Group 3 species. The Los Angeles pocket mouse is associated with fine, sandy soils in intermittent drainages, non-native grassland, Riversidean sage scrub, Riversidean alluvial fan sage scrub, chaparral and redshank chaparral habitats.[41] The DEIR relays the opinion of the Applicant's consultant that the species is absent from the Project area.[42] That conclusion is unjustified for two reasons.

First, focused surveys for the Los Angeles pocket mouse were not conducted throughout all potentially suitable habitats. In 2005, trapping surveys were limited to nine acres of suitable habitat within "Drainage Feature 9."[43] In 2010, surveys were limited to trapping along approximately 1,000 feet of Drainage Feature 9, and within two ephemeral drainages (each also approximately 1,000 feet) dominated by mule fat but within an agricultural field.[44] Trapping surveys were never conducted in other portions of the Project area that contain potentially suitable habitat for the Los Angeles pocket mouse. These include: (a) the northern portion of "Drainage Feature 7" where it is associated with native vegetation; (b) the drainages and native vegetation communities east of Gilman Springs Road and north of Highway 60; (c) the grassland community within the Project area; and (d) the remaining scrub communities in the Project area.

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[39] CDFG. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Available at: http://www.dfg.ca.gov/wildlife/nongame/survey_monitor.html#Plants.
[40] DEIR, Appendix E. Michael Brandman Associates. 2010 Dec 13. Sensitive Plant Focused Survey: Highlands Specific Plan, Table 3. *See also* DEIR, Appendix E. Michael Brandman Associates. 2010 Dec 13. Burrowing Owl Focused Survey: Highlands Specific Plan, Table 2.
[41] MSHCP, Vol II-B, Species Accounts: Mammals. Available at: http://www.wrc-rca.org/library.asp
[42] DEIR, p. 4.4-30.
[43] *Ibid*, Appendix E. Michael Brandman Associates. 2005 Sep 26. DRAFT Focused Los Angeles Pocket Mouse Survey Report for the 1,778-Acre Bel Lago Property, p. 7.
[44] *Ibid*, p. 10.

Second, it is well established in the field of wildlife science that it is nearly impossible to prove absence. This is especially true for the Los Angeles pocket mouse, which appears to occur at low densities and is difficult to trap.[45]

Potentially significant Project impacts to the Los Angeles pocket mouse cannot be properly disclosed, analyzed, and mitigated until trapping surveys have been completed throughout all potentially suitable habitats in the Project area and buffer zone.

The DEIR Fails to Disclose Impacts to All Special-Status Species

<u>Northwestern San Diego Pocket Mouse</u>

The Northwestern San Diego pocket mouse is a state listed Species of Special Concern. According to the DEIR, the Northwestern San Diego pocket mouse has a low potential of occurring in the Project area.[46] This conclusion is incorrect. The Applicant's consultant captured seven Northwestern San Diego pocket mice during its 2010 trapping surveys on the Project site.[47] Development of the Project will have an adverse effect on the Northwestern San Diego pocket mouse. The City must disclose, analyze, and provide mitigation for this potentially significant impact.

<u>San Diego Desert Woodrat</u>

The San Diego Desert woodrat is a state listed Species of Special Concern. The Applicant's consultant captured eight San Diego desert woodrats during its trapping surveys on the Project site.[48] The DEIR does not disclose the presence of San Diego desert woodrats on the Project site, nor does it analyze potentially significant impacts to the (sub)species.

<u>American Badger</u>

The American badger is a state listed Species of Special Concern that is not covered under the MSHCP. The DEIR incorrectly states that the Project area does not contain habitat for the American badger.[49] The American badger occurs in herbaceous, shrub, and open stages of most habitats with dry, friable soils.[50] American badgers have the potential to occur on the Project site, especially in the patches of habitat that have not been subject to periodic discing. As a result, the City must disclose, analyze, and provide mitigation for potentially significant Project impacts to the American badger.

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[45] MSHCP, Vol II-B, Species Accounts: Mammals, p. M-92. Available at: http://www.wrc-rca.org/library.asp
[46] DEIR, Table 4.4.D.
[47] *Ibid*, Appendix E. Michael Brandman Associates. 2010 Dec 13. Focused Los Angeles Pocket Mouse Survey Report: Highlands Specific Plan, Table 2.
[48] *Ibid*. Michael Brandman Associates. 2005 Sep 26. Focused Los Angeles Pocket Mouse Survey Report for the 1,778-acre Bel Lago Property, Table 1.
[49] *Ibid*, p. 4.4-27.
[50] California Department of Fish and Game. California Interagency Wildlife Task Group. 2005. California Wildlife Habitat Relationships version 8.1 personal computer program. Sacramento, California.

Western Yellow Bat

The western yellow bat is a state listed Species of Special Concern that is not covered under the MSHCP. The DEIR states there is no suitable habitat for the species in the Project area even though (a) no bat surveys were conducted for the Project; and (b) the species has been documented occurring in the Project region.[51]

The western yellow bat is a "tree-roosting" species commonly found roosting in the skirt of dead fronds in both native and non-native palm trees.[52] It is believed to form small maternity groups in trees and palms, including in ornamental plantings in residential areas and orchards.[53] One of the primary threats to the species in the U.S. is the cosmetic trimming of palm fronds.[54] Palms occur in the Project area and presumably may be impacted by the Project.[55]

Bats are very vulnerable to disturbance.[56] Construction activities associated with the Project have the potential to cause bats to abandon roosts and maternity colonies. The DEIR does not disclose, assess, or provide mitigation for this potentially significant impact.

Bell's Sage Sparrow

The Bell's sage sparrow is a U.S. Fish and Wildlife Service ("USFWS") Bird of Conservation Concern, a CDFW Watch List species, and a MSHCP Group 2 species. The DEIR states there is no suitable habitat for the Bell's sage sparrow within the Project area.[57] The DEIR fails to acknowledge that the subspecies was detected during small mammal trapping surveys on the Project site.[58] As a result, the City must disclose and analyze potentially significant Project impacts to the Bell's sage sparrow.

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[51] California Natural Diversity Database, Biogeograhic Data Branch, Department of Fish and Game. 2012 Feb 7 (Version 3.1.0). *See also* DEIR, p. 4.4-27.
[52] Western Bat Working Group. 2005 [updated]. Species accounts. Available at: http://www.wbwg.org/species_accounts.
[53] California Wildlife Habitat Relationships System. 2005. California Department of Fish and Game. California Interagency Wildlife Task Group. CWHR version 8.1 personal computer program. Sacramento (CA). *See also* Western Bat Working Group. 2005 [updated]. Species accounts. Available at: http://www.wbwg.org/species_accounts.
[54] Western Bat Working Group. 2005 [updated]. Species accounts. Available at: http://www.wbwg.org/species_accounts.
[55] DEIR, Appendix E.
[56] Western Bat Working Group. 2005 [updated]. Species accounts. Available at: http://www.wbwg.org/species_accounts.
[57] DEIR, p. 4.4-27.
[58] *Ibid*, Appendix E. Michael Brandman Associates. 2005 Sep 26. Focused Los Angeles Pocket Mouse Survey Report for the 1,778-acre Bel Lago Property, Appendix A: Floral and Faunal Compendia.

Grasshopper Sparrow

The grasshopper sparrow is a state listed Species of Special Concern. The species is not covered by the MSHCP because the species-specific conservation objectives defined in the MSHCP have not yet been met.[59] The grasshopper sparrow was detected on the Project site.[60] However, the DEIR does not disclose, analyze, or provide mitigation for potentially significant Project impacts to the species.

White-tailed Kite

The DEIR concludes "[n]o suitable nesting habitat for white-tailed kite or American peregrine falcon occurs within the area due to historic agricultural activities, regular disking of the site, and dominance of sparse, non-native low-quality vegetation."[61] This conclusion conflicts with scientific information. White-tailed kites are known to nest in a variety of different tree species.[62] Furthermore, agricultural habitat, especially dryland field crops (e.g., wheat and barley), may play an important role as foraging habitat for nesting white-tailed kites because the fields are known to provide prey for foraging raptors. The City must disclose and analyze potentially significant Project impacts to the white-tailed kite.

Ferruginous Hawk and Merlin

The ferruginous hawk is a USFWS Bird of Conservation Concern and a CDFW Watch List species. The merlin is a CDFW Watch List species. The DEIR states the Project site provides suitable foraging habitat for these two species, but no suitable nesting habitat.[63] Both the ferruginous hawk and merlin are known to occur in the Project region.[64]

It is well established that ferruginous hawks and merlins do not nest in California, and that the special-status designations for these two species apply to birds on their *wintering* grounds. Therefore, the lack of nesting habitat on the Project site is irrelevant to the potential for Project impacts under CEQA. As a result, the City must disclose and analyze Project impacts to the ferruginous hawk and merlin, and it must identify how potentially significant impacts to the two species would be mitigated.

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[59] MSHCP, Vol II-B, Species Accounts: Birds. *See also* MSHCP 2011 Annual Report, Table 25. Available at: http://www.wrc-rca.org/library.asp
[60] DEIR, Table 4.4.D.
[61] *Ibid*, p. 4.4-26.
[62] Niemela CA. 2007. Landscape characteristics surrounding white-tailed kite nest sites in Southwestern California. MS Thesis, Humboldt State University, Arcata, California.
[63] DEIR, p. 4.4-27.
[64] eBird. 2011. eBird: An online database of bird distribution and abundance [web application]. Version 2. eBird, Ithaca, New York. Available: http://www.ebird.org. (Accessed: 2013 Feb 2).

The DEIR Provides Incorrect Information on the Jurisdictional Status of Drainages in the Project Area.

The DEIR states the drainage features in the Project area are not subject to the jurisdiction of the CDFW.[65] This statement is inconsistent with information provided in the Jurisdictional Delineation report, which identifies portions of Drainages 7 and 9 as being jurisdictional under 1600 of the Fish and Game Code.[66]

The DEIR states that the Project site does not contain any features under the jurisdiction of the Regional Water Quality Control Board ("RWQCB").[67] This statement appears to be based on the false impression that features not under the jurisdiction of the U.S. Army Corps of Engineers are also not under the jurisdiction of the RWQCB.[68]

The jurisdictional reach of Porter-Cologne Water Quality Control Act (i.e., RWQCB) extends to all "waters of the state."[69] That term is defined as "any surface water or groundwater, including saline waters, within the boundaries of the state."[70] Because Porter-Cologne applies to any water and the federal Clean Water Act only applies to certain waters, California's jurisdictional reach is broader and more comprehensive than the federal government's.[71]

PROJECT IMPACTS

The Extent of Project Impacts to Sensitive Biological Resources Cannot Be Assessed Due to the Lack of Survey Data

For reasons previously discussed, project impacts to the burrowing owl, Los Angeles pocket mouse, and special-status plants cannot be sufficiently assessed due to the lack of comprehensive survey data. The lack of comprehensive survey data on burrowing owls is especially problematic because it is a MSHCP "Group 3" species (with additional survey needs and procedures), and because the species is known to occur on the Project site.

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[65] DEIR, p. 4.4-51.
[66] *Ibid*, Appendix E. Michael Brandman Associates. 2012 Apr 23. Assessment of Jurisdictional Waters and Wetlands, p. 42.
[67] *Ibid*, p. 4.4-59.
[68] *For example, see*: DEIR, Appendix E. Michael Brandman Associates. 2012 Apr 23. Assessment of Jurisdictional Waters and Wetlands, p. 32.
[69] State Water Resources Control Board. 2013 Jan 28. PRELIMINARY DRAFT: WATER QUALITY CONTROL POLICY for Wetland Area Protection and Dredged or fill Permitting, p. 4. Available at: http://www.waterboards.ca.gov/water_issues/programs/cwa401/docs/wrapp/policy_draft.pdf
[70] *Ibid.*
[71] *Ibid.*

Burrowing Owl

Burrowing owls have been documented occurring on the Project site.[72] As a result, the Project is likely to have significant direct and indirect impacts on burrowing owl resources (including burrows, foraging habitat, and individual owls). However, the extent and magnitude (e.g., number of afflicted owls) cannot be fully evaluated and mitigated until surveys that comply with CDFW's 2012 survey requirements have been conducted. Moreover, it is not possible to rule out the potential for the Project to significantly impact burrowing owls until surveys that adhere to the protocol have been conducted.

The DEIR Fails to Provide Scientific Analysis of Project Impacts to Raptor Habitat

The City's analysis of Project impacts to raptor foraging habitat is limited to the following statements:

> The WLCSP [World Logistics Center Specific Plan] and off-site facilities contain flat, open areas with sparse vegetation, which could be considered foraging habitat for some raptor species. Due to the regular, heavy disturbance associated with the various agricultural activities in the WLCSP and off-site facilities resulting in a rather limited prey base, and the limited size of the site in relation to the expansive foraging habitat in the near vicinity including both the CDFW Conservation Buffer Area and the SJWA[San Jacinto Wildlife Area], LSSRA [Lake Perris State Recreation Area] and the extensive Badlands to the east, the foraging habitat on site is considered marginally suitable and an adverse but not significant impact to raptor foraging habitat is anticipated.[73]

These statements are not supported by actual analysis.

First, neither the Applicant nor the City conducted any studies to quantify the prey base for raptors. Whereas agricultural activities can reduce the prey base, certain activities (e.g., harvesting, discing, mowing, flood irrigation, and burning) increase hunting efficiency by reducing cover or otherwise increasing the exposure of prey to foraging raptors. Indeed, some raptor species (e.g., Swainson's hawk) have learned to exploit the abundance of prey made available by agricultural activities. For example, Estep (1989) reported that Swainson's hawks in the Central Valley spent 52.8% of their foraging time hunting in apparent response to harvesting, discing, mowing, or irrigation.[74]

Second, the Project site cannot be characterized as being of "limited size" in relation to the expansive foraging habitat in the vicinity. Indeed, the Applicant's consultant identified the study area as containing "extensive raptor foraging habitat."[75] The consultant also concluded that impacts to the large amount of raptor foraging habitat on

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[72] DEIR, Appendix E, p. 46.
[73] *Ibid*, p. 4.4-75.
[74] Estep JA. 1989. Biology, movements, and habitat relationships of the Swainson's Hawk in the Central Valley of California, 1986-87.Calif. Dept. Fish and Game, Nongame Bird and Mammal Sec. Rep., 52 pp. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=70479
[75] DEIR, Appendix E, p. 3.

the site may be a significant impact under CEQA.[76]

Whereas I do not contest that there is a considerable amount of foraging habitat in the Project vicinity, it is overly simplistic for the City to conclude that the loss of over 2,700 acres of foraging habitat would not have a significant impact on raptors. Some raptor species are intolerant of even small amounts of urban development.[77] For example, Berry et al. (1998) concluded that even small amounts of urbanization usually rendered *whole landscapes* unacceptable to bald eagles, ferruginous hawks, rough-legged hawks, and prairie falcons.[78] In addition, raptors that are displaced from the Project site to suboptimal habitats would likely experience reduced survivorship. Thus, the City's analysis of Project impacts to raptors must consider (a) the size and configuration of remnant foraging habitat in relation to urbanization; and (b) the quality and carrying capacity of the habitat remaining in the region.

The DEIR Fails to Disclose, Analyze, or Provide Mitigation for Adverse Effects Associated with the Relocation of Wildlife

The DEIR indicates burrowing owls, Los Angeles pocket mice, and perhaps other sensitive species may be "relocated" to the 250-foot setback zone along the southern boundary of the Project site. Relocating sensitive wildlife to the setback zone defeats its intent, which is to provide a buffer between the Project and sensitive biological resources. Moreover, relocating wildlife outside of the construction area does not ensure impacts are mitigated.

In a comprehensive review of translocation projects involving birds and mammals, Griffith et al. (1989) concluded overall success rates were apparently dependent on a variety of ecological factors, including the quality of the habitat where animals were released.[79] When an animal is moved to an unfamiliar location, it has no knowledge of the habitat resources essential for its survival (e.g., food, water, and cover). The lack of cover in an unfamiliar setting makes a prey species (e.g., Los Angeles pocket mouse) an easy target for predators. In addition, many animals exhibit an intrinsic homing response that is energetically taxing, and that may preclude procurement of food and cover resources. Elevated stress hormone levels an organism generates when it is handled and moved may synergistically interact with increased energetic demands to further reduce possibility of survival. Even if the translocated animal is placed in an area with readily available resources, aggressive competitors may prevent the displaced animal from accessing the resources, and from mating.

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[76] *Ibid.*
[77] Berry ME, CE Bock, SL Haire. 1998. Biodiversity of open space grasslands at a suburban/agricultural interface, Part III: Abundance of diurnal raptors on open space grasslands in an urbanized landscape. Final report to the Biological Resources Division, U.S. Geological Survey and Department of Open Space/Real Estate, City of Boulder. Contract No. 1445-CA09-96-0025. Available at: http://www.bouldercolorado.gov/ (Attachment C).
[78] *Ibid.*
[79] Griffith B, JM Scott, JW Carpenter, C Reed. 1989. Translocation as a species conservation tool: status and strategy. Science 245:477-480. (Attachment D).

Burrowing owl-

Consistent with CDFW guidelines, passive relocation is a potentially significant impact under CEQA that must be analyzed.[80] Specifically, the temporary or permanent closure of burrows may result in: (a) significant loss of burrows and habitat for reproduction and other life history requirements; (b) increased stress on burrowing owls and reduced reproductive rates; (c) increased depredation; (d) increased energetic costs; and (e) risks posed by having to find and compete for available burrows.[81] The City must thoroughly analyze the effects of passive relocation if it may be implemented at the Project site.

The need for full analysis of potential impacts from passive relocation is further supported by research that indicates most translocation projects have resulted in fewer breeding pairs of burrowing owls at the mitigation site than at the original site, and that translocation projects generally have failed to produce self-sustaining populations.[82] Investigators attribute the limited success of translocation to: (a) strong site tenacity exhibited by burrowing owls, and (b) potential risks associated with forcing owls to move into unfamiliar and perhaps less preferable habitats.[83]

Each of these issues exemplifies the need for the Applicant to prepare a detailed translocation plan that is approved by the resource agencies before translocation occurs. At a minimum, the plan should contain:

1. an assessment of potential release sites, with special attention dedicated to estimating the size of the receiving population.
2. an assessment of threats at the release site (e.g., predators, pesticide use, land management activities), and a discussion of how these threats have been (or will be) mitigated.
3. a detailed description of the monitoring and adaptive management measures that will be implemented after animals are released.

The DEIR Fails to Assess Cumulative Impacts

The DEIR provides virtually no analysis of the Project's contribution to cumulative impacts to sensitive biological resources. It simply concludes: "the regional (cumulative) implications of the project can be addressed through the fee payment program of the MSHCP because it provides a regional and comprehensive approach to conservation planning," and that "no significant cumulative effect on biological resources would result from the development of the proposed uses with implementation of the identified program mitigation measures."[84]

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[80] CDFG. 2012. Staff Report on Burrowing Owl Mitigation, p. 10.
[81] *Ibid.*
[82] Smith BW, JR Belthoff. 2001. Burrowing owls and development: short-distance nest burrow relocation to minimize construction impacts. J. Raptor Research 35:385-391. (Attachment E).
[83] *Ibid.*
[84] DEIR, p. 4.4-81.

The City's justification fails to consider the Project's contribution to potentially significant impacts to species not covered by the MSHCP. Indeed, the Final EIR/EIS for the MSHCP states: "implementation of the MSHCP will result in cumulatively significant impacts on the Non-Covered Species because the issuance of incidental take permits will remove an impediment to development outside of the MSHCP Conservation Area. Non-Covered Species would receive little or no protection outside the reserves under existing ordinances and regulations."[85] In my opinion, the Project may contribute to cumulatively considerable impacts to Non-Covered Species, and those impacts would not be mitigated by the measures proposed by the City.

Many assumptions were incorporated into the MSHCP. The assumptions pertain to biological conditions (and relationships), development within the plan area, and actual implementation of the MSHCP. Some of the assumptions that were incorporated into the MSHCP have proven to be incorrect. For example, the MSHCP has been unsuccessful in the conservation of burrowing owls within the plan area.[86] This example highlights the flaws with the City's conclusion that the MSHCP will eliminate any potential for cumulative impacts.

Ultimately, the Project's contribution to cumulative impacts cannot be analyzed because the City has not identified the other projects within the cumulative effects analysis area. At a minimum, the City must identify the other projects may contribute to cumulatively considerable impacts to raptors, jurisdictional waters, the Northwestern San Diego pocket mouse, and other sensitive biological resources in the Project region.

MITIGATION MEASURES

The DEIR Fails to Establish Adequate Buffers to Mitigate Potentially Significant Impacts of Air Pollution on Wildlife

According to the DEIR, "[t]he most significant potential environmental impact on local wildlife (i.e., within the SJWA and Badlands) may be exposure to vehicular exhaust and especially diesel particulates and toxic air contaminants from truck exhaust as the WLCSP project builds out. New development will produce *significant amounts* of diesel-related air pollutants that will be released into the atmosphere, including gases and particles of various sizes."[87] Nevertheless, the City has concluded "[t]he 250-foot setback identified in Mitigation Measure 4.4.6.1A, and the presence of the CDFW Conservation Buffer Area, will effectively mitigate potential indirect impacts of air pollutants, including diesel particulate matter, on wildlife within the SJWA."[88]

The DEIR fails to establish a monitoring and reporting program to ensure the proposed

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[85] MSHCP, p. 5.1-7. [emphasis added].
[86] *Ibid*, Burrowing Owl Survey Report 2011. Available at: http://www.wrc-rca.org/library.asp *See also* Wilkerson RL and RB Siegel. 2010. Assessing changes in the distribution and abundance of burrowing owls in California, 1993-2007. Bird Populations 10: 1-36. (Attachment F).
[87] DEIR, Appendix E, p. 128. [emphasis added].
[88] *Ibid*, p. 4.4-72.

buffer mitigates the effects of air pollution on wildlife, vegetation, and aquatic resources. Moreover, information provided in the DEIR does not support the City's conclusion that a 400-foot buffer is sufficient to mitigate Project impacts to a less-than-significant level. Specifically, the DEIR cites research by the California Air Resources Board ("CARB") that indicates 80 percent of the particulates generally settle out of the atmosphere within 1,000 feet of the emission source.[89] Analyses by both the CARB and the South Coast Air Quality Management District indicate that providing a buffer of 1,000 feet would substantially reduce diesel PM concentrations and public exposure downwind of a distribution center.[90] Because wildlife may be more susceptible to air pollutant impacts than humans, one can infer that a buffer of at least 1,000 feet is needed to protect wildlife from air pollutants.[91]

The DEIR Lacks Adequate Mitigation for Project Impacts to Special-Status Plant Species

Mitigation proposed by the City for Project impacts to special-status plant species includes:

> Prior to the approval of any Plot Plans for development within the project area, the applicant shall submit a biological assessment of the proposed development site prepared by a qualified biologist to identify if any of the following sensitive plants (i.e., Coulter's goldfields, smooth tarplant, or thread-leaved brodiaea) are present on the proposed development site. If plants are found in the proposed development area, they may be relocated to the 250-foot clear setback area outlined in the Specific Plan and discussed in Mitigation Measure 4.4.6.1A. Alternatively, an appropriate impact fee may be paid to the Western Riverside County Regional Conservation Authority (RCA) or other appropriate conservation organizations to offset for the loss of these species on the WLC project site.[92]

The proposed measures do not ensure Project impacts to special-status plant species are mitigated to a less-than-significant level.

First, Coulter's goldfields, smooth tarplant, and thread-leaved brodiaea are MSHCP Group 3 species. As a result, if any of these species occur within a proposed development area, the City must require the project proponent to conform to the procedures listed in Section 6.3.2 in the MSHCP. Section 6.3.2 states: "[f]or locations with positive survey results, 90% of those portions of the property that provide for long-term conservation value for the identified species shall be avoided until it is demonstrated that conservation goals for the particular species are met."[93]

Second, the special-status plant species with the potential to occur in the Project area are

[89] *Ibid*, p. 4.4-70.
[90] California Air Resources Board (CARB) and California Environmental Protection Agency (CEPA). 2005. Air Quality and Land Use Handbook: A Community Health Perspective. Available at: http://www.arb.ca.gov/ch/landuse.htm
[91] DEIR, Appendix E, p. 129.
[92] *Ibid*, pp. 4.4-74 and -75.
[93] MSHCP, Vol I, Section 6.3.2. Available at: http://www.wrc-rca.org/library.asp

not limited to the three species identified in the mitigation measure.[94] In accordance with CDFW guidelines, the City must require surveys that are floristic in nature, meaning that every plant taxon that occurs on site is identified to the taxonomic level necessary to determine rarity and listing status.[95]

Third, the DEIR suggests mitigation may be limited to relocating plants to the buffer area. Although salvage and relocation have some merits as a last resort, it is generally not an effective means of mitigating impacts. Fiedler (1991) conducted a thorough review of mitigation-related transplantation, relocation and reintroduction attempts involving special-status plants in California.[96] The author reported only 8 of the 53 (15%) attempts reviewed in her study should be considered fully successful.[97] Although Fiedler reported several causes for the failed attempts, the common result was that the plants died. Unless the City can provide evidence that potentially impacted plants can be transplanted and/or propagated successfully, it must require fee payment to the Regional Conservation Authority.

Fourth, the City must identify the specific mitigation measure (or suite of potential measures) that will be required if a sensitive plant or animal species that is not covered under the MSHCP is detected within a proposed development area.

The DEIR Lacks Adequate Mitigation for Project Impacts to the Burrowing Owl

The conservation goals established in the MSHCP have not yet been met for the burrowing owl, and thus sites with burrowing owls appear to be subject to the provisions listed in Section 6.3.2 in the MSHCP.[98] Because the burrowing owl was recently (2012) detected on the Project site, the City needs to clarify whether the Project is subject to the provisions of MSHCP Section 6.3.2. If the Project is subject to those provisions, the City must identify how the Project will be capable of avoiding 90% of those portions of the site that provide for the long-term conservation value for the burrowing owl.

Burrowing owls have the potential to occupy the Project site prior to development.[99] The DEIR indicates "[t]his is a potentially significant impact requiring mitigation."[100] However, it fails to define the impact(s) or provide any mitigation to offset the impact(s). Instead, it simply requires a pre-construction survey, establishment of buffer zones around active burrows, and the exclusion of owls from their burrows during the non-breeding season (which in itself is a potentially significant impact).

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[94] *Ibid*, Table 4.4.D.
[95] CDFG. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Available at: http://www.dfg.ca.gov/wildlife/nongame/survey_monitor.html#Plants.
[96] Fiedler PL. 1991. Mitigation-related transplantation, relocation and reintroduction projects involving endangered and threatened, and rare plant species in California. Final Report. Available at: nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=3173.
[97] *Ibid.*
[98] MSHCP 2011 Annual Report, Table 25. Available at: http://www.wrc-rca.org/library.asp
[99] DEIR, p. 4.4-77.
[100] *Ibid.*

Pre-construction Survey

The DEIR requires a pre-construction survey for burrowing owls no more than 30 days prior to initiation of ground-disturbing activities.[101] This condition is not consistent with CDFW guidelines, which recommend an initial preconstruction survey within the 14 days prior to ground disturbance, followed by a subsequent survey within 24 hours prior to ground disturbance.[102] As the CDFW's 2012 Staff Report acknowledges, "burrowing owls may re-colonize a site after only a few days."[103] As a result, a single pre-construction survey up to 30 days in advance of construction is insufficient to avoid and minimize take of burrowing owls.

The City must clarify that "take avoidance" (i.e., pre-construction) surveys for the burrowing owl are not a substitute for the four surveys required to assess Project impacts and formulate appropriate mitigation. The City must require the Applicant to conduct the protocol surveys described by CDFW, and the results of those surveys need to be released in a revised DEIR.[104]

Buffers

The DEIR provides inconsistent information on the buffer distance required around active burrows (i.e., 250 feet or 500 feet).[105] Furthermore, the CDFW no longer uses the default standard of 250-foot buffers during the breeding season and 160-foot buffers during the non-breeding season. Instead, CDFW indicates that indirect impacts and appropriate mitigation should be determined through site-specific analyses that incorporate the wide variation in natal area, home range, foraging area, and other factors influencing burrowing owls and burrowing owl population persistence in a particular area.[106] CDFW guidelines indicate buffers may need to be up to 500 meters, depending on the level of disturbance.[107]

Burrow Exclusion

In accordance with CDFW guidelines, burrowing owls should not be excluded from burrows unless or until the Applicant:

1. develops a Burrowing Owl Exclusion Plan that is approved by the CDFW;
2. secures off-site compensation habitat and constructs artificial burrows in close proximity (< 100 m) to the eviction sites;

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[101] *Ibid.*
[102] CDFG. 2012. Staff Report on Burrowing Owl Mitigation. Available at: <www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf>, pp. 29-30.
[103] *Ibid*, p. 30.
[104] *Ibid*, Appendix D.
[105] DEIR, p. 4.4-79.
[106] CDFG. 2012 Mar 7. Staff Report on Burrowing Owl Mitigation. Available at: www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf. p. 12.
[107] *Ibid*, p. 9.

3. mitigates the impacts of temporary exclusion according to the methods outlined by CDFW;
4. conducts site monitoring prior to, during, and after exclusion of burrowing owls from their burrows; and,
5. documents excluded burrowing owls using artificial or natural burrows on an adjoining mitigation site.[108]

Sincerely,

Scott Cashen, M.S.
Senior Biologist

[108] *Ibid*, pp. 10 and 11.

Scott Cashen, M.S.
Senior Biologist / Forest Ecologist
3264 Hudson Avenue, Walnut Creek, CA 94597. (925) 256-9185. scottcashen@gmail.com

Scott Cashen has 20 years of professional experience in natural resources management. During that time he has worked as a field biologist, forester, environmental consultant, and instructor of Wildlife Management. Mr. Cashen currently operates an independent consulting business that focuses on CEQA/NEPA compliance issues, endangered species, scientific field studies, and other topics that require a high level of scientific expertise.

Mr. Cashen has knowledge and experience with many taxa, biological resource issues, and environmental regulations. This knowledge and experience has made him a highly sought after biological resources expert. To date, he has been retained as a biological resources expert for over 40 projects. Mr. Cashen's role in this capacity has encompassed all stages of the environmental review process, from initial document review through litigation support and expert witness testimony.

Mr. Cashen is a recognized expert on the environmental impacts of renewable energy development. He has been involved in the environmental review process for 28 renewable energy projects, and he has been a biological resources expert for more of California's solar energy projects than any other private consultant. In 2010, Mr. Cashen testified on 5 of the Department of the Interior's "Top 6 Fast-tracked Solar Projects" and his testimony influenced the outcome of each of these projects.

Mr. Cashen is a versatile scientist capable of addressing numerous aspects of natural resource management simultaneously. Because of Mr. Cashen's expertise in both forestry and biology, Calfire had him prepare the biological resource assessments for all of its fuels treatment projects in Riverside and San Diego Counties following the 2003 Cedar Fire. Mr. Cashen has led field studies on several special-status species, including plants, fish, reptiles, amphibians, birds, and mammals. Mr. Cashen has been the technical editor of several resource management documents, and his strong scientific writing skills have enabled him to secure grant funding for several clients.

AREAS OF EXPERTISE

- CEQA, NEPA, and Endangered Species Act compliance issues
- Comprehensive biological resource assessments
- Endangered species management
- Renewable energy
- Forest fuels reduction and timber harvesting
- Scientific field studies, grant writing and technical editing

EDUCATION

M.S. Wildlife and Fisheries Science - The Pennsylvania State University (1998)
B.S. Resource Management - The University of California, Berkeley (1992)

PROFESSIONAL EXPERIENCE

Litigation Support / Expert Witness

As a biological resources expert, Mr. Cashen reviews CEQA/NEPA documents and provides his client(s) with an assessment of biological resource issues. He then prepares written comments on the scientific and legal adequacy of the project's environmental documents (e.g., EIR). For projects requiring California Energy Commission (CEC) approval, Mr. Cashen has submitted written testimony (opening and rebuttal) in conjunction with oral testimony before the CEC.

Mr. Cashen can lead field studies to generate evidence for legal testimony, and he can incorporate testimony from his deep network of species-specific experts. Mr. Cashen's clients have included law firms, non-profit organizations, and citizen groups.

<u>REPRESENTATIVE EXPERIENCE</u>

Solar Energy Facilities
- Abengoa Mojave Solar Project
- Avenal Energy Power Plant
- Beacon Solar Energy Project
- Blythe Solar Power Project
- Calico Solar Project
- Calipatria Solar Farm II
- Carrizo Energy Solar Farm
- Catalina Renewable Energy Project
- Fink Road Solar Farm
- Genesis Solar Energy Project
- Heber Solar Energy Facility
- Imperial Valley Solar Project
- Ivanpah Solar Electric Generating
- Maricopa Sun Solar Complex
- Mt. Signal and Calexico Solar
- San Joaquin Solar I & II
- Solar Gen II Projects
- SR Solis Oro Loma
- Vestal Solar Facilities
- Victorville 2 Power Project

Geothermal Energy Facilities
- East Brawley Geothermal
- Mammoth Pacific 1 Replacement
- Western GeoPower Plant and

Wind Energy Facilities
- Catalina Renewable Energy Project
- Ocotillo Express Wind Energy
- San Diego County Wind Ordinance
- Tres Vaqueros Repowering Project
- Vasco Winds Relicensing Project

Biomass Facilities
- Tracy Green Energy Project

Development Projects
- Alves Ranch
- Aviano
- Chula Vista Bayfront Master Plan
- Columbus Salame
- Concord Naval Weapons Station
- Faria Annexation
- Live Oak Master Plan
- Napa Pipe
- Roddy Ranch
- Rollingwood
- Sprint-Nextel Tower

Project Management

Mr. Cashen has managed several large-scale wildlife, forestry, and natural resource management projects. Many of these projects have required hiring and training field crews, coordinating with other professionals, and communicating with project stakeholders. Mr. Cashen's experience in study design, data collection, and scientific writing make him an effective project manager, and his background in several different natural resource disciplines enable him to address the many facets of contemporary land management in a cost-effective manner.

REPRESENTATIVE EXPERIENCE

Wildlife Studies

- Peninsular Bighorn Sheep Resource Use and Behavior Study: (*CA State Parks*)
- "KV" Spotted Owl and Northern Goshawk Inventory: (*USFS, Plumas NF*)
- Amphibian Inventory Project: (*USFS, Plumas NF*)
- San Mateo Creek Steelhead Restoration Project: (*Trout Unlimited and CA Coastal Conservancy, Orange County*)
- Delta Meadows State Park Special-status Species Inventory: (*CA State Parks, Locke*)

Natural Resources Management

- Mather Lake Resource Management Study and Plan – (*Sacramento County*)
- Placer County Vernal Pool Study – (*Placer County*)
- Weidemann Ranch Mitigation Project – (*Toll Brothers, Inc., San Ramon*)
- Ion Communities Biological Resource Assessments – (*Ion Communities, Riverside and San Bernardino Counties*)
- Del Rio Hills Biological Resource Assessment – (*The Wyro Company, Rio Vista*)

Forestry

- Forest Health Improvement Projects – (*CalFire, SD and Riverside Counties*)
- San Diego Bark Beetle Tree Removal Project – (*SDG&E, San Diego Co.*)
- San Diego Bark Beetle Tree Removal Project – (*San Diego County/NRCS*)
- Hillslope Monitoring Project – (*CalFire, throughout California*)

Biological Resources

Mr. Cashen has a diverse background with biological resources. He has conducted comprehensive biological resource assessments, habitat evaluations, species inventories, and scientific peer review. Mr. Cashen has led investigations on several special-status species, including ones focusing on the foothill yellow-legged frog, mountain yellow-legged frog, desert tortoise, steelhead, burrowing owl, California spotted owl, northern goshawk, willow flycatcher, Peninsular bighorn sheep, red panda, and forest carnivores.

REPRESENTATIVE EXPERIENCE

Avian

- Study design and Lead Investigator - Delta Meadows State Park Special-Status Species Inventory *(CA State Parks: Locke)*
- Study design and lead bird surveyor - Placer County Vernal Pool Study *(Placer County: throughout Placer County)*
- Surveyor - Willow flycatcher habitat mapping *(USFS: Plumas NF)*
- Independent surveyor - Tolay Creek, Cullinan Ranch, and Guadacanal Village restoration projects *(Ducks Unlimited/USGS: San Pablo Bay)*
- Study design and Lead Investigator - Bird use of restored wetlands research *(Pennsylvania Game Commission: throughout Pennsylvania)*
- Study design and surveyor - Baseline inventory of bird species at a 400-acre site in Napa County *(HCV Associates: Napa)*
- Surveyor - Baseline inventory of bird abundance following diesel spill *(LFR Levine-Fricke: Suisun Bay)*
- Study design and lead bird surveyor - Green Valley Creek Riparian Restoration Site *(City of Fairfield: Fairfield, CA)*
- Surveyor - Burrowing owl relocation and monitoring *(US Navy: Dixon, CA)*
- Surveyor - Pre-construction raptor and burrowing owl surveys *(various clients and locations)*
- Surveyor - Backcountry bird inventory *(National Park Service: Eagle, Alaska)*
- Lead surveyor - Tidal salt marsh bird surveys (*Point Reyes Bird Observatory: throughout Bay Area*)
- Surveyor – Pre-construction surveys for nesting birds (*various clients and locations)*

Amphibian

- Crew Leader - Red-legged frog, foothill yellow-legged frog, and mountain yellow-legged frog surveys *(USFS: Plumas NF)*

- Surveyor - Foothill yellow-legged frog surveys *(PG&E: North Fork Feather River)*
- Surveyor - Mountain yellow-legged frog surveys *(El Dorado Irrigation District: Desolation Wilderness)*
- Crew Leader - Bullfrog eradication *(Trout Unlimited: Cleveland NF)*

Fish and Aquatic Resources

- Surveyor - Hardhead minnow and other fish surveys *(USFS: Plumas NF)*
- Surveyor - Weber Creek aquatic habitat mapping (*El Dorado Irrigation District: Placerville, CA*)
- Surveyor - Green Valley Creek aquatic habitat mapping *(City of Fairfield: Fairfield, CA)*
- GPS Specialist - Salmonid spawning habitat mapping *(CDFG: Sacramento River)*
- Surveyor - Fish composition and abundance study (*PG&E: Upper North Fork Feather River and Lake Almanor*)
- Crew Leader - Surveys of steelhead abundance and habitat use *(CA Coastal Conservancy: Gualala River estuary)*
- Crew Leader - Exotic species identification and eradication *(Trout Unlimited: Cleveland NF)*

Mammals

- Principal Investigator – Peninsular bighorn sheep resource use and behavior study (*California State Parks: Freeman Properties*)
- Scientific Advisor –Study on red panda occupancy and abundance in eastern Nepal *(The Red Panda Network: CA and Nepal)*
- Surveyor - Forest carnivore surveys *(University of CA: Tahoe NF)*
- Surveyor - Relocation and monitoring of salt marsh harvest mice and other small mammals *(US Navy: Skagg's Island, CA)*
- Surveyor – Surveys for Monterey dusky-footed woodrat. Relocation of woodrat houses (*Touré Associates: Prunedale*)

Natural Resource Investigations / Multiple Species Studies

- Scientific Review Team Member – Member of the science review team assessing the effectiveness of the US Forest Service's implementation of the Herger-Feinstein Quincy Library Group Act.
- Lead Consultant - Baseline biological resource assessments and habitat mapping for CDF management units *(CDF: San Diego, San Bernardino, and Riverside Counties)*

- Biological Resources Expert – Peer review of CEQA/NEPA documents (*Adams Broadwell Joseph & Cardoza: California)*
- Lead Consultant - Pre- and post-harvest biological resource assessments of tree removal sites *(SDG&E: San Diego County)*
- Crew Leader - T&E species habitat evaluations for Biological Assessment in support of a steelhead restoration plan *(Trout Unlimited: Cleveland NF)*
- Lead Investigator - Resource Management Study and Plan for Mather Lake Regional Park *(County of Sacramento: Sacramento, CA)*
- Lead Investigator - Biological Resources Assessment for 1,070-acre Alfaro Ranch property *(Yuba County, CA)*
- Lead Investigator - Wildlife Strike Hazard Management Plan *(HCV Associates: Napa)*
- Lead Investigator - Del Rio Hills Biological Resource Assessment *(The Wyro Company: Rio Vista, CA)*
- Lead Investigator – Ion Communities project sites (*Ion Communities: Riverside and San Bernardino Counties*)
- Surveyor – Tahoe Pilot Project: Validation of California's Wildlife Habitat Relationships (CWHR) Model *(University of California: Tahoe NF)*

Forestry

Mr. Cashen has five years of experience working as a consulting forester on projects throughout California. Mr. Cashen has consulted with landowners and timber operators on forest management practices; and he has worked on a variety of forestry tasks including selective tree marking, forest inventory, harvest layout, erosion control, and supervision of logging operations. Mr. Cashen's experience with many different natural resources enable him to provide a holistic approach to forest management, rather than just management of timber resources.

REPRESENTATIVE EXPERIENCE

- Lead Consultant - CalFire fuels treatment projects *(SD and Riverside Counties)*
- Lead Consultant and supervisor of harvest activities – San Diego Gas and Electric Bark Beetle Tree Removal Project *(San Diego)*
- Crew Leader - Hillslope Monitoring Program *(CalFire: throughout California)*
- Consulting Forester – Forest inventories and timber harvest projects *(various clients throughout California)*

Grant Writing and Technical Editing

Mr. Cashen has prepared and submitted over 50 proposals and grant applications. Many of the projects listed herein were acquired through proposals he wrote. Mr. Cashen's clients and colleagues have recognized his strong scientific writing skills and ability to generate technically superior proposal packages. Consequently, he routinely prepares funding applications and conducts technical editing for various clients.

PERMITS

U.S. Fish and Wildlife Service Section 10(a)(1)(A) Recovery Permit for the Peninsular bighorn sheep

CA Department of Fish and Game Scientific Collecting Permit

PROFESSIONAL ORGANIZATIONS / ASSOCIATIONS

The Wildlife Society (Conservation Affairs Committee member)

Cal Alumni Foresters

Mt. Diablo Audubon Society

OTHER AFFILIATIONS

Scientific Advisor and Grant Writer – *The Red Panda Network*

Scientific Advisor – *Mt. Diablo Audubon Society*

Grant Writer – *American Conservation Experience*

Scientific Advisor and Land Committee Member – *Save Mt. Diablo*

TEACHING EXPERIENCE

Instructor: Wildlife Management - The Pennsylvania State University, 1998

Teaching Assistant: Ornithology - The Pennsylvania State University, 1996-1997

Attachment A

ROADSIDE RAPTOR CENSUS IN THE SAN JACINTO VALLEY OF SOUTHERN CALIFORNIA

MICHAEL D. McCRARY, ROBERT L. McKERNAN, WILLIAM D. WAGNER and ROSS E. LANDRY, Los Angeles County Museum of Natural History, Section of Ornithology, 900 Exposition Blvd., Los Angeles, California 90007

In recent years much emphasis has been placed on the conservation of raptors, which are generally low in numbers and tend to be highly sensitive to human activities such as shooting, pesticide use and habitat alteration (for a review see Newton 1979). Although the alteration and destruction of breeding habitat may currently be the greatest detriment to many bird species, the work of Fretwell (1977) on Dickcissels (*Spiza americana*) suggests that the loss of wintering habitat may, in some cases, be equally important. However, this aspect of raptor research has received comparatively little attention.

In 1981 we initiated a 2-year fall and winter study of raptors in the San Jacinto Valley to provide baseline data on populations in southern California and to quantify the importance of this valley as a wintering area for raptors.

STUDY AREA AND METHODS

The San Jacinto Valley of southern California is located in Riverside County approximately 25 km east of the City of Riverside. This rural valley consists predominantly of agricultural lands (alfalfa and grain crops) and dairy farms, with most urban development concentrated at the southeast end. Duck clubs, fallow fields and a small amount of riparian habitat make up most of the undeveloped land in the valley. The elevation of the valley floor averages approximately 425 m. During the winter months mean temperatures range from 1° - 21°C and mean levels of precipitation range from 2.6 - 6.4 cm per month.

Each census consisted of two observers driving a 43-km (38.8 km^2 as measured with a planimeter) route (Figure 1) recording all raptors seen with the unaided eye within 0.5 km of either side of the road. Species identification, age and sex (when possible), and perch site (description and height) were noted for most individuals. Habitat parameters were not considered as raptor distribution in the San Jacinto Valley appears to be heavily influenced by the occurrence of man-made perches. We maintained a vehicle speed of approximately 40 km/hr for most of the route, with occasional stops for positive identification when necessary. The open terrain and sparsity of trees along the route minimized duplicate sightings. During the 1981-82 study we drove the route approximately once every 5-10 days from 19 September 1981 through 8 March 1982 for a total of 20 censuses. In 1982-83 we drove the route approximately once per week from 5 September 1982 through 25 February 1983 for a total of 21 censuses. The duration of each census was approximately 2 hours (mean = 1.8 hr) ending at sunset.

RESULTS

Species composition and seasonal abundance were notably similar between the two years of study (Table 1). In 1981-82 we observed 1.5 raptors/km (62.6 raptors/census or 1.61 raptors/km^2) based on a cumulative total of 1252 raptor sightings in 860 km (776 km^2). Similarly, in 1982-83 we observed 1.4 raptors/km (60.8 raptors/census or 1.57 raptors/km^2) based on a cumulative total of 1276 raptor sightings in 903 km (814 km^2).

Fourteen species used the valley during the two years of study. The only difference in species composition between years was the observation of a Merlin (*Falco columbarius*) in the second year. The two most abundant species during both years were the Red-tailed Hawk (*Buteo jamaicensis*) and American Kestrel (*Falco sparverius*). However, the abundance of Red-tailed Hawks was consistent between the two years (20.5/census ± 1.8 SE vs.

Table 1. Frequency of raptor sightings in the San Jacinto Valley, Riverside Co., California, fall-winter 1981-83.

Species	Number observed[a] 1981-82	1982-83
Osprey (*Pandion haliaetus*)	18(0.9)	5(0.2)
Black-shouldered Kite (*Elanus caeruleus*)	84(4.2)	72(3.4)
Bald Eagle (*Haliaeetus leucocephalus*)	1(0.1)	1(0.1)
Northern Harrier (*Circus cyaneus*)	38(1.9)	107(5.1)
Cooper's Hawk (*Accipiter cooperii*)	2(0.1)	5(0.2)
Red-shouldered Hawk (*Buteo lineatus*)	18(0.9)	20(1.0)
Red-tailed Hawk (*Buteo jamaicensis*)	409(20.5)	425(20.5)
Ferruginous Hawk (*Buteo regalis*)	20(1.0)	73(3.5)
Rough-legged Hawk (*Buteo lagopus*)	3(0.2)	6(0.3)
Golden Eagle (*Aquila chrysaetos*)	8(0.4)	16(0.8)
American Kestrel (*Falco sparverius*)	637(31.9)	513(24.4)
Merlin (*Falco columbarius*)	------	2(0.1)
Prairie Falcon (*Falco mexicanus*)	12(0.6)	10(0.5)
Burrowing Owl (*Athene cunicularia*)	2(0.1)	2(0.1)
Total	1252(62.8)	1276(60.8)

[a]Cumulative total of all censuses, with mean per census in parentheses.

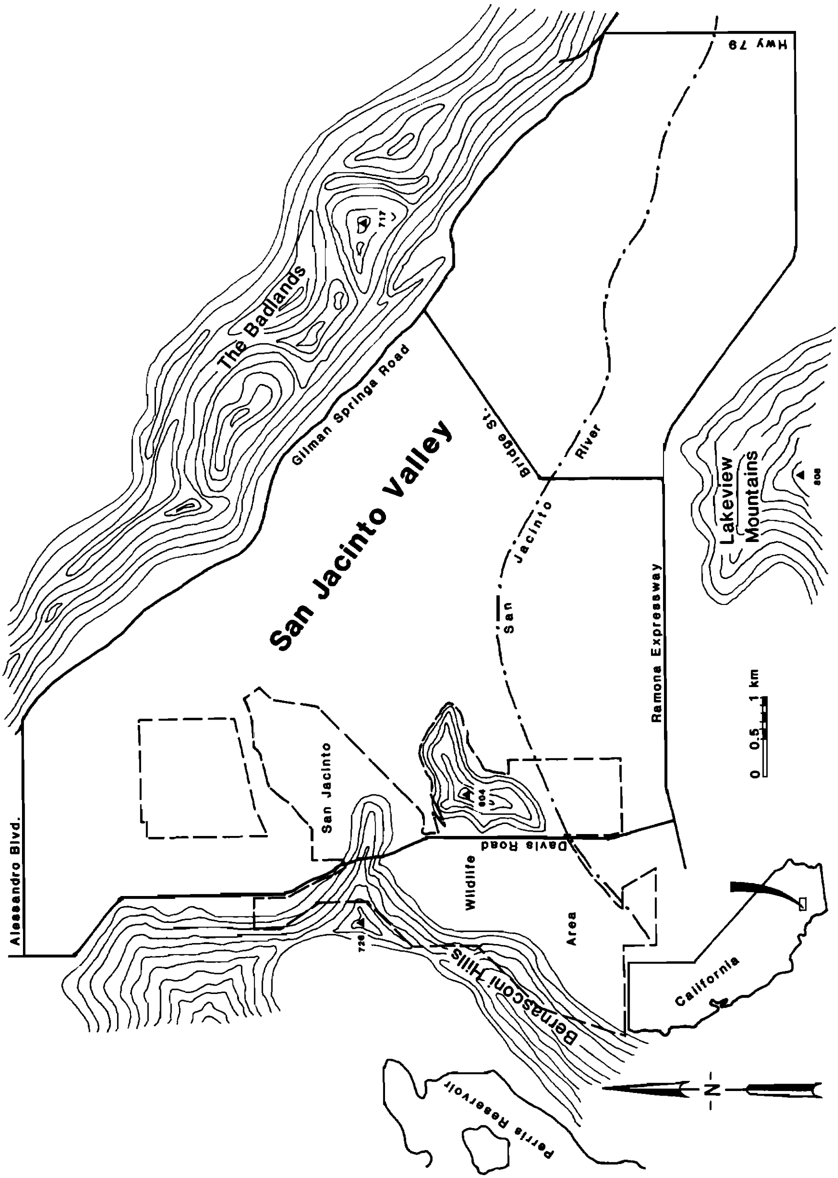

Figure 1. San Jacinto Valley raptor census route.

20.2/census ± 1.9 SE), whereas that of the American Kestrel was significantly lower (Student's t-test, $p < 0.01$) during the second year (31.9/census ± 2.1 SE vs. 24.4/census ± 1.6 SE). Of the other species recorded along the census route, Black-shouldered Kite (*Elanus caeruleus*), Red-shouldered Hawk (*Buteo lineatus*) and Prairie Falcon (*Falco mexicanus*) also occurred in similar numbers both years. Northern Harrier (*Circus cyaneus*) and Ferruginous Hawk (*Buteo regalis*) were the only two species to have notably increased in the second year (Table 1).

A substantial number of raptors were already present within the valley on the first census in both September 1981 and 1982, indicating that many raptors, but predominantly American Kestrels, had already migrated into the area from their breeding grounds (Figure 2). In general, American Kestrels occurred in relatively high numbers from September through January, decreasing to a much lower breeding population in February and March (Figure 2). Heavy rains causing major flooding and road washouts in the valley during late winter prevented further censusing after February 1983. Casual observations in March 1983, however, indicated that the abundance of raptors had markedly declined as had occurred in 1982. The high number of Red-tailed Hawks which were observed in February 1983 may have been a result of the unusually harsh winter in northern California that year.

A relatively early record for the most northerly breeding migrant, the Rough-legged Hawk (*Buteo lagopus*), occurred in 1981, when an individual was observed along the census route on 3 October. In contrast, during 1982 this species was not recorded until 2 December.

In addition to the raptors recorded during roadside counts, we observed several other species at other times of day or just off the census route. These species were Turkey Vulture (*Cathartes aura*), Swainson's Hawk (*Buteo swainsoni*), Sharp-shinned Hawk, (*Accipiter striatus*), Common Barn-Owl (*Tyto alba*), Great Horned Owl (*Bubo virginianus*) and Short-eared Owl (*Asio flammeus*). Additionally, in January 1983 McKernan saw an immature Peregrine Falcon (*Falco peregrinus*) during casual observations along the census route.

Although only one Bald Eagle (*Haliaeetus leucocephalus*) was observed during each year of censusing, several other individuals also wintered in the valley. During the winter of 1981-82 we recorded at least four individuals just off the census route, and four Bald Eagles were also recorded on 27 December 1982 (McKernan 1983).

Of the 866 Red-tailed Hawks recorded during the two years, 63.4% were adults, 27% were immatures and 9.6% were unclassified. Immature plumaged birds made up a significantly greater (chi-square test, $p < 0.01$) proportion of the population in 1982-83 when 33.2% were immatures as compared to 20.2% in 1981-82. In both years the proportion of immatures in the population was much lower than in the Sacramento Valley where 46% of those wintering Red-tailed Hawks for which age was determined were immatures (Wilkinson and Debban 1980).

Of the 1161 American Kestrels recorded during the two years, 26.9% were males, 64.2% were females, and 9% were unclassified. This greater abundance of females is similar to that found in other studies of wintering American Kestrels (Koplin 1973; Mills 1975, 1976; Wilkinson and Debban

1980) and may reflect the selection of open habitats, such as the San Jacinto Valley, by females (Koplin 1973, Mills 1976).

Perch site selection by raptors in this study was heavily influenced by the scarcity of trees in the San Jacinto Valley. Of the 2157 raptors for which flight behavior and perch type were recorded, 23.2% were flying, 11.1% were on natural structures (tree, rock, ground, etc.), and 65.7% were on man-made structures. Although controversial (see Olendorff et al. 1981), the view that utility poles and lines are beneficial to at least some raptors appears to be supported by the results of this study in which 76.8% of all perched raptors were on utility poles or wires.

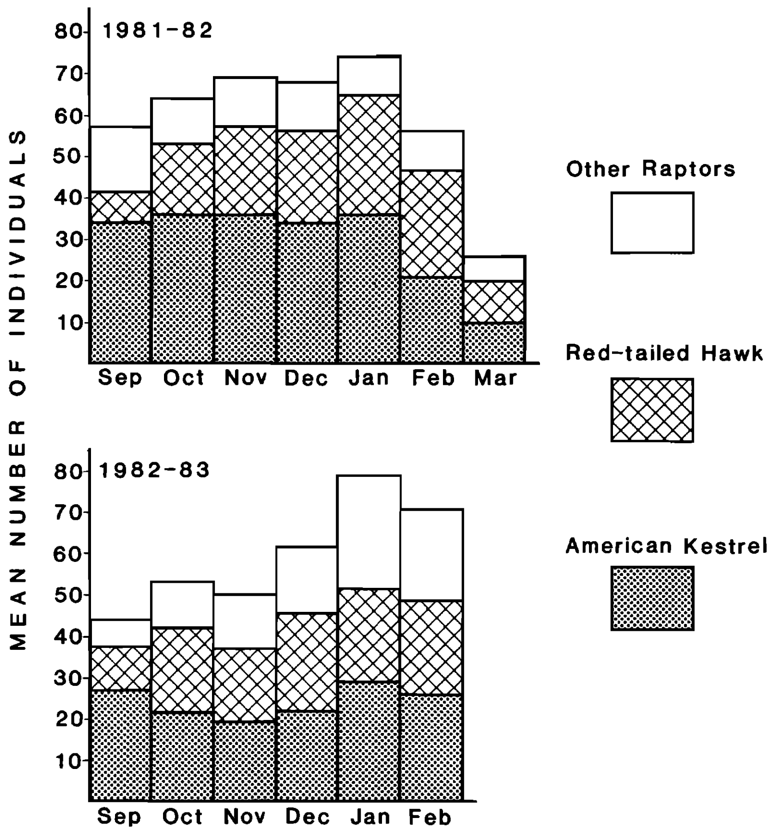

Figure 2. Mean monthly population of raptors in the San Jacinto Valley, Riverside Co., California.

DISCUSSION

Although comparative data for other areas in southern California are lacking, the mean numbers of raptors observed during two years of study, 1.5/km and 1.4/km, indicate that the San Jacinto Valley and similar surrounding areas are of major importance to wintering birds of prey.

Most areas outside southern California studied in a similar fashion (Table 2) are characterized by much lower raptor densities. This indication is especially true for Red-tailed Hawks and American Kestrels. Our study indicates that raptor densities in the San Jacinto Valley are from 5 to 17 times higher than those reported for other areas. However, the areas listed in Table 2 differ in species composition, with Rough-legged Hawks, Golden Eagles (*Aquila chrysaetos*) and Prairie Falcons being among the most common species. In northern California, density estimates for Red-tailed Hawks and American Kestrels (Wilkinson and Debban 1980) were similar to those in this study indicating that these two areas are probably similar in overall raptor densities.

The future existence of areas important to wintering raptors in Riverside County is dubious. Since 1950, the human population of the county has more than quadrupled, and almost all development has occurred in the rich agricultural lowlands west of San Jacinto Valley. Currently, development is expanding into the physiognomically similar Moreno Valley to the north of San Jacinto Valley and into Perris Valley to the southwest. Although it is difficult to assess the impact of the eventual loss of habitat in these interior

Table 2. Partial results of seven wintering raptor census studies.

	Individuals/km driven				
Study area	Rough-legged Hawk	Red-tailed Hawk	American Kestrel	All species	Number of species
California (San Jacinto)	0.01	0.5	0.7	1.5	14
California[a] (Sacramento V.)	0.061	0.54	0.54	---	13
Colorado[b] (El Paso Co.)	0.022	0.011	0.018	0.11	8
Utah[c] (Cache Valley)	0.055	0.053	0.068	0.3	14
Utah[d] (Provo)	0.014	0.002	0.003	0.1	12
Idaho[e]	0.048	---	0.019	0.085	---
Michigan[f]	0.059	0.085	0.026	0.32	6

[a]Wilkinson and Debban 1980
[b]Bauer 1982
[c]Gessaman 1982
[d]Woffinden and Murphy 1977
[e]Craig 1978
[f]Craighead and Craighead 1956

valleys upon wintering raptors, it seems likely that their utilization of other probably suboptimal areas will reduce survivorship. We encourage the initiation of similar raptor studies in other portions of California which may identify important wintering areas and point out population trends.

ACKNOWLEDGMENTS

We thank Bruce A. Henderson and John R. Storrer for their assistance in the field and Terry C. Sciarrotta of the Southern California Edison Company, Division of Research and Development, for his valuable support and assistance throughout the study. Cameron W. Barrows, Peter H. Bloom, Charles T. Collins and Tim Manolis reviewed earlier drafts of this report. This research was financially supported by the Southern California Edison Company, Division of Research and Development through purchase order C1801901.

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Accepted 11 September 1984

Prairie Falcon and Brittlebush *Sketch by Narca Moore-Craig*

Attachment B

ROADSIDE RAPTOR SURVEYS OF THE SANTA ANA RIVER WATERSHED IN RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA, 2005-2009.

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Since 2005, roadside raptor surveys have been conducted at various locations throughout the Santa Ana River Watershed to assess the abundance and distribution of diurnal raptors among habitat types and for future comparison in support of watershed restoration. One survey route duplicates a roadside raptor census conducted in the San Jacinto valley from 1981-83. Of the 18 diurnal raptor species expected to occur in the Santa Ana River Watershed, we observed 16 species. A total of over 1,350 raptors (not individuals) have been detected along four established survey routes (n=99 surveys). The most abundant species detected was the Red-tailed Hawk (*Buteo jamaicensis*), with 775 total sightings, followed by 268 sightings of the American Kestrel (*Falco sparverius*). Differences in species composition/abundance were noticeable among survey routes. The San Jacinto valley and Lake Perris State Recreation Area appear to not only provide important breeding/foraging areas for resident species, but also serve as important wintering grounds for the Northern Harrier, Ferruginous Hawk, Golden Eagle, Bald Eagle, Merlin, and Prairie Falcon.

Attachment C

BIODIVERSITY OF OPEN SPACE GRASSLANDS AT A SUBURBAN/AGRICULTURAL INTERFACE

PART III

ABUNDANCE OF DIURNAL RAPTORS ON OPEN SPACE GRASSLANDS IN AN URBANIZED LANDSCAPE

Final Report to:

Biological Resources Division
United States Geological Survey
4512 McMurry Avenue
Fort Collins, Colorado 80525-3400
[Contract No. 1445-CA09-96-0025]

and

Department of Open Space/Real Estate
City of Boulder
P. O. Box 791
Boulder, Colorado 80306

Prepared by:

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Date: April 7, 1998

Abstract: We conducted point counts of diurnal raptors on Boulder, Colorado, Open Space grasslands for three winters and three summers (1993-1996), and compared results to landscape features of the count areas. Four species were particularly scarce on plots that included significant amounts of urban habitat, with a critical landscape threshold at about 5-7% urbanization: Bald Eagle (*Haliaeetus leucocephalus*), Ferruginous Hawk (*Buteo regalis*), Rough-legged Hawk (*Buteo lagopus*), and Prairie Falcon (*Falco mexicanus*). Counts of the first three species also were positively correlated with proximity of the count plots to the nearest colony of black-tailed prairie dogs (*Cynomys ludovicianus*). Historical records suggest that Bald Eagles and Ferruginous Hawks have increased over the past century in the Boulder Valley, perhaps because of reduced human persecution of their prairie dog prey. Three species were more abundant on plots dominated by lowland hayfields and tallgrass prairies, as opposed to upland mixed and shortgrass prairies: Swainson's Hawk (*Buteo swainsoni*), Red-tailed Hawk (*Buteo jamaicensis*), and American Kestrel (*Falco sparverius*). The Red-tailed Hawk was the most abundant raptor in the study area. Its numbers were negatively correlated with urbanization in the count areas, but in a linear rather than a threshold fashion. We conclude that urbanization represented simple habitat loss to this adaptable species, whereas even small amounts of urbanization usually rendered whole landscapes unacceptable to Bald Eagles, Ferruginous Hawks, Rough-legged Hawks, and Prairie Falcons.

Key words: conservation, eagles, falcons, grasslands, hawks, landscape, open space, raptors, urbanization.

INTRODUCTION

The objective of this study was to examine relationships between abundances of diurnal birds of prey on Boulder, Colorado, open space grasslands, and the degree of urbanization of landscapes in which these grasslands were embedded.

Studies of habitat selection by diurnal raptors frequently have focused on attributes such as prey availability, vegetation structure, abundance of perch and nesting sites, and interspecific competition (e.g., Marion and Ryder 1975, Schmutz et al. 1980, Woffinden and Murphy 1983, Janes 1985, Preston 1990). Urban and suburban development can negatively impact raptors through habitat alteration, habitat loss and fragmentation, and direct human disturbance of nesting and roosting sites (Senner et al. 1984, Cringan and Horak 1989). However, some raptor species can thrive in human-modified landscapes, if the habitats retain ecologically important features (Bird et al. 1996).

There is increasing evidence that abundances of animal populations can be influenced by the landscape setting and spatial arrangement of their habitats, especially in places where these habitats are fragmented by human activities (Soulé 1986, Hansen and di Castri 1992, Andren 1994, Wiens 1995). This should be the case particularly for birds of prey, given their low densities, large home ranges, and the resulting scale at which they operate. Conservation of most raptorial birds therefore could benefit from landscape approaches to both analysis and management of their habitats (e.g., Olendorff 1984).

Most studies of the responses of terrestrial vertebrates to habitat fragmentation have focused on forests and woodlands (Andren 1994, Robinson et al. 1995). Relatively little is known about the impacts of fragmentation on grassland communities (but see Herkert 1994, Vickery et al. 1994). The city of Boulder, Colorado, owns and manages over 10,000 ha of Open Space (City of Boulder 1995; Fig. 1), the majority of which is grassland. It is the largest per capita municipally-owned greenbelt system in the United States (J. Crain, pers. comm.). To the west of the city, Boulder Open Space includes coniferous forests and shrublands at the base of the Front Range of the Rocky Mountains (Fig. 1). However, most parcels of Boulder Open Space include short, mixed, and tallgrass prairies and hayfields around its northern, eastern, and southern perimeters, where the present study took place.

Boulder Open Space grasslands do not exist as isolated patches embedded in urban landscapes, but as part of a belt of largely agricultural and grazing land enclosing the city. Therefore, metrics derived from island biogeographic theory and frequently applied to fragmented mainland habitats , namely patch size and isolation (e.g., Bolger et al. 1997), cannot be applied readily to Boulder Open Space. While grasslands at the urban edges are not strictly isolated from similar habitats in adjacent rural areas, nevertheless they occur in very different landscape mosaics that may impact their animal populations (Wiens 1995).

An alternative to the patch size/patch isolation approach to landscape ecology is to quantify the landscape composition of a particular sampling plot, in terms of such variables as percentages of various cover types represented. In the present study, we counted raptors on 34 600-m diameter plots in Boulder Open Space that differed in terms of habitat composition, including amount of urban development. We then compared count results with the habitat composition of the plots, using a land-cover data base for the Boulder Valley derived from a Landsat Thematic Mapper image.

METHODS

STUDY AREA AND PLOTS

Boulder Open Space lies at the intersection of the western Great Plains and the eastern edge of the Rocky Mountain foothills (Fig. 1). Habitats include narrow riparian corridors along streams, tallgrass prairies and hayfields in adjacent lowland floodplains, mixed and shortgrass prairies on upland slopes and benches, all against a montane backdrop of saxicoline shrublands and ponderosa pine (*Pinus ponderosa*) woodland (Moir 1969, Bock et al. 1995, Bennett 1997). Of particular importance to raptors, lowland tallgrass prairies and hayfields frequently supported high densities of prairie voles (*Microtus ochrogaster*) during our study, while colonies of black-tailed prairie dogs (*Cynomys ludovicianus*) were scattered through upland grasslands (personal observations).

In the fall of 1993, we established 66 sampling points spaced widely across Boulder Open Space, and placed to include replicates of the various grassland habitats and the maximum available range of urban landscape settings. We used these points to conduct fixed-distance counts of songbirds as well as raptors, and initially intended each count circle to be 200-m in diameter (Bock et al. 1995). However, numbers of raptors detected at this scale were too few for meaningful analyses. Therefore, we expanded the count circles for raptors to 600-m in diameter. At this scale, many pairs of plots overlapped or were too close to be considered independent. To address this problem, the 66 points were pooled into 34 non-overlapping study plots, each separated by at least 500-m, and each including one (n = 9), two (n = 20), three (n = 3), or four (n = 2) of the original 66 sampling points. A single value was computed for each raptor and each landscape variable on each of the 34 study plots, by averaging when necessary, so that n = 34 for all of our analyses. We averaged landscape data, rather than re-calculating new landscape measures for the 34 study plots, in order to hold spatial sampling scale constant around each raptor count point, regardless of how many points were included in each plot.

POINT COUNTS

We counted raptors between November and March for the winters of 1993-1994, 1994-1995, and 1995-1996, completing four ten-minute 300-m radius fixed-distance point counts (Ralph et al., 1995) per year at each of the 66 points. Breeding season raptors were counted between late May and mid-July, with four counts in 1994 and three each in 1995 and 1996. Total field sampling time over the 22 counts on the 66 plots was 242 hr.

We divided the number of raptor observations per pooled plot by the number of counts conducted, to yield detections per count as a metric of relative abundance among plots. For species present exclusively or predominantly within a single season (winter or summer), we only included counts from the appropriate season. Certain raptors (e.g., Bald Eagle) doubtless were detectable at greater distances than others (e.g., American Kestrel). However, we used count data only for intra-specific comparisons. Observability was similar at all 66 points, because each was centered in an open grassland landscape.

LANDSCAPE DESCRIPTION

We defined the landscape study area to include grasslands that are part of City of Boulder Open Space, and the area extending approximately 1 km in all directions around these properties (Fig. 1). A Geographic Information Systems (GIS) land cover data base was generated for this area using an August, 1995, Landsat Thematic Mapper (TM) image, ancillary data from existing GIS coverages, and ground truth data. The image was georectified in State Plane coordinate system (GRS 1980, Zone -501/3451, North American Datum 83), and re-sampled to 90 x 90-ft pixel size. Image classification was accomplished using ERDAS IMAGINE software version 8.2 on a Sun Sparc Workstation. Map accuracy was confirmed and certain revisions made, based on ground truth information from the 66 bird count points, our general familiarity with the study area, and review by employees of the Boulder Open Space Department.

Locations of the 66 sampling points were determined with Global Positioning Systems. We then described the rectangular landscape setting of each point at the scale of 23 x 23 cells (appr. 40 ha), in terms of percentages of various land cover types. Each 300-m radius count circle (28.3 ha) therefore comprised 71% of the rectangle enclosing it, in which available habitats were quantified.

We also described larger landscapes centered on count points (up to 420 ha), with the goal of determining whether landscape features at larger scales affected raptor counts, perhaps independent of features of the count plots themselves. However, percentage compositions of the larger landscapes were so highly positively correlated with those at the 40-ha scale, including amounts of urbanization, that we were unable to test for scale effects (Wiens 1989).

Prairie dog towns in the study area were digitized by the City of Boulder Open Space Department from 1:24,000 aerial photographs. We calculated the distance from the center of each study plot to the edge of the nearest prairie dog town(Table 1), using Arc/Grid (ESRI 1996). Many of the prairie dog colonies in our study area were exterminated by an outbreak of bubonic plague in the summer of 1994. The coverage of prairie dog towns used in the analysis was based on post-plague distributions in 1996, which approximated the conditions during the majority of our study.

STATISTICAL ANALYSES

We compared raptor detections per count with landscape variables on each of the 34 study plots using the Spearman rank correlation coefficient ($P < 0.05$).

RESULTS

On average, 91.3% of the 40-ha landscape rectangle enclosing each count point consisted of three habitats: urban development, upland grasslands, and lowland grasslands (Table 1). The urban category included both developed areas (pavement, buildings) and urban vegetation. Upland grasslands dominated 17 of the 34 plots, and included several categories of short and mixed-grass prairie (Bennett 1997). Lowland grasslands were the most abundant habitat on the remaining 17 plots, and included both tallgrass prairies and hayfields, which were not readily distinguishable using the Landsat data.

We counted 465 diurnal raptors of eleven species during the three winter and three summer seasons (Table 2). Counts of seven species were significantly correlated with at least one landscape variable (Table 3).

Bald Eagles were detected only in winter, usually in areas with little urban habitat (Fig. 2), and most frequently on plots near prairie dog towns (Fig. 3). Their avoidance of urban landscapes was particularly striking, as only 1 of 15 plots where this species occurred included >5% urban environments.

We counted Swainson's Hawks only in summer, and then only 15 times on 10 plots. Their numbers were uncorrelated with urbanization, and positively correlated with % lowland grasslands (Fig. 4).

The Red-tailed Hawk was present year-round, was the most frequently-counted species in winter (Table 2), and occurred on 26 of 34 plots. Detections were much more common in landscapes dominated by lowland grasslands (Table 3, Fig. 4). Across all plots, Red-tailed Hawk numbers were uncorrelated with urbanization. However, there was a significant negative correlation between Red-tailed Hawk detections and urbanization among the 17 plots dominated by lowland grasslands, where this species was most abundant (Table 3, Fig. 2).

Both Ferruginous and Rough-legged Hawks were present almost exclusively in winter, and, like Bald Eagles, they avoided urbanized landscapes and aggregated near prairie dog towns (Table 3, Figs. 2 and 3). Also like the Bald Eagle, these hawks appeared to have a low threshold of tolerance for amount of urban landscape in the count circles. Rough-legged Hawks were counted on 15 plots, only one of which was >6% urbanized. Ferruginous Hawks occurred on 14 plots, 11 of which consisted of <5% urban environments, suggesting a somewhat greater tolerance of urban landscapes than the Bald Eagle, Rough-legged Hawk, or Prairie Falcon.

The American Kestrel was common year-round (Table 2), and occurred on 26 plots. Its numbers were uncorrelated with the amount of urban habitat (Table 3, Fig. 2), and positively correlated with the percentage of lowland tallgrass prairies and hayfields in the landscape (Fig. 4).

The Prairie Falcon was seen only twice in three summers. The 11 winter detections were negatively correlated with % urbanization (Table 3), and this species was never seen on a plot that was >5% urbanized (Fig. 2).

Counts of Turkey Vultures, Northern Harriers, Golden Eagles, and Merlins were not significantly correlated with any environmental variables.

DISCUSSION

EFFECTS OF URBANIZATION

Diurnal birds of prey responded in three distinctly different ways to urban development in the Boulder Valley. First, there were raptors that appeared indifferent to the presence of urban and suburban landscapes, at least to the degree they occurred on our study plots (up to 30% of the count circles). The species most clearly fitting this category was the American Kestrel, one of the most abundant raptors in our study area. Kestrels have relatively small home ranges, and are well-suited to heterogeneous environments including mixtures of grasslands, riparian corridors, and mature urban vegetation (Bird and Palmer 1988, Varland et al. 1993).

Other species whose counts were not correlated with landscape urbanization were the Turkey Vulture, Northern Harrier, Swainson's Hawk, and Golden Eagle. We are unwilling to conclude that these species were insensitive to urban development, for two reasons. First, the lack of significant correlations could be artifacts of relatively small numbers of detections overall, and second, other studies suggest at least some of these species may be negatively affected by urbanization elsewhere (Horak 1986, England et al. 1995).

The second pattern of response to urban landscapes is illustrated by the Red-tailed Hawk. This abundant species, along with the Swainson's Hawk, usually hunted over lowland hayfields, where the most abundant prey was the prairie vole (*Microtus ochrogaster*; personal observation), where mowed vegetation probably made prey conspicuous, and where nearby riparian woodlands provided both nest and perch sites (see Preston 1990, and England et al. 1997). In these landscapes, counts of Red-tailed Hawks were negatively correlated with urbanization, but in an essentially linear fashion (Figure 2). We interpret this to mean that urbanization represented simple habitat loss to Red-tailed Hawks, rather than any particular intolerance for the proximity of urban landscapes. Interestingly, we rarely observed Red-tailed Hawks in upland grasslands, except in the least urbanized of our plots (Fig. 2). This suggests that the Red-tailed Hawk may be more tolerant of urban development near high-quality habitats (as suggested by Preston and Beane 1996), but such a hypothesis clearly requires additional testing. Overall, our data are consistent with a variety of studies of Red-tailed Hawks documenting their abundance in heterogeneous rural and agricultural landscapes across much of North America (Bock and Lepthien 1976, Preston and Beane 1993).

Finally, there were those species that appeared generally intolerant of even small amounts of urban development in our study area: the Bald Eagle, Rough-legged Hawk, Prairie Falcon, and, perhaps to a lesser degree, the Ferruginous Hawk. For these raptors, it seems clear that urbanization represented a critical landscape threshold or "transition range" (Turner and Gardner 1991, With and Crist 1995), whose upper bound may have been as little as 5-7%. Below this range of urbanization, counts were highly variable (Fig. 2). These patterns are consistent with the hypothesis that urbanization represented a limiting factor to abundances of these species (Terrell et al. 1996, Schroeder and Vangilder 1997).

There have been few other studies quantifying responses of diurnal raptors to urban landscapes, especially in western North America (Cringan and Horak 1989). In Larimer County, Colorado, Christmas Bird Counts of Golden Eagles and Merlins significantly declined through a 40-yr period of urban development (Horak 1986). The low counts of both species in our study area, and lack of spatial correlation with present urbanization, suggest that these species may have found the entire Boulder Valley generally unsuitable in 1994-1996. Merlins, however, are known to breed and winter in cities elsewhere in their range (Sodhia et al. 1993).

Smallwood et al. (1996) found that accipitrine hawks as a group (mostly Red-tailed Hawks) avoided human settlements in the Sacramento Valley of California. However, Red-tailed Hawks were more common in urbanized areas in New Jersey (Bosakowski and Smith 1997), probably because these were the areas with mixtures of wooded and open landscapes preferred by this species. In California, Swainson's Hawks nested in urban environments with mature trees, but reproductive success was very low (England et al. 1995).

Near Denver, Colorado, wintering Ferruginous Hawks hunted prairie dogs with equal frequency on grassland patches imbedded in a highly suburbanized landscape, and on a large open space nearby (the Rocky Mountain Arsenal; Plimpton and Andersen 1998). Following a plague outbreak on the arsenal, Ferruginous Hawks concentrated especially in the suburban areas. These results are not consistent with ours from Boulder Open Space, where Ferruginous Hawks generally (but not entirely) avoided plots with > 5% urban development. Ferruginous Hawks declined on Boulder Open Space following a plague outbreak among prairie dogs in 1994, as they have in the past (Jones 1989).

Bald Eagles avoided urban landscapes in the Boulder Valley, and have been found to be highly sensitive to urbanization in other circumstances as well (Buehler et al. 1991). We found no studies documenting Rough-legged Hawk abundance in relation to urbanization. However, this species is known to prefer expanses of relatively open terrain in winter (Schnell 1968, Bock and Lepthien 1976, which may explains its avoidance of the generally-wooded urban landscapes in the Boulder Valley (Fig. 2).

Our study was designed to reveal patterns of raptor habitat use in relation to urbanization, and we can only speculate about the causal relationships behind those patterns. Raptors have proven sensitive to human disturbance in a variety of circumstances (Knight and Knight 1984, Knight and Gutzwiller 1995, Preston and Beane 1996, Brown and Stevens 1997). Boulder Open Space grasslands are heavily used for recreational activities such as hiking, mountain biking, and dog-walking, especially near urban neighborhoods. It seems likely that these activities could be dispersing certain raptors to the more remote parts of the open space system. Some birds of prey also might require habitat patches whose size and configuration are precluded by even a small amount of urbanization (Olendorff 1984), but this is an area of much-needed further research.

HISTORICAL CHANGES

Early published descriptions of the birds of Boulder County were little more than annotated checklists (Henderson 1909, Betts 1913). Nevertheless, it is interesting to compare the current status of raptors on Boulder Open Space with descriptions of their occurrence in the same region nearly a century ago.

With the exception of the Peregrine Falcon (*Falco peregrinus*), which apparently has always been scarce in Boulder County, we found all species of diurnal raptors that have been associated with grasslands of the Boulder Valley since the early 1900's. In this sense, Boulder Open Space clearly serves as a valued biodiversity reserve, since by now the whole place would be covered in suburban sprawl were it not for this effort. Indeed, comparison of our results with the early accounts suggests that contemporary open space grasslands may support more of certain raptors, especially in winter, than they once did.

Henderson, Betts, and more recently Alexander (1937) all described the Bald Eagle as a rare transient in Boulder County, and the Ferruginous Hawk as rare or absent in winter. By contrast, we found both species to be frequent winter residents, as have others in recent decades (Jones 1989). An explanation may lie in these species' dependence upon black-tailed prairie dogs as winter prey (Jones 1989, Manci 1992, Bechard & Schmutz 1995, Preston and Beane 1996). While prairie dogs were present in the Boulder Valley a century ago (Armstrong 1972), they almost certainly were more consistently persecuted then than now. Nearly all of the region was devoted to livestock grazing and haying at the turn of the century. Most ranchers and farmers considered prairie dogs incompatible with these activities, and major prairie dog control efforts already were underway throughout the western Great Plains by the early 1900's (Miller et al. 1994).

The Rough-legged Hawk has long been a common winter resident of Boulder Valley grasslands (Betts 1913), as it was in our study in non-urbanized landscapes. This species is not known as a prairie dog predator, and its association with the vicinity of prairie dog towns (Fig. 3), while less striking than that of the Bald Eagle or Ferruginous Hawk, is puzzling. One possibility is that Rough-legged Hawks may have preferred to hunt prairie dog towns because other prey were more conspicuous in the sparse vegetation around prairie dog burrows. We also frequently observed Rough-legged Hawks hunting lowland hayfields that had been mowed.

Red-tailed Hawks and American Kestrels were common breeding birds in the Boulder Valley in the early 1900's, but apparently were uncommon in winter (Henderson 1909, Betts 1913). Today, both are common winter residents, and our winter counts exceeded summer counts for both species (Table 2). The reasons for these winter season increases are unclear. One possible explanation is that changing agricultural practices (e.g., more irrigated hayfields) may have increased availability of winter-active prey such as voles and deer mice (*Peromyscus maniculatus*).

Finally, abundances of Northern Harriers may have declined in the Boulder Valley over the past century. Betts (1913) described the harrier as "common on the plains," while Alexander (1937) considered it an "infrequent to common summer resident." We counted only one harrier in summer on Boulder Open Space, and found it on only 12 of 34 plots in winter. Loss of wetlands likely has contributed to the decline of the Northern Harrier in the Boulder Valley, as it has elsewhere (MacWhirter and Bildstein 1996).

CONSERVATION IMPLICATIONS

The western edge of the Great Plains, along the eastern front of the Rocky Mountains in Colorado, once was a heterogeneous mixture of tall and mixed grass prairies, riparian corridors, and wetlands. Today, it is rapidly being overtaken by suburban expansion, from Fort Collins in the north to Colorado Springs in the south (Mutel and Emerick 1992, Long 1997). Results of this study testify to the conservation value of protecting open spaces in this region, especially any remaining larger areas with little urban or suburban development. Our study should be replicated elsewhere, to determine if the apparent critical landscape threshold of 5-7% urbanization is generally true, and to search for possible causes of this relationship.

ACKNOWLEDGMENTS

This study was supported by the City of Boulder Open Space Department, and by the Biological Resources Division of the U. S. Geological Survey. The Boulder Open Space Department kindly provided the GIS image, digital coverages, map review, and access to their properties. We thank the following individuals for advice and assistance: H. Alden, D. Armstrong, B. Bennett, J. Bock, J. Bley, D. Craig, J. Crain, D. Dean, J. Holland, D. Kuntz, C. Miller, T. Nauman, R. Schroeder, and K. Vierling.

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Figure Legends

FIGURE 1. Map of the study area, showing the distribution of Boulder Open Space properties in relation to the Rocky Mountain Front Range (stipple), and the City of Boulder and outlying residential areas (shaded). White areas on the map are mostly private rangelands and hayfields in the Boulder Valley.

FIGURE 2. Detections per point count of six raptor species in relation to percentage landscape urbanization on 34 study plots in the Boulder Valley.

FIGURE 3. Detections per point count of three raptor species in relation to distance to the nearest prairie dog town from the center points of 34 study plots in the Boulder Valley.

FIGURE 4. Detections per point count of three raptor species in relation to lowland grasslands as percent of the landscape on 34 study plots in the Boulder Valley.

Fig. 1

Berry

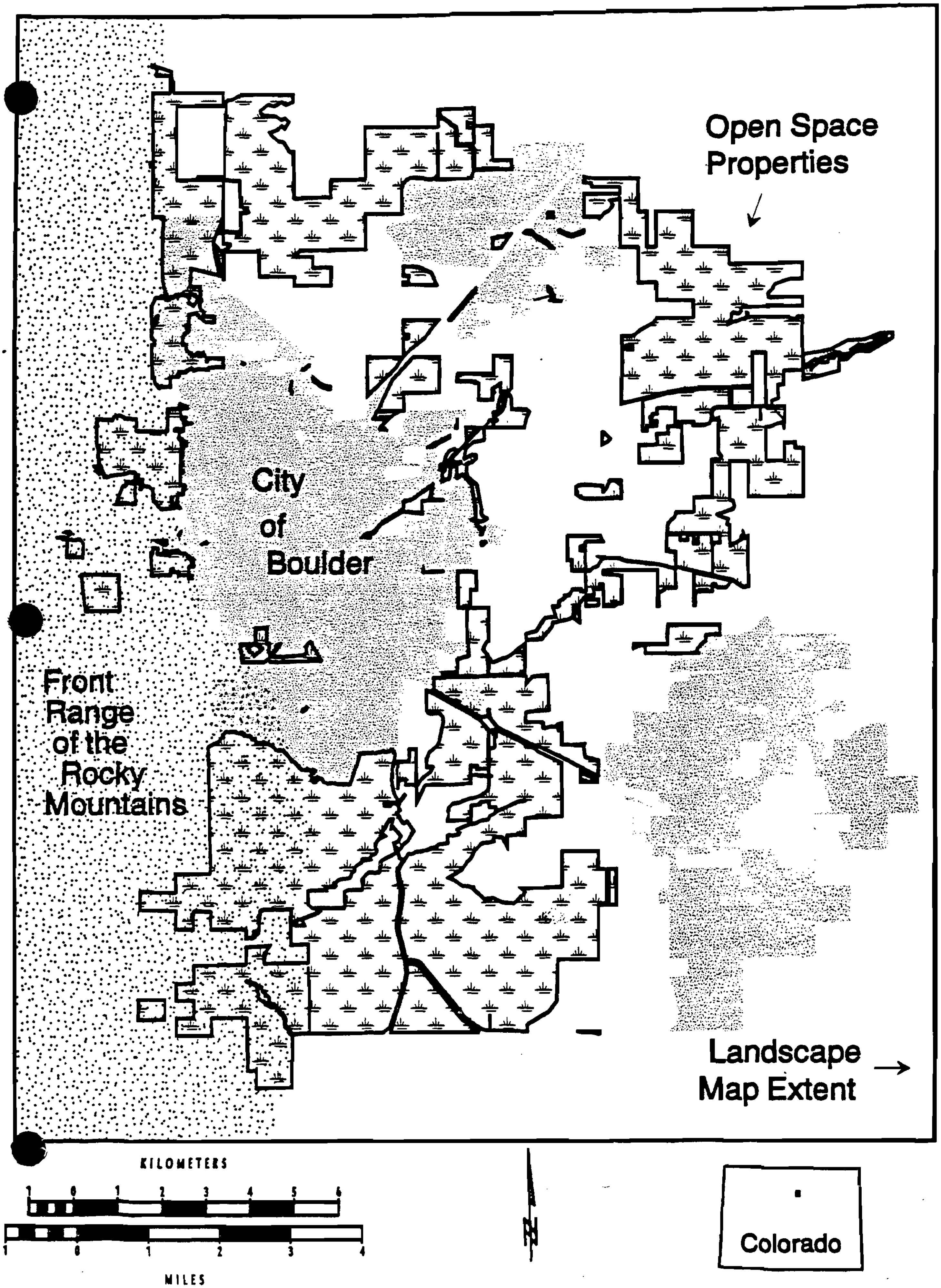

Open Space Properties
City of Boulder
Front Range of the Rocky Mountains
Landscape Map Extent
KILOMETERS
1 0 1 2 3 4 5 6
1 0 1 2 3 4
MILES
N
Colorado

Fig. 2a

Berry

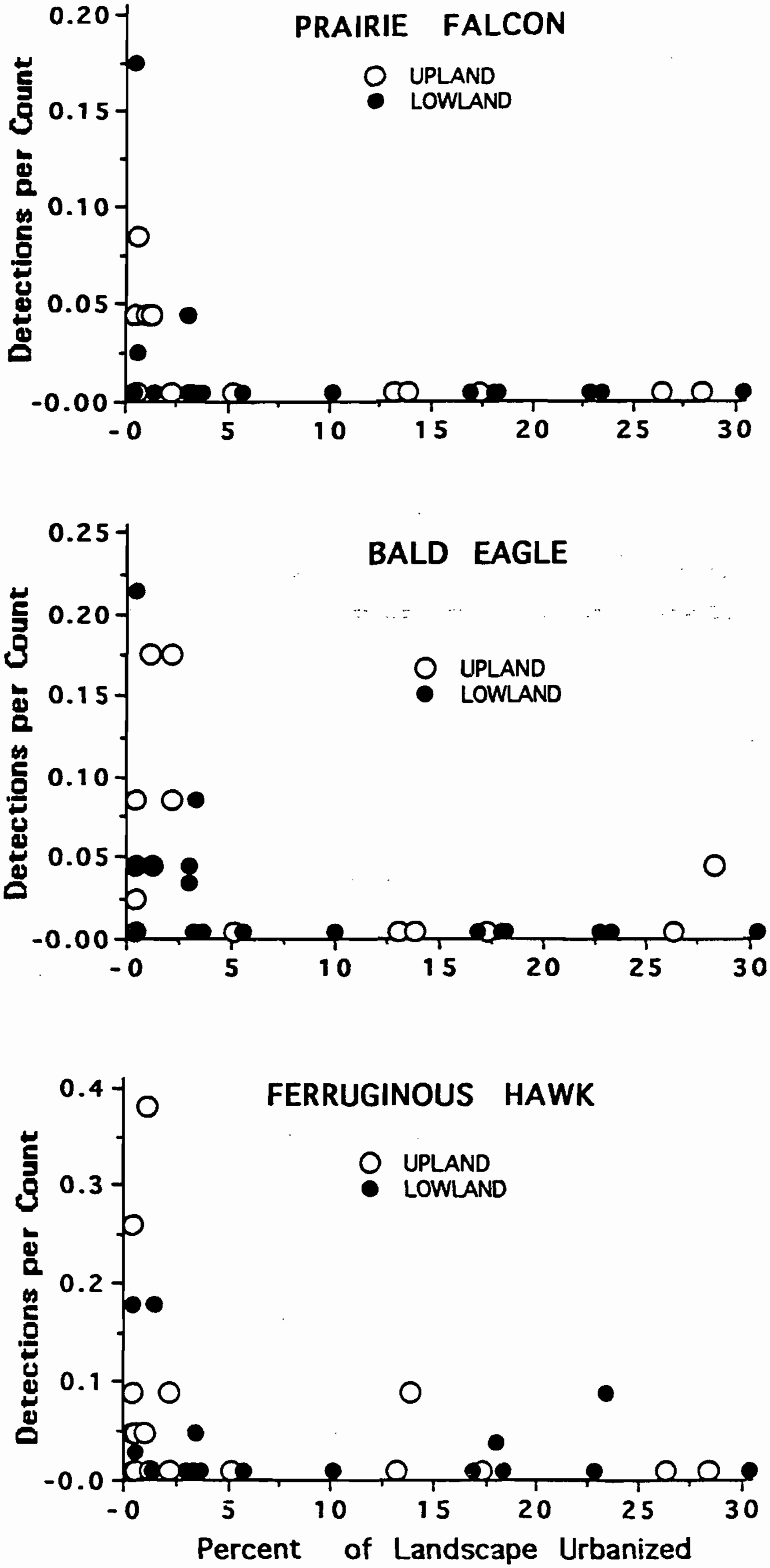

PRAIRIE FALCON
UPLAND
LOWLAND
Detections per Count
0.20
0.15
0.10
0.05
-0.00
-0
5
10
15
20
25
30
BALD EAGLE
UPLAND
LOWLAND
Detections per Count
0.25
0.20
0.15
0.10
0.05
-0.00
FERRUGINOUS HAWK
UPLAND
LOWLAND
Detections per Count
0.4
0.3
0.2
0.1
-0.0
Percent of Landscape Urbanized

Fig. 2b

Berry

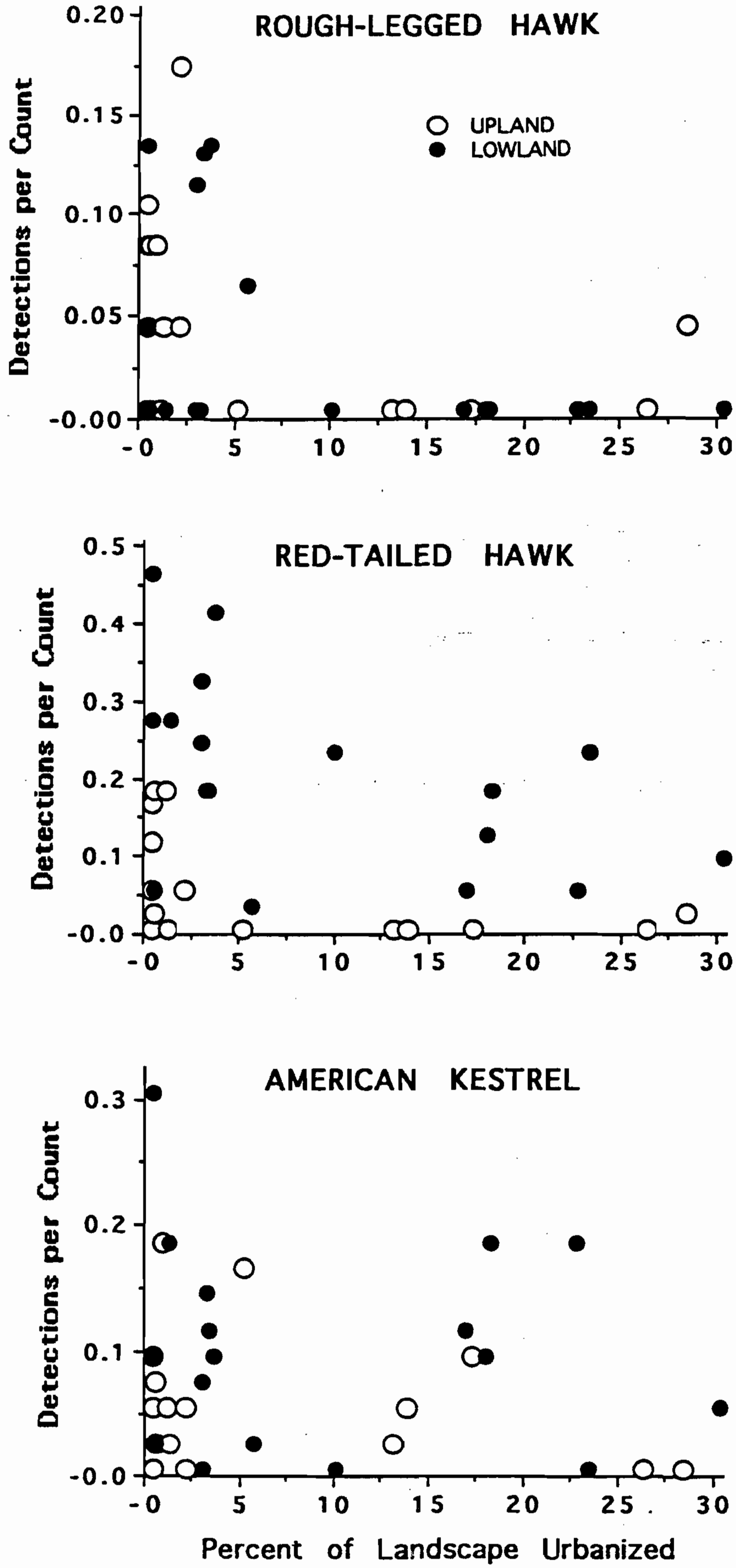
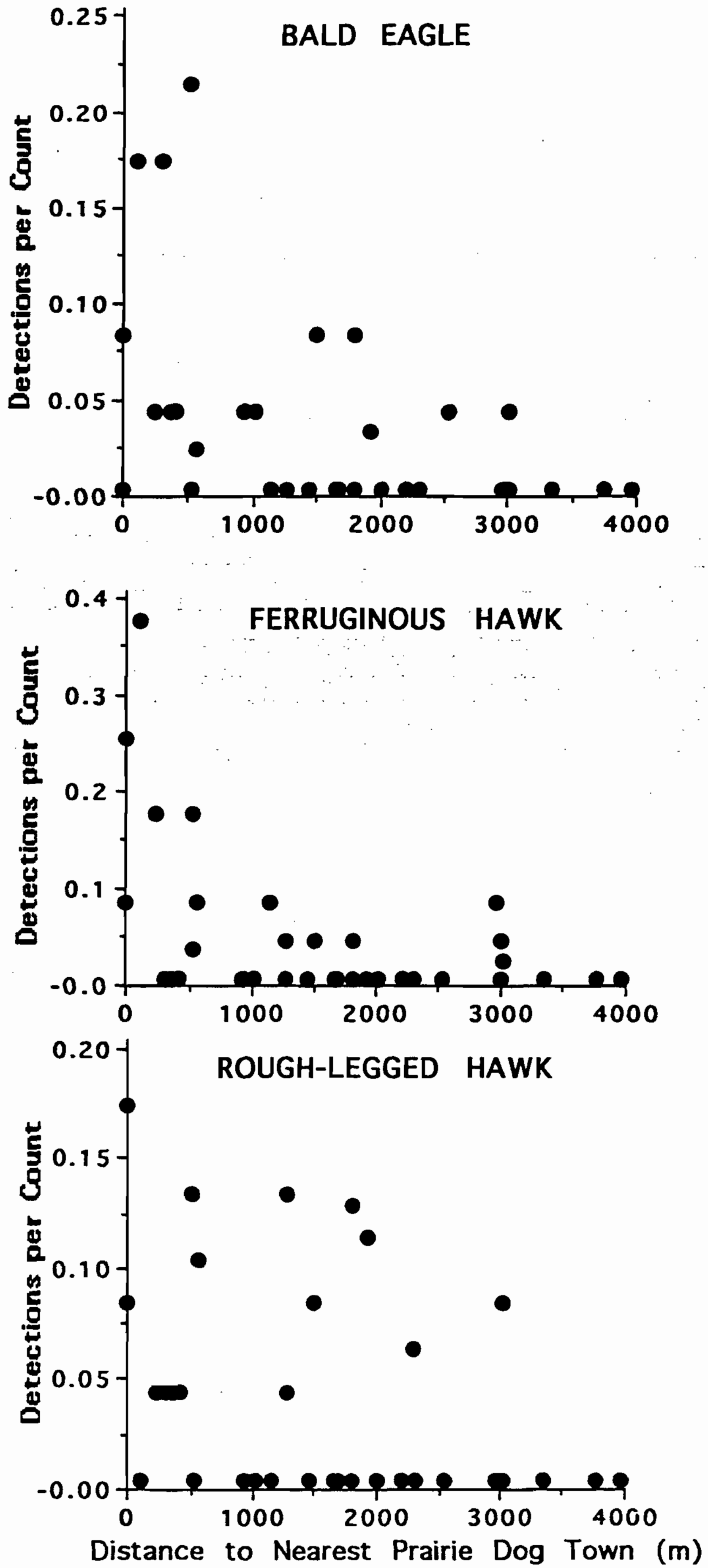

ROUGH-LEGGED HAWK
UPLAND
LOWLAND
Detections per Count
0.20
0.15
0.10
0.05
-0.00
-0
5
10
15
20
25
30
RED-TAILED HAWK
Detections per Count
0.5
0.4
0.3
0.2
0.1
-0.0
AMERICAN KESTREL
Detections per Count
0.3
0.2
0.1
-0.0
Percent of Landscape Urbanized

Fig. 3

Berry


BALD EAGLE
FERRUGINOUS HAWK
ROUGH-LEGGED HAWK
Detections per Count
0.25
0.20
0.15
0.10
0.05
-0.00
0.4
0.3
0.2
0.1
-0.0
0
1000
2000
3000
4000
Distance to Nearest Prairie Dog Town (m)

Berry

Fig. 4

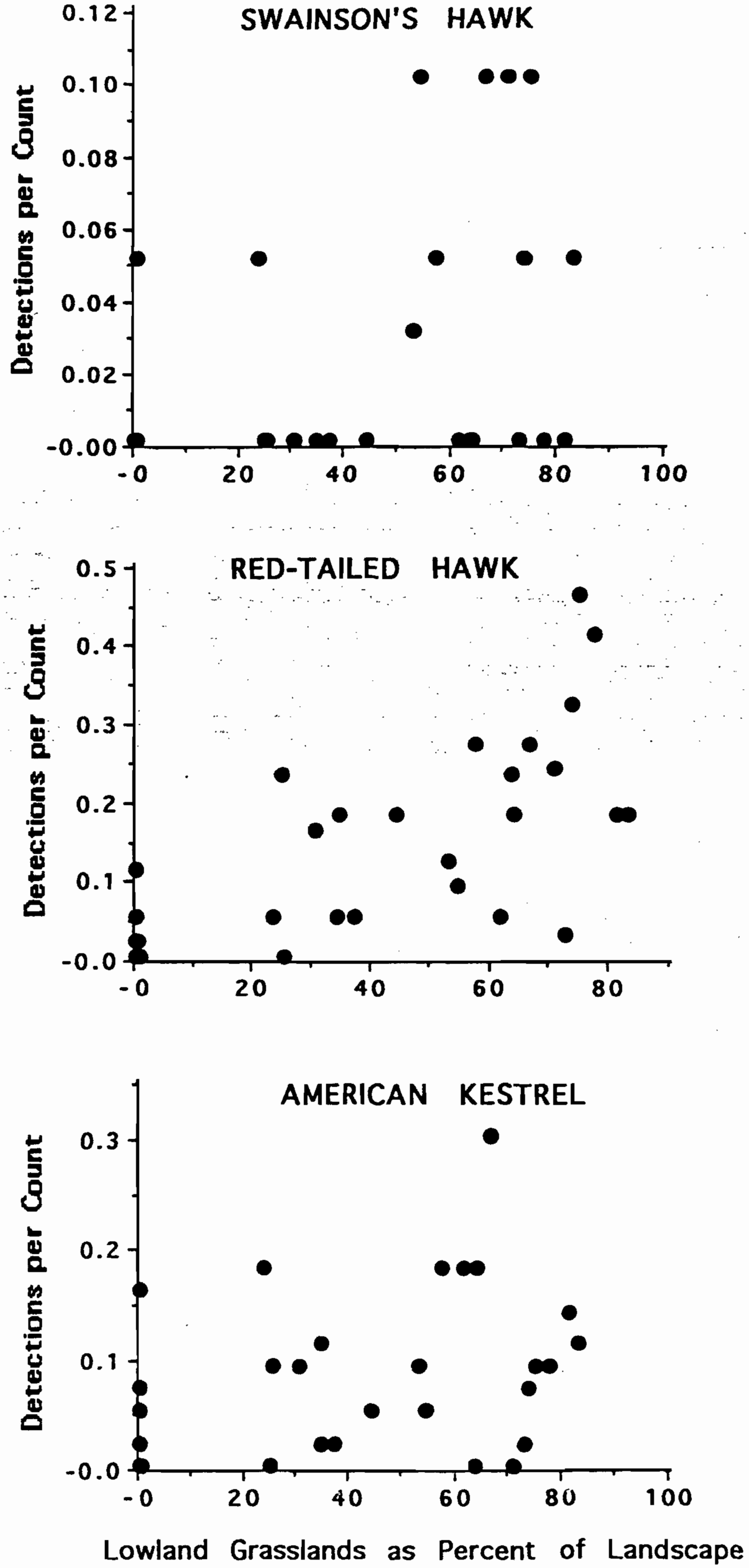

SWAINSON'S HAWK
Detections per Count
0.12
0.10
0.08
0.06
0.04
0.02
-0.00
-0
20
40
60
80
100
RED-TAILED HAWK
Detections per Count
0.5
0.4
0.3
0.2
0.1
-0.0
-0
20
40
60
80
AMERICAN KESTREL
Detections per Count
0.3
0.2
0.1
-0.0
-0
20
40
60
80
100
Lowland Grasslands as Percent of Landscape

TABLE 1. Environmental variables quantified on 34 study plots used in analyses of raptor abundance on Boulder Open Space.

Variable	Mean	Standard Deviation	Range
Percent urban development	7.7	9.6	0 - 29.9
Percent upland grassland	48.2	32.3	4.9 - 94.1
Percent lowland grassland	35.4	30.9	0 - 82.9
Distance to prairie dog town (m)	1,615	1,131	0 - 3,963

TABLE 2. Numbers of detections of diurnal raptors during 300-m radius point counts on 34 Boulder Open Space grassland plots, 1993-1996.

Species	Number of detections	
	Winter	Summer
Turkey Vulture (*Cathartes aura*)	3*	21
Bald Eagle (*Haliaeetus leucocephalus*)	27	0
Northern Harrier (*Circus cyaneus*)	23	1*
Swainson's Hawk (*Buteo swainsoni*)	0	15
Red-tailed Hawk (*Buteo jamaicensis*)	157	22
Ferruginous Hawk (*Buteo regalis*)	33	1*
Rough-legged Hawk (*Buteo lagopus*)	32	0
Golden Eagle (*Aquila chrysaetos*)	15	4*
American Kestrel (*Falco sparverius*)	61	35
Merlin[1] (*Falco columbarius*)	2	0
Prairie Falcon (*Falco mexicanus*)	11	2*

* Data from this season not used in landscape analysis for this species.

[1] Landscape associations not analyzed, given paucity of data.

TABLE 3. Spearman rank correlations between numbers of diurnal raptors detected per point count, and landscape features of 34 40-ha study plots on Boulder Open Space grasslands.

	Correlation with landscape variable[1]		
Species	% urbanized	% lowland grassland[2]	Distance (m) to nearest prairie dog town
Turkey Vulture	-0.18	-0.12	-0.25
Bald Eagle	<u>*-0.48*</u>	0.09	<u>*-0.51*</u>
Northern Harrier	-0.12	0.26	-0.05
Swainson's Hawk	-0.05	<u>*0.45*</u>	-0.12
Red-tailed Hawk[3]			
- all data	-0.15	<u>*0.76*</u>	-0.22
- lowlands only	<u>-0.51</u>		
Ferruginous Hawk	<u>*-0.48*</u>	-0.13	<u>*-0.45*</u>
Rough-legged Hawk	<u>*-0.45*</u>	0.06	<u>-0.41</u>
Golden Eagle	-0.11	-0.17	-0.03
American Kestrel	-0.07	<u>0.38</u>	0.01
Prairie Falcon	<u>-0.44</u>	0.08	0.12

[1] Underlined values statistically significant at the $P < 0.05$ level; underlined and italicized values significant at the $P < 0.01$ level.

[2] Correlations with % upland grassland are not shown, because this variable was strongly correlated with % lowland grassland (Rho = -0.92). The three species positively correlated with % lowland grassland were the only ones signficantly correlated (all negatively) with % uplands.

Table 3 (continued)

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[3] Data for Red-tailed Hawks were analyzed for lowland plots alone (n = 17), because of their association with these habitats, and to test significance of apparent negative relationship to urbanization in lowland landscapes (see Figs. 2 and 3).

Attachment D

Translocation as a Species Conservation Tool: Status and Strategy

BRAD GRIFFITH, J. MICHAEL SCOTT, JAMES W. CARPENTER, CHRISTINE REED

Surveys of recent (1973 to 1986) intentional releases of native birds and mammals to the wild in Australia, Canada, Hawaii, New Zealand, and the United States were conducted to document current activities, identify factors associated with success, and suggest guidelines for enhancing future work. Nearly 700 translocations were conducted each year. Native game species constituted 90 percent of translocations and were more successful (86 percent) than were translocations of threatened, endangered, or sensitive species (46 percent). Knowledge of habitat quality, location of release area within the species range, number of animals released, program length, and reproductive traits allowed correct classification of 81 percent of observed translocations as successful or not.

A TRANSLOCATION IS THE INTENTIONAL RELEASE OF ANImals to the wild in an attempt to establish, reestablish, or augment a population (*1*) and may consist of more than one release. To date, translocations have been used to establish populations of nonnative species and restore native species extirpated by hunting. An increasing perception of the value of biological diversity has focused attention on translocations of rare native species. These latter translocations are expensive (*2, 3*) and are subject to intense public scrutiny (*4*). They have varied goals (*3*) that include bolstering genetic heterogeneity of small populations (*5–7*), establishing satellite populations to reduce the risk of species loss due to catastrophes (*8, 9*), and speeding recovery of species after their habitats have been restored or recovered from the negative effects of environmental toxicants (*2*) or other limiting factors.

In the face of increasing species extinction rates (*10–12*) and impending reduction in overall biological diversity (*12*), translocation of rare species may become an increasingly important conservation technique. If current patterns of habitat loss continue, natural communities may become restricted to disjunct habitat fragments and intervening development may disrupt dispersal and interchange mechanisms (*2*). Increased rates of extinction may be expected in small fragmented habitats (*13*) and translocation may be required to maintain community composition, especially for species with limited dispersal abilities.

The immediacy of reduction in biodiversity (*14*) demands a rigorous analysis of translocation methodology, results, and strategy. We need to know how well it works, what factors are associated with success, and what strategies suggest greatest potential success.

We conducted three surveys of contemporary (1973 to 1986) translocations of native birds and mammals in Australia, Canada, Hawaii, New Zealand, and the United States (*15*). In the first survey, we obtained general information on the number of programs completed by various organizations. In the later surveys, we sought detailed information on translocations of (i) threatened, endangered, or sensitive species and (ii) native game birds and mammals.

Current Status

At least 93 species of native birds and mammals were translocated between 1973, the year the Endangered Species Act became law, and 1986. Most (90%) translocations were of game species; threatened, endangered, or sensitive species accounted for 7%. Ungulates (39%), gallinaceous birds (43%), and waterfowl (12%) dominated translocations of game species; raptors (28%) and marsupials (22%) dominated threatened, endangered, or sensitive species translocations.

A typical translocation consisted of six releases over the course of 3 years. Many (46%) released 30 or fewer animals and most (72%) released 75 or fewer animals.

The average number of translocations per reporting organization doubled from 1974 (5.5) to 1981 (10.6) suggesting contemporary totals of 700 translocations per year. Most (98%) of these were conducted in the United States and Canada. Effort was not uniformly distributed; 21% of North American agencies conducted 71% of North American translocations. Only 27% of reporting organizations had protocols that specified the types of information to be recorded during translocation programs.

Theoretical Considerations

A translocation is a success if it results in a self-sustaining population; conversely, the founder group may become extinct. Theoretical considerations predict that population persistence is more likely when the number of founders is large, the rate of population increase is high, and the effect of competition is low (*13*). Low variance in rate of increase (*16*), presence of refugia (*9*), reduced environmental variation (*16*), herbivorous food habits (*17*), and high genetic diversity among founders (*18*) may also enhance persistence. Suitable, protected, and maintained habitat, control of limiting factors, and proper care and training of captive reared

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animals (*3, 19*) are also considered prerequisites of a successful translocation.

We found that several factors were associated with success of translocations (Table 1). Native game species were more likely to be successfully translocated than were threatened, endangered, or sensitive species. Increased habitat quality was associated with greater success. Translocations into the core of species historical ranges were more successful than were those on the periphery of or outside historical ranges. Herbivores were more likely to be successfully translocated than either carnivores or omnivores. Translocations into areas with potential competitors of similar life form were less successful than translocations into areas without competitors or areas with a congeneric potential competitor. Early breeders with large clutches were slightly more likely to be successfully translocated than were species that bred late and had small clutches.

Translocations of exclusively wild-caught animals were more likely to succeed than were those of exclusively captive-reared animals (Table 1). Among translocations of exclusively wild-caught animals, success depended ($P \leq 0.10$) on whether the source population density was high (77% success, $n = 109$), medium (78%, $n = 37$), or low (37%, $n = 8$). Success of translocations of wild-caught animals was also associated ($P \leq 0.10$) with whether the source population was increasing (83% success, $n = 93$), stable (63%, $n = 49$), or declining (44%, $n = 9$). Successful translocations released more animals than unsuccessful translocations (160 compared to 54, respectively; $P = 0.024$).

Our results are consistent with analyses of naturally invading or colonizing species that show (i) larger founder populations are more successful (*20, 21*), (ii) that habitat suitability is important (*21*), and (iii) increased number and size of clutches enhances successful invasion (*22*). Our data also support the hypothesis that herbivores are more successful invaders than carnivores (*17*) and the conclusion that, for birds, morphologically similar species have a greater depressing effect on successful invasion than do congeneric species (*23*).

We found no consistent association of translocation success with number of releases, habitat improvement, whether the release was hard (no food and shelter provided on site) or soft, immediate or delayed release on site, or average physical condition of animals at release. We were unable to directly evaluate genetic heterogeneity, sex and age composition, or specific rearing and handling procedures for released animals because of inadequate response to survey questions.

Table 1. Percentage success of intentional introductions or reintroductions (translocations) of native birds and mammals to the wild in Australia, Canada, Hawaii, New Zealand, and the United States between 1973 and 1986. Data were obtained from a survey conducted in 1987 (*15*). The data include 134 translocations of birds and 64 translocations of mammals. For all variables listed, χ^2 was statistically significant ($P \leq 0.10$), implying true differences in the percentages of successful translocations among the categories. Animals that first give birth at age 2 or less with average clutch size of three or more are considered early breeders with large clutches; all others are late breeders with small clutches.

Variable	Translocations (n)	Success (%)
Threatened, endangered, or sensitive species	80	44
Native game	118	86
Release area habitat		
Excellent	63	84
Good	98	69
Fair or poor	32	38
Location of release		
Core of historic range	133	76
Periphery or outside	54	48
Wild-caught	163	75
Captive-reared	34	38
Adult food habit		
Carnivore	40	48
Herbivore	145	77
Omnivore	13	38
Early breeder, large clutch	102	75
Late breeder, small clutch	96	62
Potential competitors		
Congeneric	39	72
Similar	48	52
Neither	105	75

Evaluating Alternative Strategies

Analyses of individual factors associated with translocation success do not adequately reflect the multivariate nature of actual translocations. To overcome this problem, we used stepwise logistic regression (*24, 25*) to develop preliminary predictive equations for estimating the success of translocations (Table 2). An expanded data set or independent sample would probably yield different regression coefficients and estimates of success than we report. As a result, extrapolation to conditions much different than those represented by our data and applications to individual species are discouraged.

The coefficients from Table 2 can be used to plot predicted success of different kinds of translocations as a function of continuous variables such as the number released. We present an example for a threatened, endangered, or sensitive bird (Fig. 1).

This exercise (Fig. 1) illustrates that the increase in success associated with releasing larger numbers of organisms quickly becomes asymptotic. Releases larger than 80 to 120 birds do little to increase the chances that a translocation will be successful for this particular set of conditions. The asymptotic property is consistent across other classifications of the data but the inflection point varies. For large native game mammals the asymptote is reached at releases of 20 to 40 animals with a concurrently higher predicted success.

The asymptotic property of the association of translocation success and number released (Fig. 1) is consistent with theoretical predictions (*13*) and analytical treatments (*26*) that suggest a threshold population size below which extinction is likely, primarily due to chance events affecting birth and death of individuals. The existence of the inflection (Fig. 1) is also consistent with the prediction of a threshold density below which population social interactions and mating success are disrupted (*27*), again leading to diminished population viability.

The coefficients from Table 2 and relationships presented in Fig. 1 can be used to assess alternative strategies. Suppose 300 threatened and endangered birds are available for a translocation program and they must be released during a 3-year time frame. Further suppose that two potential translocation areas are available within the core of the species historical range. If the goal of the translocation is to establish at least one geographically disjunct population to reduce the risk of catastrophic loss of the species, how should the birds be distributed between the two potential translocation areas to minimize the probability that both translocations will fail?

If both release areas have excellent habitat quality, and the areas are independent, the answer is obvious. The birds should be divided between the areas. The coefficients from Table 2 allow us to estimate the probability that a single release of 300 birds will fail (1.0 minus probability of success) is 0.257. Two releases of 150 birds each have individual probabilities of failure of 0.312. The probability that both will fail is $0.312 \times 0.312 = 0.097$; substantial gain is achieved by splitting the birds between areas.

If we complicate the picture and say that one potential area has excellent habitat quality and the other has only good habitat quality, we see that it remains slightly advantageous to split the birds between areas. Predicted probabilities of failure are 0.312 for excellent and 0.698 for good habitat, respectively. The probability that both translocations will fail is $0.312 \times 0.698 = 0.218$ compared to 0.257 for putting all birds in a single excellent habitat quality area. In this example, slight advantage to splitting the translocated birds between areas is maintained down to a total release of 40 birds. However, with so few birds released the probability that both translocations will fail is increased to about 0.42.

The model coefficients in Table 2 may be used to evaluate other scenarios. For example, given two alternatives, should a given number of birds be released in good habitat quality in the core of the historical species range or in excellent habitat quality on the periphery or outside the historical range? Good habitat quality in the core of the range is the better choice regardless of the number of birds released. This suggests that the physiological amplitude of a species may influence local population viability.

Enhancing the Chances of Success

Without high habitat quality, translocations have low chances of success regardless of how many organisms are released or how well they are prepared for the release. Active management is required. Limiting factors must be identified and controlled and assurances of maintenance of habitat quality obtained prior to translocation.

Identification and retention of adequate habitat will require a combined species and ecosystem approach. Ecological information will be necessary to identify critical life history traits, factors determining habitat quality, species interactions, and minimum habitat fragment size (*28*). Regional approaches to maintaining diversity (*29*) will be essential to ensure that existing species and habitat assemblages are identified, their interactions are understood, and remnant habitats are protected. The latter approach may ultimately reduce the number of species that require translocation if it enhances understanding of the effects of habitat fragmentation on persistence of multiple disjunct populations.

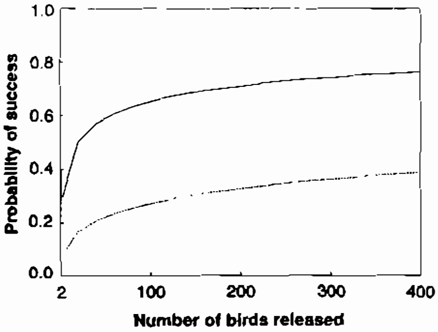

Fig. 1. Predicted probability of successful translocation as a function of the number of animals released during a 3-year period in the core of the historic species range in either excellent (solid line) or good (dashed line) habitat quality for a threatened, endangered, or sensitive bird species that first breeds at 2 years of age or more with average clutch size of three or less. Probabilities are based on stepwise logistic regression model coefficients (Table 2).

Table 2. Stepwise logistic regression (*24*) model coefficients for predicting probability $[P = 1/(1 + e^{-x})]$ of success of intentional introductions or reintroductions (translocations) of native birds and mammals in Australia, Canada, Hawaii, New Zealand, and the United States between 1973 and 1986; x is the sum of applicable coefficients for categorical variables plus the applicable coefficient times the value of continuous variables. The model is based on 155 translocations; 100 were of birds and 55 were of mammals. Data were obtained from a survey conducted in 1987 (*15*). The stepwise procedure was run at the $\alpha = 0.10$ level for entry of terms and the $\alpha = 0.15$ level for removal of terms. Probability of larger test statistics for the model were χ^2, $P = 0.90$ (*24*); Hosmer-Lemeshow χ^2, $P = 0.121$ (*24*); Brown's χ^2, $P = 0.537$ (*24*). The model correctly classified 81.3% of observed translocations based on a cutpoint of 0.50 in predicted probability of success.

Variable	Coefficient (SE)
	−1.418 (0.738)
Threatened, endangered, or sensitive species	−0.972 (0.253)[1]*
Native game	0.972 (0.253)[1]
Birds	−0.919 (0.374)[6]
Mammals	0.919 (0.374)[6]
Release area habitat	
Excellent	1.681 (0.438)[2]
Good	0.053 (0.314)[2]
Fair or poor	−1.734 (0.450)[2]
Release area	
Core of historic range	1.028 (0.267)[3]
Periphery or outside	−1.028 (0.267)[3]
Early breeder, large clutch	1.080 (0.355)[5]
Late breeder, large clutch	−1.080 (0.355)[5]
Log(number released)	0.887 (0.405)[7]
Program length (years)	0.181 (0.074)[4]

*Numbers in brackets represent order of entry.

We may reduce the need for and increase the success of translocations if we can improve our ability to identify potentially tenuous situations and act before we are faced with a rescue. Simulation modeling (*28, 32*) of the behavior of small populations of species or of groups of species with similar reproductive strategies can provide guidance for establishing minimum population and vital rate goals. Simulations will be most productive if set in a regional context that addresses the interaction among metapopulations and the spatial relation among reserves or potential release sites (*28*).

The asymptotic nature of the relation between translocation success and number of animals released emphasizes the point that releasing large numbers of animals does little to increase the success of translocations. Lack of demonstrated success after translocating large numbers of animals is cause for reevaluating other variables associated with success.

The asymptotic levels do suggest that there is a minimum number of animals that should be released. Because longer translocation programs are more successful (Table 2), the minimum number may be released over several years if insufficient animals are available for a single release. Captive rearing programs that are focused on translocation should have the goal of establishing multiple self-sustaining populations so they can provide sufficient animals over a number of years and increase the success of these expensive (*2, 3*) programs.

Those planning translocations should adopt rigorous data recording procedures (*19, 30*). Details of translocation attempts should be assembled in a database. It is critical that both failures and successes be adequately documented. Permit-granting agencies may need to assume the role of ensuring that adequate records are kept so the database can be increased and predictability of success enhanced.

Because of the low success of translocations of small numbers of endangered, threatened, or sensitive species, even in excellent habitat quality, it is clear that translocation must be considered long before it becomes a last resort for these species—before density has become low and populations are in decline. Both these traits are associated with low chances of successful translocation. In addition, obtaining sufficient numbers of animals to achieve reasonable chances of success may be impossible. The greatest potential for establishing satellite populations may occur when a candidate population is expanding and numbers are moderate to high. These conditions are the ones that tend to make endangered species biologists relax; our analysis suggests that these conditions may point out the time for action.

Attachment E

J Raptor Res. 35(4):385–391

BURROWING OWLS AND DEVELOPMENT: SHORT-DISTANCE NEST BURROW RELOCATION TO MINIMIZE CONSTRUCTION IMPACTS

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ABSTRACT.—During June–July 1998, we used a combination of active and passive relocation to move five Burrowing Owl (*Athene cunicularia*) nests in artificial burrow systems (ABS) that faced destruction by development in southwestern Idaho. Regulatory agencies agreed that relocation of the nest burrows would allow construction to proceed and provide an opportunity to determine the efficacy of moving occupied Burrowing Owl nests as a mitigation technique. Relocated nests contained one to five nestlings, ranging in age from 27–45 d. ABS (plastic chamber and tunnel), wooden perches, and dependent young were relocated (active relocation) to adjacent areas that contained natural vegetation; adults were not moved but were expected to travel the short distances to new burrow locations on their own (passive relocation). Access to natural burrows near original nest locations was restricted where possible. Relocation distances averaged 153 m and ranged from 72–258 m. Because terrain was flat, new nest locations generally were within view of original burrow locations. Relocations were successful at two of five nests. For two other nests, both adults and young returned to the vicinity of the original nest and occupied natural burrows 1 d after relocation. Owls from the fifth nest were not detected following burrow relocation and presumably vacated the immediate vicinity of the construction.

KEY WORDS: *Burrowing Owl;* Athene cunicularia; *nest relocation; artificial burrow system; active relocation; passive relocation; mitigation technique.*

Búhos Cavadores y desarrollo: redisposición de las cuevas nido a corta distancia papa minimizar los impactos de la construcción

RESUMEN.—Durante Junio–Julio 1998, usamos una combinación de reubicación activa y pasiva para mover 5 nidos de Búho Cavador (*Athene cunicularia*) a sistemas de cuevas artificiales (ABSs), estos nidos estaban a punto de ser destruidos por el desarrollo en el sudoeste de Idaho. Las agencias reguladoras estuvieron de acuerdo que la redisposición de los nidos cueva debería permitir proseguir la construcción y proveer una oportunidad para determinar la eficacia de mover nidos ocupados de Búho Cavador como una alternativa de mitigación. Los nidos reubicados contenían de uno a cinco polluelos, con edades entre 27–45 d. Los ABSs (cámara y túnel plásticos), perchas de madera, y los jóvenes nidícolas fueron reubicados (reubicación activa) a áreas adyacentes que contenían vegetación natural; los adultos no fueron movidos pero se esperaba que recorrieran por su propia cuenta las cortas distancias a los nuevos sitios de las cuevas (reubicación pasiva). El acceso a las cuevas naturales cerca de los sitios de los nidos originales fue restringido a donde quiera que fue posible. Las distancias a la reubicación promediaron 153 m en un rango de 72–258 m. Debido a que el terreno era plano, las nuevas ubicaciones de los nidos generalmente estaban a la vista desde los sitios de las cuevas originales. La reubicación fue exitosa en dos de los cinco nidos. Para los otros dos nidos, ambos adultos y el joven retornaron a la vecindad del nido original y ocuparon cuevas naturales 1 día después de la reubicación. No se detecto que los búhos del quinto nido siguieran la reubicación de la cueva y presumiblemente se dispersaron de la vecindad inmediata de la construcción.

[Traducción de Victor Vanegas y César Márquez]

Burrowing Owl (*Athene cunicularia*) populations are declining throughout much of their range in North America (De Smet 1997, James and Espie 1997, Sheffield 1997). Human disturbances, such as elimination of burrowing mammals, use of pesticides and herbicides, and conversion of grasslands to agricultural or urban areas, are factors contributing to the decline in Burrowing Owl num-

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bers (Zarn 1974, Haug et al. 1993). Anthropogenic habitat change is continually displacing owls, forcing them from previous seasons' nesting areas, reducing prey abundance and foraging areas, and potentially limiting opportunities for breeding. Although regulations protect the owls, situations where Burrowing Owls and land uses conflict continue to arise.

To minimize direct impacts resulting from habitat conversion for agriculture or development, mitigation efforts often attempt to provide Burrowing Owls with suitable habitat near areas scheduled for development. Once mitigation land is established near an impact area, owls are either evicted (i.e., passive relocation) or actively relocated (Trulio 1995, Feeney 1997). Passive relocation usually occurs in the nonbreeding season or immediately before the breeding season commences. Under this scenario, owls are excluded from available natural burrows in areas slated for development and are forced to seek alternate burrows in nearby habitat outside the areas directly affected by construction. Active relocation entails: 1) capturing owls and moving them to suitable habitat, which is generally well removed from the original site; and 2) releasing the owls at a new site, often after a period of acclimation in temporary aviaries. To replenish or reintroduce populations, Burrowing Owls also have been translocated into areas where suitable habitat remained but natural populations had declined or were extirpated (Martell 1990, Dyer 1991). Translocation projects require active capture and transport of adults and juveniles from breeding areas and then release in establishment sites.

The efficacy of these mitigation techniques (active relocation, passive relocation, and translocation) has varied. Most relocation projects resulted in fewer breeding pairs of Burrowing Owls at the mitigation site than at the original site, and translocation projects generally have failed to produce self-sustaining populations. Investigators attribute the limited success of management efforts to: 1) strong site tenacity exhibited by Burrowing Owls, and 2) potential risks associated with forcing owls to move into unfamiliar and perhaps less preferable habitats (Trulio 1995, Delevoryas 1997, Feeney 1997). Further research on methods of Burrowing Owl relocation and translocation may lead to an increase in the success of these techniques.

In this study, we examined the responses of Burrowing Owl families to short-distance nest burrow relocation. We predicted that nest-site fidelity would be overcome through parental responses to their offspring, thus eliminating the need to capture and relocate adults.

We conducted this research in response to the planned destruction of a 130-ha field, in which five pairs of Burrowing Owls nested in 1998. Each artificial burrow system (ABS) contained a pair of adults and their dependent fledglings, which were still closely associated with their nest burrow. Before young were ready to leave their natal area (i.e., flight skills improving, but still dependent on adults), the field became a borrow pit for construction of a wastewater treatment facility; ultimately, the site will function as an effluent field in which alfalfa and other cover crops are grown. To allow the project to proceed, state and federal regulatory agencies agreed that the situation offered an opportunity to examine the feasibility of relocation of Burrowing Owl nest burrows to minimize construction impacts. We decided that nest burrows would be relocated to the periphery of the construction project, into a buffer strip surrounding the field. Burrow relocations would allow construction to continue without costly delays that would result from waiting until the owls migrated from the construction area after the breeding season.

This study provides data on relocation of ABS occupied by Burrowing Owls to determine if passive adult and active fledgling relocation is a feasible mitigation technique to avoid or reduce direct impacts from construction or other anthropogenic pressures.

METHODS

Study Area. Five Burrowing Owl nests were located approximately 3 km south of Kuna, Ada County, which is 32 km southwest of Boise, Idaho and <23 km north of the Snake River Canyon. Topography was flat to rolling, and elevations ranged from 841–896 m. Rock outcrops and a few isolated buttes (e.g., Kuna Butte, elevation 896 m) exist in the region. Annual temperatures range from −20 to +45°C, and annual precipitation typically averages <20 cm (NOAA 1985).

The study area was once a typical shrub-steppe community dominated by big sagebrush (*Artemisia tridentata wyomingensis,* Hironaka et al. 1983). Range fires and other disturbances have converted much of the surrounding shrublands to exotic grasslands dominated by cheatgrass (*Bromus tectorum*) and tumble mustard (*Sisymbrium altissimum*). The area contained a few homes, several large dairy farms, paved and gravel roads, and irrigated agricultural fields that grew primarily alfalfa, mint, and sugar beets. Irrigated agricultural fields bordered the northern, eastern, and southern sides of the field that was scheduled for construction, and a two-lane highway bordered the field's western edge. Previously excavated badger (*Taxidea taxus*) burrows were abundant throughout the study area and served as nest and shelter sites for Burrowing Owls (King 1996, King and Belthoff 2001).

Fledgling Data. Before moving nest burrows, we estimated the age of juveniles based on feather growth (Landry 1979) and the estimated hatching date of the brood (±1 d, Smith 1999). For individual recognition in the field, each owl received one United States Geological Survey aluminum leg band and a unique combination of three plastic color bands (National Band and Tag Co., Newport, KY).

Nest Relocation. Each of the five nest burrows were in ABS deployed as part of another study (Smith 1999, Smith and Belthoff 2001) in 1997 (Nos. 1, 3, and 5) and in 1998 (Nos. 2 and 4). Therefore, active relocation of nests and juveniles was relatively simple when compared with moving nests from natural burrows. This project occurred during the latter part of the nesting cycle; thus, we expected adult owls to move the short distance from the original nest area to the relocation site (i.e., passive relocation). However, nest burrows and fledglings were physically moved (i.e., active relocation) to sites outside the impacted area.

All five nests were relocated to a buffer strip between 25 June–9 July 1998. The buffer strip was along the western and southern borders of the field, was approximately 25 m wide, and was the nearest habitat with natural vegetation suitable for ABS placement (Fig. 1). We selected new nest locations that were as close as possible to the original nest location in areas deemed to provide sufficient space and habitat for owls. New sites generally were no closer to neighboring nests than were original sites (except for Nos. 3 and 5; Table 1) and, in each case, new nest locations were within view of original nests. After site selection, we: 1) dug holes to place relocated ABS, 2) removed all fledglings from their nest chambers, 3) removed each ABS intact (i.e., the chamber and tunnel), 4) buried each ABS at the new location with the same orientation as the original burrows, and 5) returned juveniles to nest chambers. We also moved the wooden perches from the original sites to the new sites to lure adult owls, who used the perches for roosting. Each ABS was encircled with highly-visible flagging to reduce chances that construction personnel would inadvertently disturb the new sites. To determine the fate of each relocated nest, we monitored relocation areas (via spotting scope from a vehicle as far away as possible) each day after relocation for 2 wk, and at least three times/wk thereafter until the date that migration normally commenced.

Burrowing Owls exhibit strong site attachment behavior (Trulio 1995, Delevoryas 1997, Feeney 1997), so we were aware that some owls might return to their original nest locations after the nest burrow was removed. To minimize this possibility, we first placed Owl Exclusionary Devices (OED) at natural burrows near the original nest site. Each OED consisted of a 0.5-m section of perforated plastic drainage pipe and a piece of transparent Plexiglas® attached to a hinge at one end of the pipe. Once placed at the entrance to a natural burrow, OED allowed any owls that were underground to exit but prevented owls from taking up residence at such burrows. We also attempted to coordinate relocations such that original nest areas would be destroyed shortly after nest burrows were moved, thus reducing the likelihood that owls would return to original nest locations.

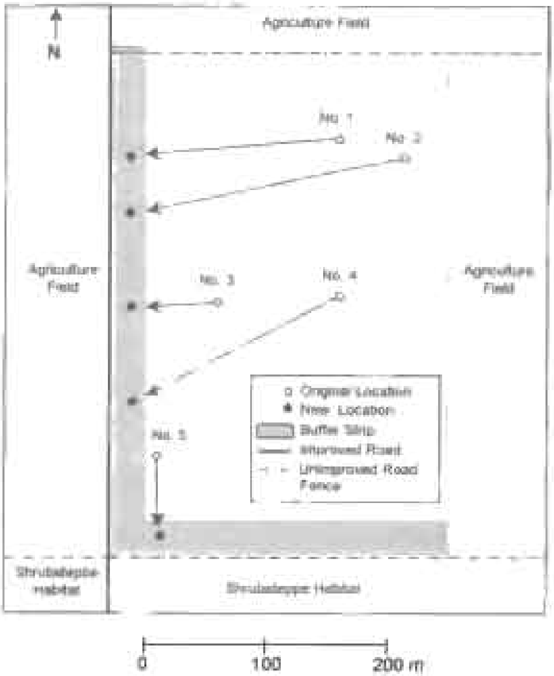

Figure 1. Original and new locations of artificial burrow systems relocated to minimize construction impacts on Burrowing Owl nests in southwestern Idaho, 1998. Numbers indicate nest burrows and their associated young that were relocated to a buffer strip along the western and southern border of the field; adults were not captured but were expected to locate the new sites on their own. The entire field (except the buffer strip) was leveled by machinery soon after all nests were relocated.

Upon relocating each ABS, we measured the distance (to nearest 0.5 m) and direction from the original nest location to its new site. We considered a relocation successful if the owl family took up residence at its new location and remained until dispersal or migration. Unsuccessful relocations occurred when owl families returned to their original nest areas or immediately disappeared from the study area; dispersal from natal areas at this young age is not characteristic of Burrowing Owls (King 1996, King and Belthoff 2001).

RESULTS

Fledgling Data. At the time of relocation, the number of juveniles at each ABS varied from one to five, ranging from 27–45 d post-hatch (Table 1). These young had developed modest to good flight capabilities, but they still depended on parental

Table 1. Information on Burrowing Owl young, relocation measurements, and apparent fates of relocated nests. Juveniles and artificial nest burrows were relocated during the 1998 breeding season to minimize construction impacts in Ada County, Idaho.

Nest	Number of Young	Age (d) of Young[a]	Relocation Date	Distance Moved (m)	Nearest Nest Before (m)	Nearest Nest After (m)	Fate
No. 1	2	39–40	25 June	174	55	55	Accepted new site
No. 2	4	38–39	25 June	258	55	55	Site tenacity
No. 3	5	35–38	7 July	79	102	85	Disappeared
No 4	1	27	9 July	183	102	85	Site tenacity
No. 5	3	44–45	7 July	72.5	290	271	Accepted new site

[a] Estimated based on morphological development and estimated hatching dates. Young >28 d are considered fledglings.

care and remained associated with natal burrows. We captured and relocated all juveniles within each ABS except at No. 5 where, upon our approach to the nest, one fledgling flew ca. 25 m away. At No. 1, both young were captured and relocated, but immediately after being relocated one juvenile flew across the two-lane highway in the opposite direction of the original site.

Nest Relocation. Relocation distances averaged 153 m, ranging from 72.5–258 m, and four of the five nests were moved in a westerly direction (Table 1; Fig. 1). Overall, two families accepted their relocation sites (40%), two families (40%) returned to the vicinity of their original nest burrows, and one family (20%) disappeared from the field (Table 1). All family members from Nos. 1 and 5 were observed at their new sites 1 d after relocation, and both adults and fledglings from each family used their new sites for several weeks until they disappeared. In contrast, two families (Nos. 2 and 4) did not remain in the relocation areas. Instead, 1 d after relocation, family groups from these nests were observed at natural burrows <20 m away from their original nest burrows. The adult male from No. 4 began using the perch, and possibly the ABS, at the new site approximately 10 d after relocation, but his young and his mate remained near the original nest. Fates of birds from these nests are unknown, except for the female from No. 2 (see below). We believe family No. 3 moved from the immediate vicinity of both the original nest and the relocated burrow, even though this nest was moved only 79 m from the original site. After moving this ABS and all five fledglings, no members of the family were observed again at the original or relocation sites, or in nearby areas that contained suitable habitat for Burrowing Owls. The fates of the members of this family were also unknown, except for the male from No. 3 (see below). Finally, within the period of our study, dates of relocation events did not appear to be related to relocation outcomes (Table 1).

In 1999, two adults returned to the area and fledged young successfully from ABS that had been relocated to the buffer strip in 1998. The adult female that nested in No. 2 in 1998 (an unsuccessful relocation) nested at the relocated No. 2 ABS in 1999. The male that nested at No. 3 in 1998 (also an unsuccessful relocation) nested at the relocated No. 5 ABS. This represented a 20% return rate (by sex, and overall) for adults affected by construction in this field in 1998. During 1999, we observed none of the 15 fledglings from 1998 nests, despite continued work in the area.

DISCUSSION

Burrowing Owls typically remain within 50–100 m of their nest or satellite burrows during daylight hours (Haug and Oliphant 1990) and exhibit strong nest-site tenacity, even after a site has been disturbed (Zarn 1974, Feeney 1997). Because Burrowing Owls commonly use burrows in close proximity to their nest burrows for roosting, escape cover, and other activities (Zarn 1974, Haug et al. 1993), relocated nests should be in close proximity to the original nest burrow (Trulio 1995). For successful relocations in our study (Nos. 1 and 5), burrows were generally closer to their original sites than were those relocations considered unsuccessful (Nos. 2–4). However, three of five relocation distances were greater than the 100-m maximum distance that Trulio (1995, 1997) recommended for passive relocation techniques. Because shorter relocations generally were more successful, distance also may have been a relevant factor in the type of relocations we employed. However, as No. 3 family members were relocated only 79 m and apparently disappeared from the study area, other factors besides distance must play a role in relocation success.

Burrowing Owls commonly return to the same or nearby nest burrows year after year (Thomsen 1971, Rich 1984, Botelho and Arrowood 1998). For the relocations that we considered to be successful (Nos. 1 and 5), banding information from our study area showed that both adult males and one adult female bred successfully in the same field during the previous (1997) breeding season. Such experience could have made these owls more familiar with relocation areas and led to their increased willingness to accept new sites. For the three relocations we considered unsuccessful (Nos. 2–4), one adult male was known to have nested in this field during 1997, and the family dispersed from the field immediately following relocation. Ages and previous breeding experiences were unknown for the two remaining pairs, as these birds were not banded before they entered the 1998 breeding season. Nonetheless, familiarity with this field may have influenced whether a family accepted their relocation site, returned to the original nest area, or dispersed from the area.

Although immediate success was realized for two relocations, long-term success of relocations and their effects on Burrowing Owls are also important. In 1999, one female and one male returned to the buffer strip to nest (both had new mates). Of the two remaining ABS, one was occupied by a pair of unmarked owls and the other was unoccupied. The fifth ABS was destroyed during the nonbreeding season. Return rates for females on the impacted area were similar to female return rates over the entire area (20% vs. 24%, respectively) for 1997–98, but were lower for males on the impacted area than over the entire area (20% vs. 44%, respectively, J. Belthoff and B. Smith unpubl. data). We failed to detect any of the juveniles from this study in the impacted field or in surrounding areas during 1999. However, this is not surprising because only 15 juveniles were associated with this field, and first-year return rates are very low (<4% of banded individuals during 1997–98) for birds in our area (J. Belthoff and B. Smith unpubl. data). Nonetheless, the subsequent return and successful nesting of two adults to the impacted site in 1999 suggested that our methods provided both immediate and longer-term success for some of the owls involved.

Other factors also may have affected the owls' willingness to accept new sites. Unfamiliar disturbances (e.g., traffic) could have caused the owls to reject the new sites (Feeney 1997). Both Nos. 2 and 4 (unsuccessful relocations) were relocated from relatively quiet portions of the field to <25 m from a busy road (Fig. 1). Given surrounding land use and destruction of the field, the placement of each relocated nest was restricted to the buffer strip because it offered the nearest "suitable" habitat Also, we were unable to have the original nest areas destroyed immediately because of inclement weather (i.e., destruction of sections of the field did not occur on planned dates). These delays, or our inability to locate all natural burrows near original nest locations to place OED, potentially allowed two families (Nos. 2 and 4) to return to natural burrows near their original nest areas.

Finally, for the two successful relocations (Nos. 1 and 5), one juvenile from each nest either was not captured or escaped during the relocation process. At the time of relocation, juveniles from successful nests also were older than those from unsuccessful nests. It is not clear if or why these factors would affect the tendency for families to remain in the relocation area. Possibly, separation of family members led to increased rate of contact vocalizations by juveniles, which lured adults to the new site more readily, or the older individuals were more visible because of increased activity (i.e., practice flights, perching, hunting) around the relocation site.

Our results indicated that short-distance relocation of occupied nests was successful under some circumstances, although the factors associated with success remained unclear. Regardless, the relocations we performed avoided the almost certain death of many young owls that would have resulted from construction. Because this was a small study (five nests), success rates for the techniques described here should be quantified in much larger studies before such relocations are considered viable options. Additionally, whether the techniques we examined would relate also to owls nesting in natural burrows (the most likely situation faced in many areas) remains unknown. Currently, we recommend that these techniques be used only when no alternatives exist. Postponing mitigation and construction activities until the nonbreeding season (i.e., after dispersal and/or migration occurs), as well as compensating for any habitat loss or degradation, would be the preferred approach to reduce impacts on Burrowing Owls. If mitigation activities cannot be avoided, original nest areas should be destroyed immediately after moving the owls so they cannot return to the original burrow, or any other burrow, in the impacted area (Trulio 1995). Finally, it remains unknown whether actively relocating adults with their dependent young would affect success rates of short-distance relocations. If the stress of capture on owls is not severe, it seems reasonable that including adults would increase relocation success. However, it may be difficult to capture adults late in the nesting cycle, so timing of the relocation would be important. Therefore, passive relocation of adults and active relocation of fledglings may encourage adult Burrowing Owls to overcome nest-burrow tenacity and inhabit new burrows to care for young when relocations are over short distances.

ACKNOWLEDGMENTS

We thank L. Hannon and B. Nelson for assistance with fieldwork and the U.S. Fish and Wildlife Service and Idaho Fish and Game personnel for consultation on this project. Financial and logistical support for our research on Burrowing Owls has been provided through challenge cost share grants from the Bureau of Land Management to J. Belthoff, by the Department of Biology and Raptor Research Center at Boise State University, and by the Snake River Field Station, Forest and Rangeland Ecosystem Science Center, U.S. Geological Survey, Boise, Idaho. Finally, we thank E. Botelho, A. Dufty, D. Plumpton, S. Novak, L. Trulio, and T. Wellicome for comments on previous versions of the manuscript.

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Attachment F

BIRD POPULATIONS

A journal of global avian biogeography

Volume 10 2010 (2009-2010)

Bird Populations 10:1-36

ASSESSING CHANGES IN THE DISTRIBUTION AND ABUNDANCE OF BURROWING OWLS IN CALIFORNIA, 1993-2007[1]

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Abstract. The Western Burrowing Owl (*Athene cunicularia hypugaea*) has declined in recent decades across much of its range, including California, where it is classified as a Species of Special Concern. During 2006-2007, we surveyed the entire breeding range of the species in California, except the Channel Islands. Relying largely on volunteers, we surveyed 860 5km x 5km blocks, and documented exact locations of 1,758 pairs. Using data from randomly-selected blocks, we extrapolated a statewide, breeding-season population of 9,187 (SE = 2,346) pairs. For all of the species' California range, except the Modoc Plateau and the Mojave and Sonoran deserts, we compared results with those of DeSante et al. (2007) using identical methods and study area boundaries during 1991-1993. Our 2006-2007 estimate of 8,128 (SE = 2,391) pairs was 10.9% lower than the previous estimate, but the difference was not statistically significant. The major patterns of Burrowing Owl occurrence across California appeared to be relatively unchanged since 1993, although non-significant declines were apparent in numerous regions. Burrowing Owls appear to have declined particularly sharply in two urban areas: the San Francisco Bay Area and Bakersfield. Our surveys of previously unsurveyed portions of the species' California range yielded few or no owls in the Modoc Plateau/Great Basin, Northern Mojave/eastern Sierra Nevada, eastern Mojave, and Sonoran Desert regions (excluding the Palo Verde Valley) but detected large aggregations in the Palo Verde Valley and the western Mojave Desert region.
Key words: Burrowing Owl, California, Athene cunicularia, *citizen science*

EVALUAR LOS CAMBIOS EN LA DISTRIBUCIÓN Y ABUNDANCIA DEL BÚHO LLANERO EN CALIFORNIA, 1993-2007

Resumen. El Búho Llanero (*Athene cunicularia hypugaea*) ha disminuido en las últimas décadas en gran parte de su distribución, incluyendo a California, donde está clasificado como una especie de interés especial. Durante el periodo 2006-2007, encuestamos a todo el rango reproductivo de la especie en California, con la excepción de las Channel Islands.

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Dependimos en gran medida de voluntarios para contar búhos en 860 bloques de 5 km x 5 km, y para documentar la ubicación exacta de 1,758 parejas. Usando datos de los bloques seleccionados al azar, extrapolamos una población para la temporada de reproducción en todo el estado de 9,187 (SE = 2,346) pares. En toda la distribución de la especie de California, con excepción de la Modoc Plateau y los Mojave y Sonoran Deserts, se compararon los resultados con los de DeSante et al. (2007) utilizando métodos idénticos y los límites del área de estudio durante 1991-1993. Nuestra 2006-2007 estimación de 8,128 (SE = 2,391) pares fue 10.9% inferior a la estimación anterior, pero la diferencia no fue estadísticamente significativa. Los principales patrones de ocurrencia del Búho Llanero a través de California parece no haberse cambiado desde 1993. Aunque hubo disminuciones evidentes en numerosas regiones, éstas no fueron estadisticamente significativas. La disminución del Búho Llanero fue especialmente marcada en dos áreas urbanas: el San Francisco Bay Area y Bakersfield. Nuestro estudio de las regiones préviamente no investigadas de distribución de la especie de California dio pocos o ningunos búhos en la Modoc Plateau/Great Basin, el norte de Mojave/este de Sierra Nevada, el este de Mojave, y regiones del Sonoran Desert (excluyendo el Palo Verde Valley), pero detectó grande agregaciones en el Palo Verde Valley y la región occidental del Mojave Desert.

Palabras clave: Búho Llanero, California, *Athene cunicularia*, ciencia ciudadana

INTRODUCTION

Burrowing Owls (*Athene cunicularia hypugaea*) in California breed in natural grasslands and a variety of human-modified habitats, including areas of intense agriculture (Cuolombe 1971, DeSante et al. 2004), as well as airports (Thomsen 1971, Barclay 2007b) and other open areas in urban environments (Trulio 1997, Trulio and Chromczak 2007). Once considered "abundant" and "common" throughout California (Baird 1870, Keeler 1891, Grinnell 1915, Dawson 1923), the species has been declining since at least the 1940s (Grinnell and Miller 1944, Remsen 1978, James and Ethier 1989, DeSante et al. 2007) and is now classified as a Species of Special Concern (Gervais et al. 2008, Shuford and Gardali 2008). The species has declined throughout much of its range (Wedgwood 1978, James and Ethier 1989, Sheffield 1997a, Holroyd et al. 2001, Wellicome and Holroyd 2001) with suggested causes including conversion of grassland habitats to urbanization and inhospitable forms of agriculture (DeSante et al. 2007, Gervais et al. 2008), eradication of fossorial mammals (Zarn 1974, Remsen 1978, Holroyd et al. 2001) and perhaps exposure to pesticides and other contaminants (James and Fox 1987, Haug et al. 1993, Sheffield 1997b; but see also Gervais and Anthony 2003).

In the early 1990s, DeSante et al. (2007) coordinated a survey of the species' entire California breeding range, except for the Modoc Plateau/Great Basin region and the Mojave and Sonoran deserts. At that time Burrowing Owl populations in the southern San Francisco Bay region and in the northern and central portions of the Central Valley appeared to have been declining rapidly, and populations elsewhere in the census area, including the coastal slope of central and southern California, had virtually disappeared. DeSante et al. (2007) estimated that the entire survey area contained >9,000 pairs, with 71% of the estimated population occupying the Imperial Valley south of the Salton Sea (an area comprising just 2.5% of the state) and 24% occupying the Central Valley, primarily in the southern portion of the San Joaquin Valley. Prior to the present study, adequate information to assess Burrowing Owl population trends since 1993 was not available, and in the Great Basin and Mojave and Sonoran desert regions no systematic assessment of population size had ever been made.

Local-scale demographic studies of four focal populations (Imperial Valley, Carrizo Plain, Naval Air Station Lemoore, and the San Jose area) suggest highly variable demographic rates (Gervais 2002, Ronan 2002, Gervais and Anthony 2003, Rosenberg and Haley 2004). Breeding Bird Survey (Sauer et al. 2008) trend results for California exist but are difficult to interpret, because the great majority of detections are clustered on a small number of routes in the Imperial Valley, home to one of the largest concentrations of the species anywhere (DeSante et al. 2007).

We undertook the present study to assess how Burrowing Owl distribution and abundance in California may have changed since 1993, and to determine the status of Burrowing Owl populations in the previously unsurveyed Modoc Plateau and desert regions of the state.

METHODS

STUDY AREA

For their 1991-1993 study, DeSante et al. (2007) defined and surveyed 11 distinct geographic regions, comprising the entire California breeding range, except for the Sonoran and Mojave deserts and the Modoc Plateau. To maximize comparability, we retained all of the region boundaries established by DeSante et al. (2007; Fig. 1).

We re-surveyed 8 of the 11 regions defined for the early 1990s survey (Table 1); because populations in the San Francisco Bay Area Coast, Central-western Coast, and Southwestern Coast regions were well studied and known to be very small or extirpated entirely, we opted not to devote volunteer resources to surveying those, but instead to rely on published literature and/or local experts for population estimates.

In addition to resurveying most of the DeSante et al. (2007) regions, we also targeted the state's Modoc/Great Basin and desert, in order to assess the species' heretofore largely unknown abundance and distribution within these areas, and to better understand their relative importance to the state's overall Burrowing Owl population. DeSante et al. (2007) omitted these areas from the 1991-1993 survey because adequate numbers of local volunteer surveyors were not available. We were able to include these regions in the 2006-2007 effort by surveying them with a crew of full-time field technicians, rather than relying on local volunteers.

We divided the previously unsurveyed portions of the California breeding range into five new regions, four of which are described in greater detail in Wilkerson and Siegel (*in press*; Fig. 1): Northern Mojave Desert/Eastern Sierra Nevada, Western Mojave Desert, Eastern Mojave Desert, Sonoran Desert. The fifth, the Modoc Plateau/Great Basin region (Fig. 1), matches the geographic boundaries of the "Jepson area" mapped as "Modoc Plateau" by Hickman (1993) and the California Gap Analysis Project (1998). The region lies entirely above the 610m elevation contour, which was used as the upper limit for high elevation subregions in ten of the 12 regions defined by DeSante et al. (2007). We therefore did not stratify our sampling within this region by elevation. Rather, we classified the entire region as "upland". Because of the presence of large tracts of forested areas that are not suitable Burrowing Owl habitat, we used the Forest Multi-source Landcover Data (California Department of Forestry and Fire Protection 2002) in conjunction with Burrowing Owl habitat characterizations produced for the region by Cull and Hall (2007) to assess the extent of potential habitat within each survey block. All land area above 1,830m was excluded from the sample frame because it consists of mountainous and forested habitat. We classified the remaining survey blocks as having either greater than or less than 50% suitable Burrowing Owl habitat, and then drew our random sample of blocks such that 2/3 had >50% suitable habitat cover and 1/3 had <50% suitable habitat cover. Survey blocks with <5% suitable habitat cover were not included.

SURVEY DESIGN

Within each region previously surveyed by DeSante et al. (2007), we used the grid defined for their 1991-1993 survey, which divides all the land in the study area into 5-km by 5-km blocks, oriented and referenced according to the Universal Transverse Mercator (UTM) system. Each block was classified as belonging primarily to the lowland subregion or the upland subregion, using a set of classification rules that varied slightly by region (see details in DeSante et al. 2007). Survey effort was stratified by elevational subregion because Burrowing Owl densities are generally much higher in lowland areas throughout California than in upland areas (DeSante et al. 2007). For logistical reasons, we discarded the small number of blocks that could not be accessed anywhere by roads, and then stratified sampling effort among the remaining blocks by region and subregion, randomly selecting as many blocks as we

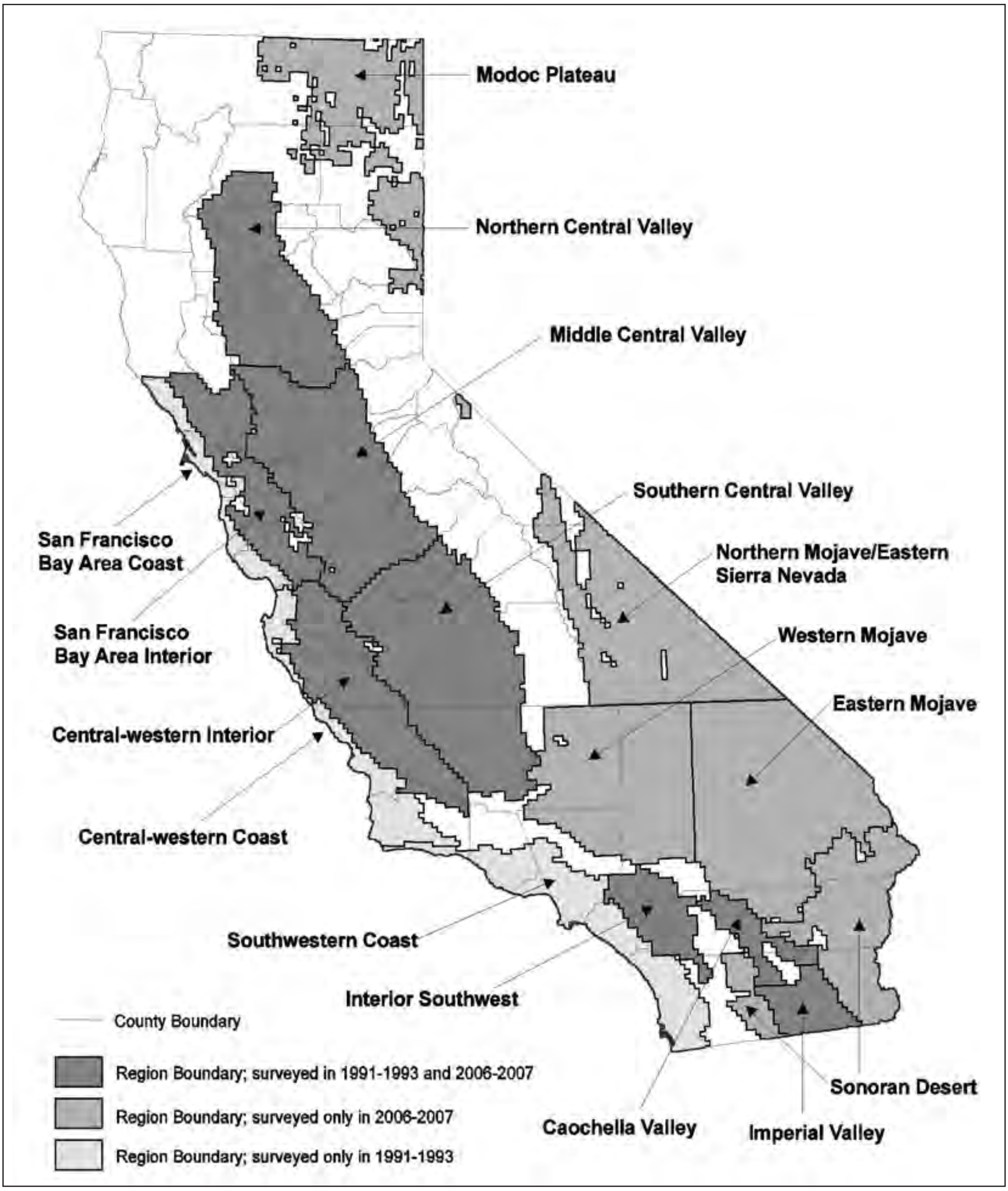

FIGURE 1. Burrowing Owl regions delineated and surveyed for The Institute for Bird Populations' 1991-1993 and/or 2006-2007 statewide Burrowing Owl surveys.

thought we would have the manpower to survey. Blocks in each region were then assigned to be surveyed in a randomly determined order to avoid bias if our volunteers and field crew were unable to survey all of the selected blocks.

We used Geographic Information System (GIS) software to define grids of 5-km by 5-km blocks covering each of the four new regions in a manner consistent with the previously established grid. The 1991-1993 survey drew from a sampling frame of 5,990 blocks (DeSante et al. 2007). The five new survey regions

TABLE 1. Regions of California defined and surveyed for The Institute for Bird Populations' California Burrowing Owl surveys during 1991-1993 and/or 2006-2007.

Region	Status during 2006-2007 survey
Regions surveyed during the 1991-1993 survey	
Northern Central Valley	Resurveyed
Middle Central Valley	Resurveyed
Southern Central Valley	Resurveyed
San Francisco Bay Area Interior	Resurveyed
San Francisco Bay Area Coast	Not resurveyed – population extirpated
Central-western Interior	Resurveyed
Central-western Coast	Not resurveyed – population likely extirpated
Southwestern Coast	Not resurveyed – small, well-known population
Southwestern Interior	Resurveyed
Coachella Valley	Resurveyed
Imperial Valley	Resurveyed
Regions not previously surveyed	
Modoc Plateau/Great Basin	Surveyed for the first time
Northern Mojave Desert/Eastern Sierra Nevada	Surveyed for the first time
Western Mojave Desert	Surveyed for the first time
Eastern Mojave Desert	Surveyed for the first time
Sonoran Desert	Surveyed for the first time

contained an additional 4,991 blocks. After removing those regions from the 1991-1993 survey we decided not to survey, our sampling frame contained a total of 9,823 blocks.

Random sample blocks were selected separately by region and elevation stratum. The selected number of blocks to be visited in each subregion was proportional to its size and amount of estimated surveyor effort available over the two-year survey period. Because Burrowing Owls are known to be more abundant in the lower elevation strata throughout our sample area (DeSante et al. 2007), low elevation blocks comprised 2/3 of the random sample selected to be visited while high elevation substrata blocks comprised 1/3 of selected random sample blocks in all survey regions.

We also identified additional blocks (hereafter, "historic breeding blocks") where Burrowing Owls were known to have been detected during the breeding season in any year since 1981. Historic breeding blocks were identified by querying or consulting the following sources for historical detections: the database compiled by DeSante et al. (2007), which includes Burrowing Owls detected during the 1991-1993 survey as well as historical detections gathered from multiple sources from the decade prior to that survey; the California Natural Diversity Database (CNDDB; California Dept. Fish and Game 2006); and knowledgeable researchers and birders with local expertise throughout the state.

Based on previous knowledge from the 1991-1993 survey, we estimated that it was feasible to visit approximately 670 blocks in the eight regions being resurveyed, and 230 blocks in the five new survey regions, for a total of 900 blocks. Prior to the 2006 field season, we identified 500 historic breeding blocks (459 historic breeding blocks in the eight regions surveyed in 1991-1993 and 41 historic breeding blocks in the five new survey regions); a few additional historic blocks were identified during the course of our two-year survey. We also selected 520 random blocks to be surveyed: 340 in regions scheduled to be resurveyed and 180 in the new regions, of which 47 also happened to be historic breeding blocks in which Burrowing Owls had been detected during the 1991-1993 survey. The total number of blocks drawn for surveying during 2006-2007 was 973 (slightly more than we thought we could survey, in case some selected blocks proved to be inaccessible or we were able to sample more blocks than we anticipated).

All selected blocks were assigned to a randomly generated order. In each subregion, half of all blocks in each elevation stratum and each category (random or historic) were

TABLE 2. Number of blocks surveyed, Burrowing Owl pairs found, and population estimate for each geographic region surveyed during 2006-2007 that was also surveyed in 1991-1993 by DeSante et al. (2007). For each region and elevational subregion, we considered our "best estimate" of the number of pairs in 2006-2007 to be the larger of a) the extrapolated estimate of pairs, based only on results from randomly-selected blocks, or b) the actual number of pairs counted, pooling data from randomly-selected blocks and historic breeding blocks.

		All blocks			Random blocks only				
Region	Total area of region (km2)	Random & historic breeding blocks surveyed	Square km surveyed	No of pairs found	Random blocks surveyed	Square km surveyed	No. of pairs found	Estimated no. of pairs (SE)	"Best estimate" of no. of pairs (SE)[a]
Northern Central Valley									
Lowland	10,900	37	822	12	22	497	0	0	12
Upland	8,975	11	252	0	11	252	0	0	0
All	19,875	48	1,074	12	33	749	0	0	12
Middle Central Valley									
Lowland	16,400	174	3,903	339	59	1,265	34	502 (209)	502 (209)
Upland	10,858	25	433	43	12	236	0	0	43
All	27,258	199	4,336	382	71	1,501	34	502 (209)	545 (209)
Southern Central Valley									
Lowland	18,650	121	2,902	204	63	1,544	72	968 (342)	968 (342)
Upland	13,025	43	714	32	18	323	3	145 (118)	145 (118)
All	31,675	164	3,616	236	81	1,867	75	1,113 (460)	1,113 (460)
San Francisco Bay Area Interior									
Lowland	4,903	69	1,592	98	20	447	0	0	98
Upland	6,275	21	515	14	12	290	1	21 (21)	21 (21)
All	11,178	90	2,107	112	32	737	1	21 (21)	119
Central-western Interior									
Lowland	5,325	20	308	8	17	276	0	0	8
Upland	11,225	24	477	13	13	233	2	76 (51)	76 (51)
All	16,550	44	785	21	30	509	2	76 (51)	84
Southwestern Interior									
Lowland	1,250	12	301	37	3	75	1	17 (17)	37
Upland	5,050	56	1,265	113	8	173	0	0	113
All	6,300	68	1,566	150	11	248	1	17 (17)	150
Coachella Valley									
Lowland	1,615	10	245	12	4	100	1	16 (16)	16 (16)
Upland	2,350	10	251	37	4	100	0	0	37
All	3,965	20	496	49	8	200	1	16 (16)	53

TABLE 2. Continued.

		All blocks			Random blocks only				
Region	Total area of region (km2)	Random & historic breed-ing blocks surveyed	Square km surveyed	No of pairs found	Random blocks surveyed	Square km surveyed	No. of pairs found	Estimated no. of pairs (SE)	"Best estimate" of no. of pairs (SE)[a]
Imperial Valley									
Lowland	2,810	12	301	499	5	126	254	5,701 (2,244)	5,701 (2,244)
Upland	1,780	3	53	22	2	50	17	707 (140)	707 (140)
All	4,590	15	354	521	7	176	271	6,408 (2,384)	6,408 (2,384)

[a] For each subregion we considered our "best estimate" of the number of Burrowing Owl pairs to be the larger of a) the extrapolated estimate of pairs, based only on results from randomly-selected blocks, or b) the actual number of pairs counted, pooling data from randomly-selected blocks and historic breeding blocks. We then summed the "best estimate" for each subregion to obtain "best estimates" for each region.

assigned to observers for sampling in year one (2006) based on the firing order. All random and historic blocks not sampled in 2006 were assigned to be surveyed in 2007. Most blocks were sampled during one of the two years in our survey period. In the few instances that a block was surveyed during both years (generally because volunteer observers became interested in "their" blocks during 2006 and independently chose to resurvey them in 2007), we used data from the first survey year (2006) in our analysis.

DATA COLLECTION

Adhering to the strategy developed by DeSante et al. (2007), we relied largely upon volunteer observers, many associated with local California Audubon Society chapters, to collect our field data in the regions that were surveyed during 1991-1993. We also deployed a crew of full-time field biologist technicians to a) survey some of the blocks in regions where the number of volunteer observers was inadequate to reasonably survey all the selected blocks, and b) survey all of the selected blocks in the Sonoran, Mojave, and Great Basin regions, where potential volunteers were very scarce.

Volunteer surveyors and IBP field crews surveyed blocks using the field methodology developed for the 1991-1993 survey (DeSante et al. 2007). For most regions, surveyors were instructed to visually scan all of the area in their blocks at least once during morning (dawn to 10:00 AM) or late-afternoon (4:00 PM to dusk) during the two-month period between May 15 and July 15, when breeding Burrowing Owls are likely to be feeding nestlings or recently-fledged young. The survey season was shifted two weeks earlier in the Western and Eastern Mojave Desert, Sonoran Desert, Southwestern Interior, and the Coachella and Imperial Valley regions to account for phenological differences among areas.

We provided surveyors with 1:24,000 scale topographic maps with survey block boundaries and clearly marked locations of any owls known or suspected to have bred anytime since 1981. Surveyors delineated the extent of appropriate habitat in their block, visually scanned all areas of appropriate habitat for owls, and plotted the locations of any detections on their maps. For each detection location, observers provided a count of all owls seen (identified to age and sex, if possible), an estimate of the number of breeding pairs present, and standardized habitat information. The latter included information on vegetation community type and structure, land use, distance to irrigation canals, local abundance of ground squirrels, and other variables. Finally, observers provided a detailed assessment of how much of their block they were actually able to survey adequately. In some cases this was <100%, due to private property restrictions or physiographic barriers.

For each region (except for the Modoc Plateau and desert regions where we relied strictly on IBP field crews) we recruited one or more local area coordinators, who helped recruit volunteers and coordinate their efforts. Prior to the start of the first field season, we developed a training presentation to explain the rationale and goals of the survey, provide tips for identifying Burrowing Owls and determining their age and sex, and teach volunteers how to conduct the survey and complete data forms in a standardized manner. We gave the presentation at eight live meetings and workshops, and also posted it as an online presentation on our website so that it was available to volunteers who could not attend a local training session. We also prepared a detailed data collection protocol which was provided to all observers prior to data collection.

STATISTICAL ANALYSES

We estimated the number of breeding pairs in each subregion and region surveyed. First we calculated the density of breeding pairs on each randomly-selected surveyed block, as the quotient of the number of pairs observed divided by the area of the block that was adequately surveyed. Densities were then averaged across all randomly-selected blocks surveyed in each subregion. Estimates are presented with standard errors, except in cases where the estimate was zero pairs and the SE could not be calculated.

For each subregion and region, we also totaled the actual number of pairs detected, as the sum of all pairs found on randomly-selected blocks plus all pairs found on historic breeding blocks. We present these totals without standard errors, since they are minimum counts rather than statistical estimates.

For each subregion, we considered our "best estimate" of the number of Burrowing Owl pairs to be the larger of a) the extrapolated estimate of pairs, based only on results from randomly-selected blocks, or b) the minimum number of pairs counted, pooling data from randomly-selected blocks and historic breeding blocks (in other words, we only used the minimum count as our "best estimate" if it was larger than the extrapolated estimate). We then summed the "best estimate" for each subregion to obtain "best estimates" of the number of pairs in each region, and across the state.

For subregions and regions surveyed in the 1990s, we compared the 2006-2007 population estimate (no. of pairs) with the estimate obtained for 1991-1993 by a) using Levene's Test to determine whether variances for the two estimates were similar, and then b) using F-tests to assess statistical significance of differences between the estimates (Zar 1984). Such comparisons were only possible when our best estimate for the number of pairs in a region was derived from randomly-selected sample blocks; in cases where our "best estimate" was the actual number of pairs counted (aggregating results from randomly-selected blocks and historic breeding blocks) there was no variance associated with the estimate, so we provide only qualitative, rather than statistical, assessments of population change since the early 1990s.

We used ArcMap to determine land ownership (public versus private) or land managing agency (various federal agencies, state government, local government, tribal areas) at all occupied sites, based on the California Department of Fish and Game Region 6 Spatial Data Framework's Public and Conservation Lands shapefile ("govconfee_1").

We used a paired t-test to assess whether owl abundance changed between the 1991-1993 and 2006-2007 surveys for historic breeding blocks where owls were detected during 1991-1993. We used logistic regression to assess whether the probability of detecting owls on these blocks during 2006-2007 was related to the number of owl pairs detected on them during 1991-1993.

RESULTS

With the help of 21 local coordinators, we recruited 394 volunteers to participate in surveying one or more blocks during the 2006 or 2007 field season. These volunteers spent over 6,400 hr surveying blocks and completing data forms. Their efforts were augmented by our full-time crews of field biologist technicians, who largely focused their efforts in the new survey regions, where few volunteers were available, and in the southern Central Valley, where the large number of historic breeding blocks surpassed the survey capacity of the local pool of volunteers.

During our 2006-2007 efforts we were able to complete surveys at 453 of the 500 historic breeding owl blocks identified prior to the start of the 2006 field season; 47 historic breeding blocks thus went unsurveyed. However, 24 of those unsurveyed historic breeding blocks were surveyed but yielded no owl detections during the 1991-1993 survey. In other words, the occupancy records were from before 1991-1993, and occupancy could not be confirmed during the 1991-1993 survey. Thus, only 26 historic blocks known to have owls during the 1991-1993 survey went unsurveyed during 2006-2007.

We completed surveys of 860 blocks during 2006-2007. Of these, 444 were randomly selected, and 453 were historic breeding blocks (37 of which were also randomly selected and were treated as random blocks in our analysis). During the course of this survey, we documented the exact locations of 1,758 Burrowing Owl pairs, and have provided this information to the California Department of Fish and Game for their conservation planning purposes.

INDIVIDUAL REGIONS

NORTHERN CENTRAL VALLEY

We surveyed 33 randomly-selected and 15 historic breeding blocks in this region (Fig. 2). We detected no burrowing owls in the random blocks and 10 pairs in the historic breeding blocks; 2 pairs were incidentally detected outside our targeted blocks. All pairs were detected on lowland blocks in Tehama and Yuba counties.

Our random-sample based population estimate for this region is zero. Using our criteria stated earlier, the "best estimate" is 12 pairs for the lowland subregion and zero for upland subregion. The number of Burrowing Owl pairs detected in the region declined only moderately, from 18 pairs to 12 pairs between the 1991-1993 and 2006-2007 surveys, but because 11 pairs were found on randomly-selected blocks during 1991-1993 (compared to no owls detected on randomly-selected blocks during 2006-2007), DeSante et al. (2007) extrapolated their early 1990s findings to estimate that 231 pairs were present in the region, a number greatly in excess of both our estimate of zero pairs extrapolated from random blocks only ($\chi^2_1 = 4.274$, $P = 0.039$; Table 3) and our "best estimate" of 12 pairs, reflecting the actual number of pairs we detected on all blocks surveyed (Table 4).

MIDDLE CENTRAL VALLEY

We surveyed 71 randomly-selected blocks and 128 historic breeding blocks in this region (Fig. 3). Surveys of random blocks yielded 34 Burrowing Owl pairs, and surveys of historic breeding blocks yielded 348 pairs, for a total of 382 pairs. Substantial concentrations of owls were located in lowland areas of Yolo, Solano, Sacramento, Contra Costa, and San Joaquin counties. However we found only two pairs in all of Stanislaus County, and detected only one pair incidentally in Merced County. We found no Burrowing Owls in the upland (foothill) blocks of western El Dorado, Amador, Calaveras, Tuolumne, and Merced counties.

In the 59 randomly-selected lowland blocks surveyed, we found 34 owl pairs, yielding a random-sample based estimate of 502 ± 209 pairs. This estimate was greater than the total number of pairs we actually found in the lowland subregion (34 pairs on randomly-selected blocks plus 305 pairs on historic breeding blocks), so it serves as our "best estimate" for the upland subregion. No owls were detected on randomly-selected upland blocks anywhere in the region, so our random-sample based estimate for the upland subregion is zero pairs. However, we found 43 pairs on upland historic breeding blocks, so our "best estimate" for the upland subregion is the actual number of pairs we found in upland blocks: 43 pairs. Summing our estimate of 502 ± 209 pairs in the lowland subregion and our count of 43 pairs on the upland blocks surveyed, our estimate for the Middle Central Valley region is 545 pairs, 8.2% fewer than the 594 pairs DeSante et al. (2007) estimated to be present in the early 1990s (Table 4).

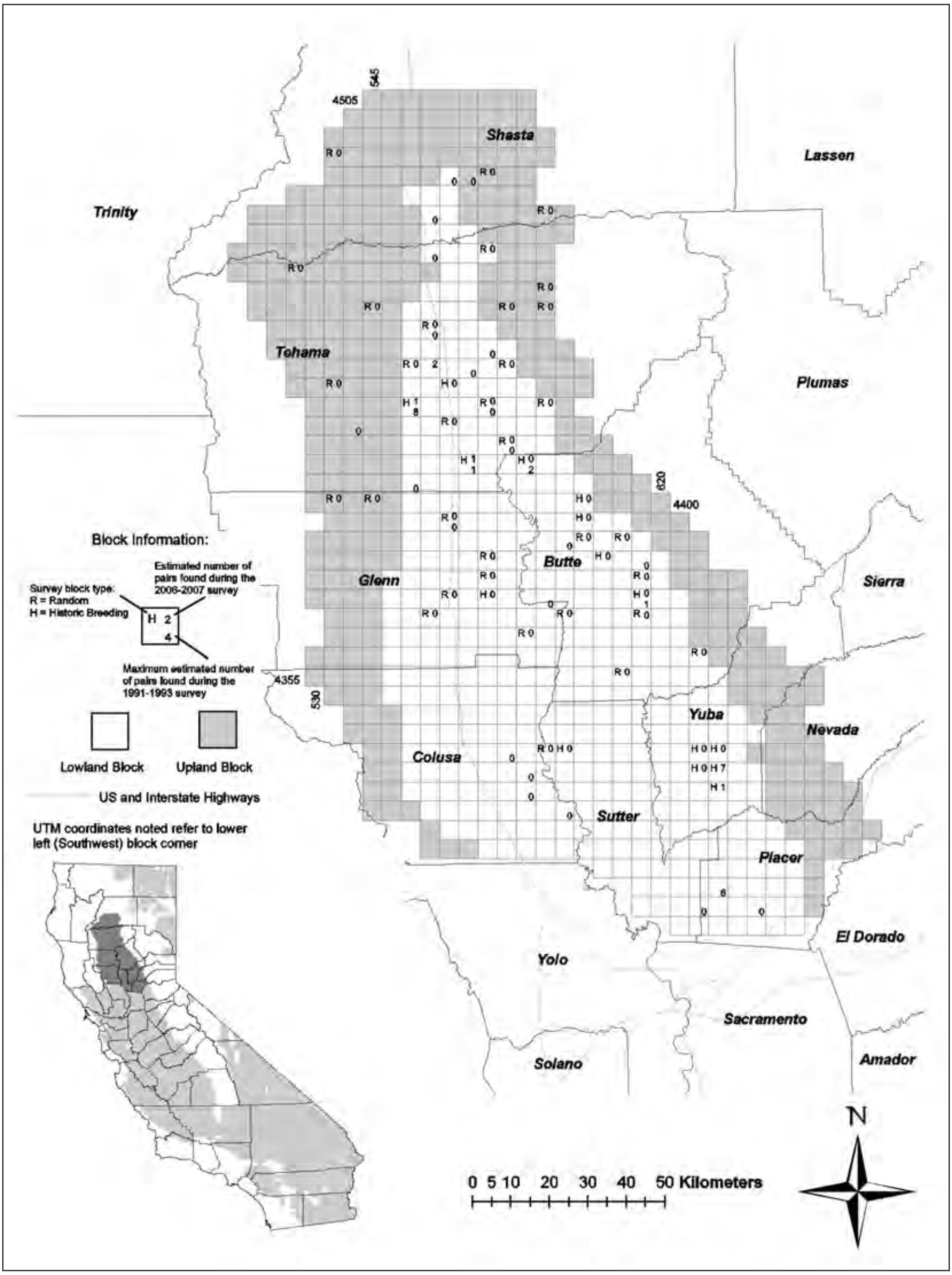

FIGURE 2. Results from the Northern Central Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Northern Central Valley region are shown in the inset.

TABLE 3. Comparison of Burrowing Owl regional population estimates extrapolated from randomly-selected blocks for regions that were surveyed during both the 1991-1993 and 2006-2007 surveys. Although we present extrapolated population estimates for all regions here, in many cases the extrapolated number of pairs based on random blocks only was not judged to be the "best estimate" of the regional population.

	1991-1993 survey		2006-2007 survey			
Region	No. of random blocks surveyed	Extrapolated no. of pairs (SE)	No. of random blocks surveyed	Extrapolated no. of pairs (SE)	Change in estimated no. of pairs	Percent change in estimated no. of pairs
Northern Central Valley						
Lowland	22	231 (153)	22	0	-231	-100%
Upland	2	0	11	0	0	n/a
All	24	231 (153)	33	0	-231	-100%
Middle Central Valley						
Lowland	163	577 (122)	59	502 (209)	-75	-13.0%
Upland	28	17 (17)	12	0	-17	-100%
All	191	594 (139)	71	502 (209)	-92	-15.5%
Southern Central Valley						
Lowland	41	1,000 (410)	63	968 (342)	-32	-3.2%
Upland	11	396 (182)	18	145 (118)	-251	-61.4%
All	52	1,396 (592)	81	1,113 (460)	-283	-20.3%
Entire Central Valley	267	2,221 (884)	185	1,615 (669)	-606	-27.3%
San Francisco Bay Area Interior						
Lowland	86	41 (20)	20	0	-41	-100%
Upland	25	0	12	21 (21)	+21	n/a
All	111	41 (20)	32	21 (21)	-20	-51.2%
Central-western Interior						
Lowland	14	0	17	0	0	n/a
Upland	16	31 (27)	13	76 (51)	+45	+145.2%
All	30	31 (27)	30	76 (51)	+45	+145.2%
Southwestern Interior						
Lowland	4	100 (100)	3	17 (17)	-83	-83%
Upland	10	127 (81)	8	0	-127	-100%
All	14	227 (181)	11	17 (17)	-210	-95.2%
Coachella Valley						
Lowland	5	0	4	16 (16)	+16	n/a
Upland	6	0	4	0	0	n/a
All	11	0	8	16 (16)	+16	n/a
Imperial Valley						
Lowland	15	6,429 (1,135)	5	5,701 (2,244)	-728	-11.32%
Upland	1	142	2	707 (140)	+565	+397.9%
All	16	6,577	7	6,408 (2,384)	-163	-2.6%

SOUTHERN CENTRAL VALLEY

We surveyed 81 randomly-selected blocks and 83 historic breeding blocks in this region (Fig. 4). Surveys of random blocks yielded 75 Burrowing Owl pairs, and surveys of historic breeding blocks yielded 161 pairs, for a total of 236 pairs.

Owls were considerably more abundant in the southern portion of this region than in the northern portion. We found Burrowing Owls in only one survey block in Madera County (though it had 12 pairs), and our detections were nearly as sparsely distributed in Fresno and Kings counties. We found substantial concentrations only in Tulare and Kern counties. As in the other Central Valley regions, the great majority of owls we found were in lowland blocks; in the upland blocks covering the Sierra foothills we found owls in just one block in each

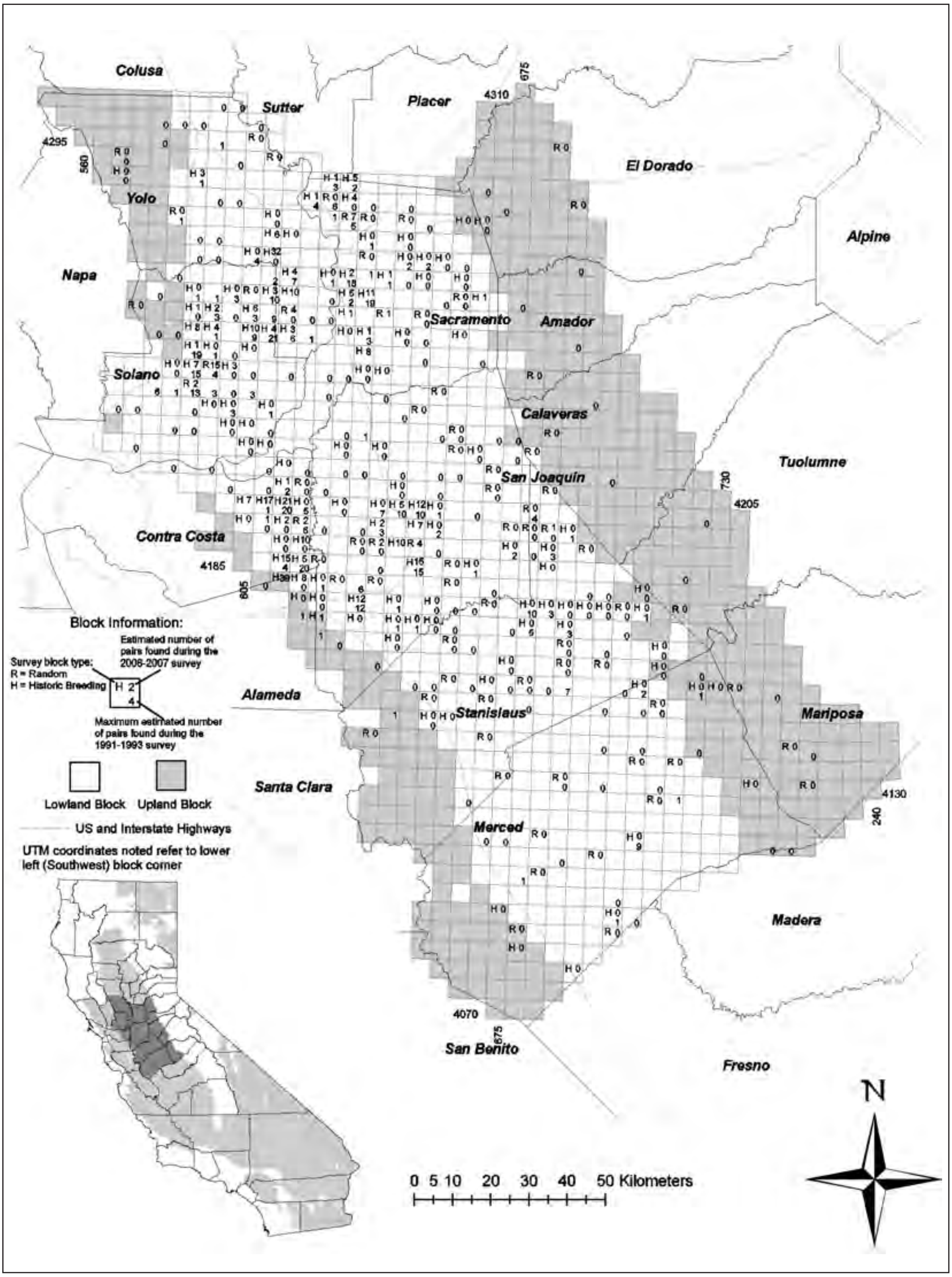

FIGURE 3. Results from the Middle Central Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Middle Central Valley region are shown in the inset.

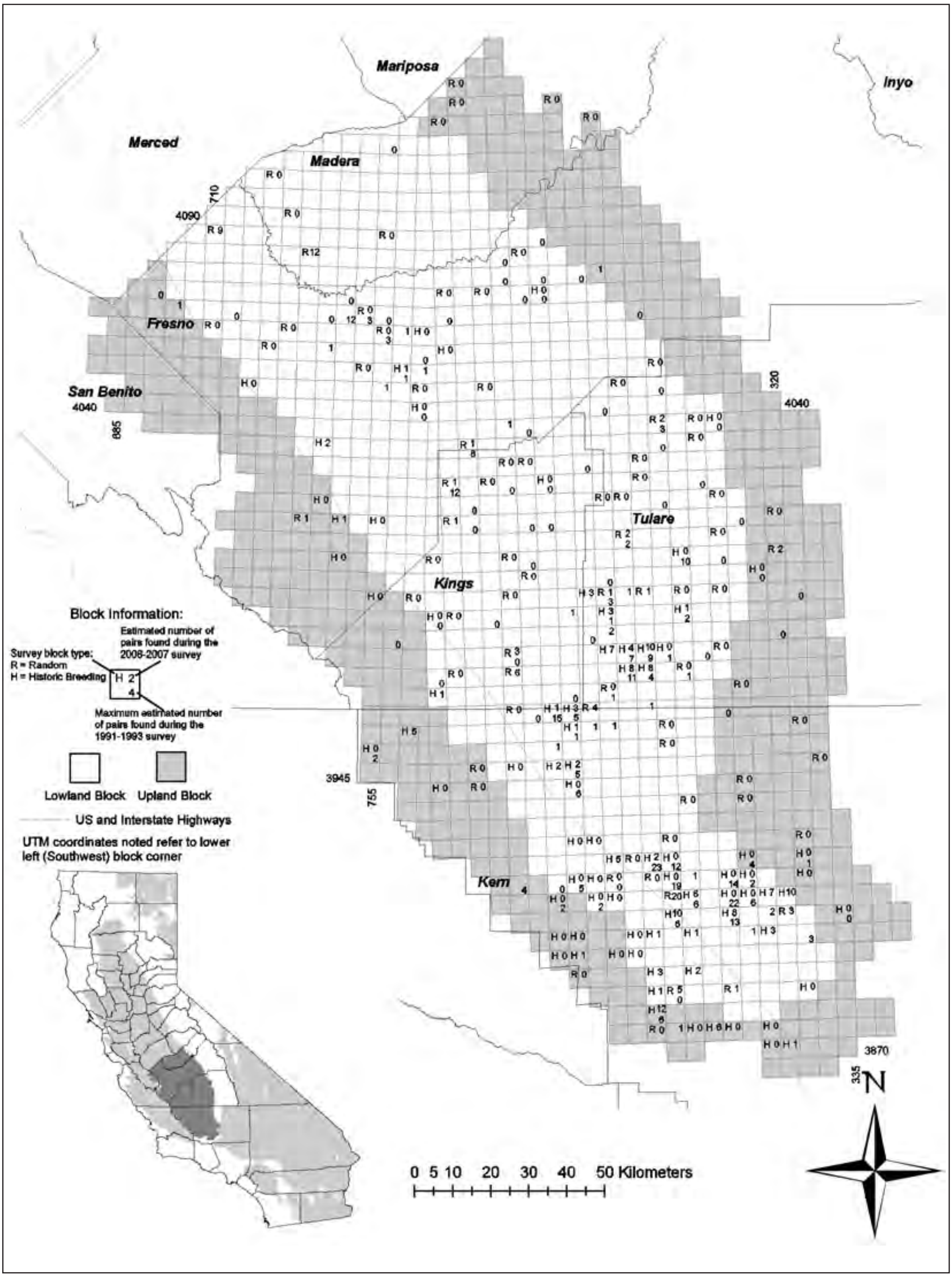

FIGURE 4. Results from the Southern Central Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Southern Central Valley region are shown in the inset.

TABLE 4. Comparison of regional and statewide "best estimates" of population size from the 1991-1993 and 2006-2007 Burrowing Owl surveys.

	1991-1993 survey		2006-2007 survey			
Region	No. of pairs found	"Best estimate" of pairs in region[a]	No. of pairs found	"Best estimate" of pairs in region[a]	Change in estimated no. of pairs	Percent change in estimated no. of pairs
Northern Central Valley						
Lowland	18	231 (153)	12	12	-219	-94.8%
Upland	0	0	0	0	0	n/a
All	18	231 (153)	12	12	-219	-94.8%
Middle Central Valley						
Lowland	404	577 (112)	339	502 (209)	-75	-13.0%
Upland	1	17 (17)	43	43	+26	+152.9%
All	405	594 (129)	382	545	-49	-8.2%
Southern Central Valley						
Lowland	259	1,000 (410)	204	968 (342)	-32	-3.2%
Upland	19	396 (182)	32	145 (118)	-251	-63.4%
All	278	1,396 (592)	236	1,113 (460)	-283	-20.3%
San Francisco Bay Area Interior						
Lowland	154	154	98	98	-56	-36.4%
Upland	11	11	21	21	+10	+90.9%
All	165	165	119	119	-46	-27.9%
San Francisco Bay Area Coast[b]						
Lowland	0	0	0	0	0	n/a
Upland	0	0	0	0	0	n/a
All	0	0	0	0	0	n/a
Central-western Interior						
Lowland	7	7	8	8	+1	+14.3%
Upland	3	31 (27)	13	76 (51)	+45	+145.2%
All	10	38	21	84	+46	+121.1%
Central-western Coast[c]						
Lowland	8	8	0	0	-8	-100%
Upland	0	0	0	0	0	n/a
All	8	8	0	0	-8	-100%
Southwestern Coast[d]						
Lowland	8	36 (36)	16	16	-20	-55.6%
Upland	0	0	26	26	+26	n/a
All	8	36 (36)	42	42	+6	+16.7%
Southwestern Interior						
Lowland	12	100 (100)	37	37	-63	-63%
Upland	6	127 (81)	113	113	-14	-11.0%
All	18	227 (181)	150	150	-77	-33.9%
Coachella Valley						
Lowland	0	0	12	16 (16)	+16	n/a
Upland	0	0	37	37	+37	n/a
All	0	0	49	53	+53	n/a
Imperial Valley						
Lowland	1,041	6,429 (1,135)	499	5,701 (2,244)	-728	-11.3%
Upland	4	142	22	707 (140)	+565	+397.9%
All	1,045	6,571	521	6,408 (2,384)	-163	-2.5%
Modoc Plateau/Great Basin						
All	Not surveyed		0	0	n/a	n/a
Northern Mojave/Eastern Sierra Nevada[e]						
Lowland	Not surveyed		1	1	n/a	n/a
Upland	Not surveyed		0	0	n/a	n/a
All	Not surveyed		1	1	n/a	n/a

TABLE 4. Continued.

Region	1991-1993 survey No. of pairs found	1991-1993 survey "Best estimate" of pairs in region[a]	2006-2007 survey No. of pairs found	2006-2007 survey "Best estimate" of pairs in region[a]	Change in estimated no. of pairs	Percent change in estimated no. of pairs
Western Mojave Desert[e]						
Lowland	Not surveyed		94	560 (268)	n/a	n/a
Upland	Not surveyed		0	0	n/a	n/a
All	Not surveyed		94	560 (268)	n/a	n/a
Eastern Mojave Desert[e]						
Lowland	Not surveyed		1	32 (32)	n/a	n/a
Upland	Not surveyed		0	0	n/a	n/a
All	Not surveyed		1	32 (32)	n/a	n/a
Sonoran Desert[e]						
All	Not surveyed		179	179	n/a	n/a
Statewide, excluding "new" regions						
Number of pairs found	1,955		1,532		-423	-21.6%
Extrapolated no. of pairs		9,127 (1,243)		8,128 (2,391)	-999	-10.9%
"Best estimate" of no. of pairs		9,266		8,526	-740	-8.0%
Statewide, including "new" regions						
Number of pairs found			1,758			
Extrapolated no. of pairs				9,187 (2,346)		
"Best estimate"				9,298		

[a] Numbers in parenthesis indicate the standard error of the estimate. Estimates lacking a standard error indicate the actual count of breeding pairs detected in a subregion and are presented as the "best estimate" in cases where the count is higher than the region's calculated population estimate, which is based on randomly-selected blocks only and excludes data from historic breeding blocks that were not randomly selected

[b] The San Francisco Bay Area Coast region was not surveyed as part of this study in 2006-2007. Our "best estimate" of zero pairs in both the lowland and upland subregions is based on local knowledge (D. DeSante, *pers. comm.*) and information in Townsend and Lenihan (2007).

[c] The Central-western Coast region was not surveyed as part of this study in 2006-2007. Our "best estimate" of zero pairs in both the lowland and upland subregions is based on local knowledge (D. Roberson, *pers. comm.*).

[d] The Southwestern Coast region was not surveyed as part of this study in 2006-2007. Our "best estimates" of 16 pairs in the lowland subregion and 26 pairs in the upland subregion are based on information in Lincer and Bloom (2007) and Kidd et al. (2007).

[e] Reported in Wilkerson and Siegel (*in press*).

of Fresno, Tulare, and Kern counties.

In the 63 randomly-selected lowland blocks surveyed, we found 72 pairs of owls, yielding a random-sample based estimate of 968 ± 342 pairs. This estimate was greater than the total number of pairs found in the lowland subregion (72 pairs on randomly-selected blocks plus 132 pairs on historic breeding blocks), so it serves as our "best estimate" for the lowland subregion. In the 18 randomly-selected upland blocks surveyed, we found three pairs of owls, yielding a random-sample based estimate of 145 ± 118 pairs in the upland subregion. This estimate is greater than the total number of pairs found in the upland subregion (three pairs on randomly-selected blocks plus 32 pairs on historic breeding blocks), so it serves as our "best estimate" for the upland subregion. Summing our extrapolated estimates for the lowland and upland subregions, our estimate for the Southern Central Valley region is 1,113 ± 460 pairs (Table 3), 20.3 % fewer than the 1,396 pairs DeSante et al. (2007) estimated in the early 1990s (Table 4), but not a statistically significant difference ($F_{1,131}$ = 0419, P = 0.838).

Examining blocks that contained Burrowing Owls in the early 1990s and were resurveyed during 2006-2007 indicates two areas in the region where substantial, concentrated losses appear to have occurred: six blocks in western

Bakersfield lost a total of 53 breeding pairs, and further west, in agricultural land located west of Rosedale and south of Shafter, 42 fewer pairs were detected on three survey blocks (Fig. 5). Concentrated losses of Burrowing Owls on the western edge of Bakersfield occurred in blocks where substantial urban land conversion occurred between 1992 and 2001 (Multi-resolution Land Characteristics Consortium 2001).

SAN FRANCISCO BAY AREA INTERIOR

We surveyed 32 randomly-selected blocks and 58 historic breeding blocks in this region (Fig. 6). The relatively large proportion of historic breeding blocks reflects the excellent pre-survey information available about the region's Burrowing Owls. Surveys of random blocks yielded only a single pair, located on an upland block in northeastern Alameda County, north of Livermore. Pooling data from random and historic breeding blocks, we found 119 pairs.

All of the Burrowing Owls detected in the region were in Alameda or Santa Clara counties. During the 1990s survey small numbers of Burrowing Owl pairs were also detected in San Mateo County (one pair) and Sonoma County (two pairs), but our surveyors were unable to find owls in these or other locations throughout those counties.

In Alameda County, we detected no Burrowing Owls in the western, lowland portion adjacent to San Francisco Bay, where 34 pairs were found distributed across nine blocks in the early 1990s (Fig. 7). In contrast, we found 14 pairs of owls in the upland blocks of the eastern half of the county (compared with 11 pairs found in the early 1990s) along the Highway 580 corridor between Dublin and Livermore and in the Altamont Hills northeast of Livermore, an area where relatively large numbers of breeding Burrowing Owls have recently been observed (Barclay and Harman 2007). The richest area in Alameda County was the south-central lowland portion; we observed 25 pairs on a single block at Don Edwards San Francisco Bay National Wildlife Refuge. Two pairs were detected on the same block during the 1991-1993 survey. Nine additional pairs were distributed across two historic breeding blocks to the north of this area, apparently in urban park or industrial yard settings in the cities of Fremont and Newark.

In Santa Clara County, detections were restricted to the lowland area in the northwestern corner, as they were during the early 1990s. We detected 56 pairs on two blocks in San Jose and two blocks in Mountain View (Fig. 7), reduced from 97 pairs in the early 1990s.

We detected no pairs on randomly-selected lowland blocks anywhere in the San Francisco Bay Area Interior region, resulting in a zero population estimate for the lowland subregion. We detected 98 pairs on lowland historic breeding blocks, resulting in our "best estimate" of 98 pairs for the lowland subregion. On the 12 randomly-selected upland blocks surveyed, we found one owl pair, yielding a random-sample based estimate of 21 ± 21 pairs throughout the upland subregion. This estimate was greater than the total number of pairs we found on surveyed blocks in the upland subregion (one pair on randomly-selected blocks plus 13 pairs on historic breeding blocks), so it serves as our best estimate for owl pairs in the upland subregion. Summing our count from the lowland blocks and our estimate in the upland subregion, our "best estimate" for the number of Burrowing Owl pairs in the San Francisco Bay Area Interior region is 119. This estimate represents a nearly 28% reduction from the 165 pairs estimated from the 1991-1993 survey (Table 4). Like our estimate, the early 1990s estimate was also an actual count of all pairs found, rather than an extrapolated estimate based on randomly-selected blocks only, so the statistical significance of the apparent decline cannot be tested. However, because the region is very well known by the local birding community (which helped us identify historical breeding blocks), it seems unlikely that there could be more than a few pairs that went undetected during either survey.

SAN FRANCISCO AREA COAST

DeSante et al. (2007) were unable to find any Burrowing Owls in this region during the 1990s survey (Table 4). This relatively small region is well-monitored and well-known by the local birding community. We did not resurvey the region for the 2006-2007 study, as consultation with local experts as well as information in Townsend and Lenihan (2007) strongly indicates that the species remains extirpated from the region.

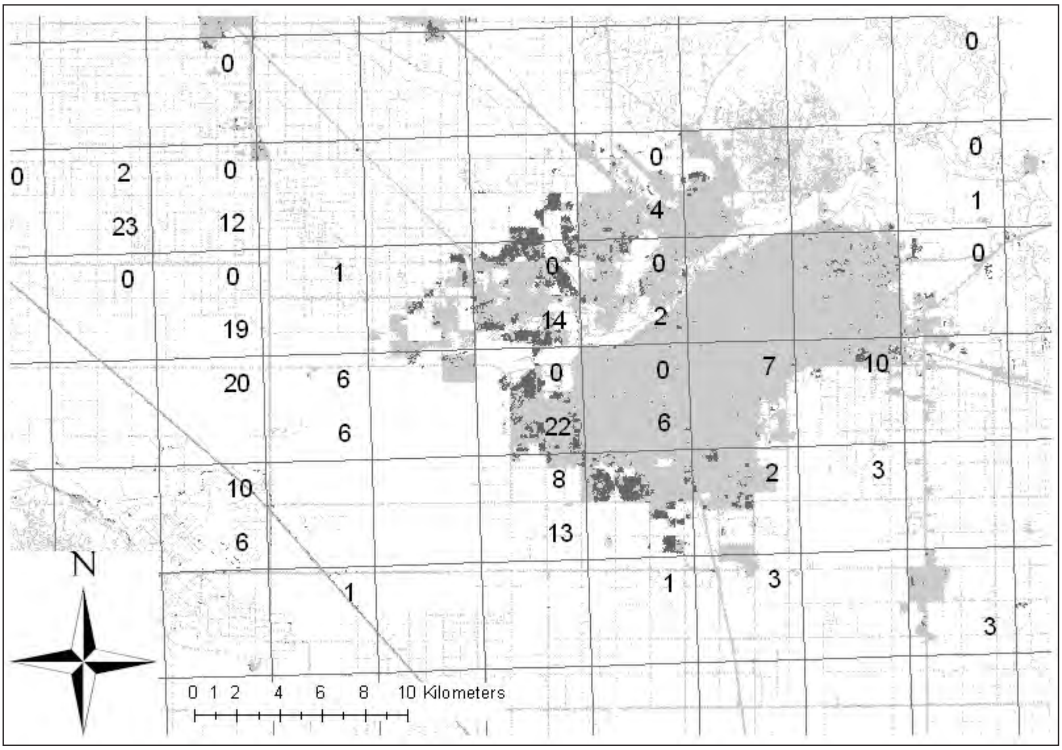

FIGURE 5. The number of Burrowing Owl pairs detected in the Bakersfield area during IBP's 1991-1993 survey (indicated in lower right corner of each block) and 2006-2007 survey (indicated in upper right corner of survey block). The large shaded area represents metropolitan Bakersfield; light gray shading indicates urban land cover as of 1992; dark gray shading indicates areas that were not mapped as urban in 1992, but were converted to urban use between 1992 and 2001 (Multi-resolution Land Characteristics Consortium 2001). Note the concentrated losses of Burrowing Owls in blocks on the western edge of Bakersfield, where substantial urban land conversion occurred between 1992 and 2001.

CENTRAL-WESTERN INTERIOR

We surveyed 30 randomly-selected blocks and 14 historic breeding blocks in this region (Fig. 8). Surveys of random blocks yielded just two Burrowing Owl pairs, both located on upland blocks of San Luis Obispo County. Pooling data from random and historic breeding blocks, we found 21 pairs in the region. Small clusters of owls were found in four areas: Bolsa Valley northwest of Hollister, San Benito County; low foothills of the Coast Range east of King City, Monterey County; northeast corner of San Luis Obispo County; and the Carrizo Plain, southeastern San Luis Obispo County (Fig. 8).

Since no Burrowing owls were detected on randomly-selected lowland blocks anywhere in this region, our random-sample based population estimate for the lowland subregion is zero pairs. However, we found 8 pairs on lowland historic breeding blocks, so our "best estimate" for the lowland subregion is the actual number of pairs we found: eight. On the 13 randomly-selected upland blocks we surveyed, we found two pairs, yielding a random-sample based estimate of 76 ± 51 pairs throughout the upland subregion. This estimate was greater than the total number of pairs we found in the upland subregion (two pairs on randomly-selected blocks plus 11 pairs on historic breeding blocks), so it serves as our best estimate for owl pairs in the upland subregion. Summing our count on the lowland blocks and our estimate in the upland subregion, our estimate for the Central-western Interior region is 84 pairs, a 121% increase from the estimate of 38 pairs during the 1991-1993 survey (Table 4).

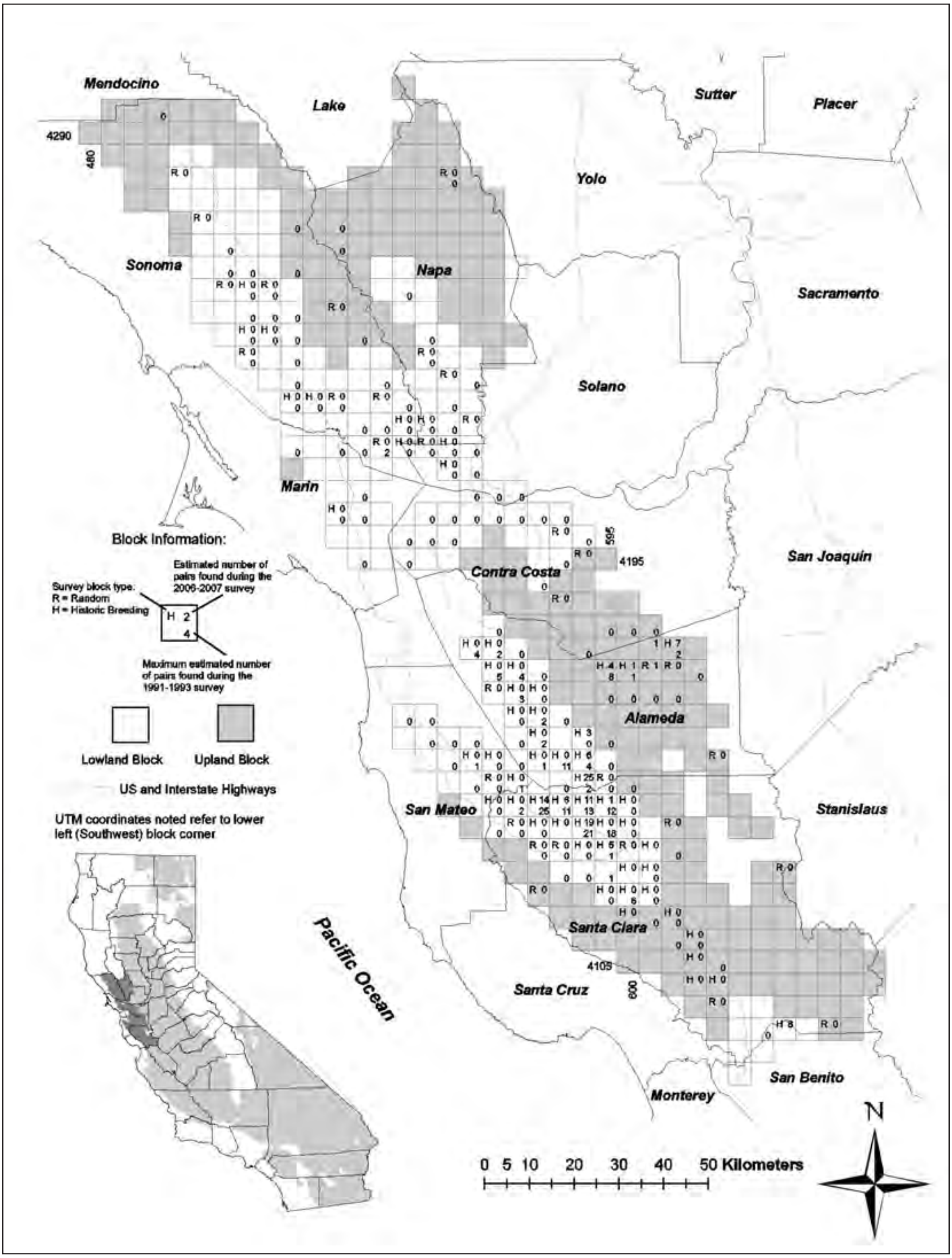

FIGURE 6. Results from the San Francisco Bay Area Interior region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the San Francisco Bay Area Interior region are shown in the inset.

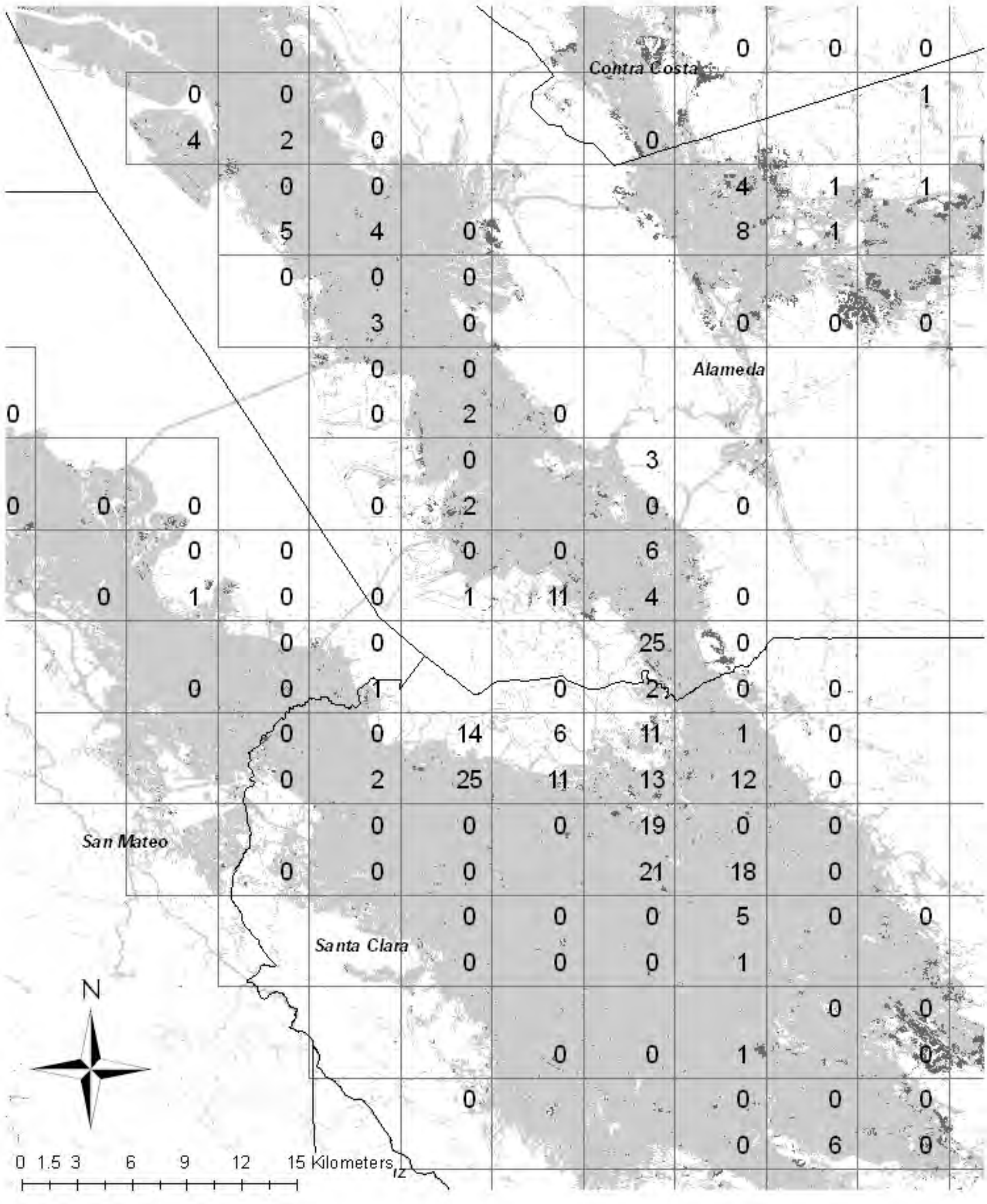

FIGURE 7. The number of Burrowing Owl pairs detected on survey blocks in the southern and eastern San Francisco Bay Area during IBP's 1991-1993 survey (indicated in lower right corner of each block) and 2006-2007 survey (indicated in upper right corner of survey block). Light gray shading indicates urban land cover as of 1992; dark gray shading indicates areas that were not mapped as urban in 1992, but were converted to urban use between 1992 and 2001 (Multi-resolution Land Characteristics Consortium 2001).

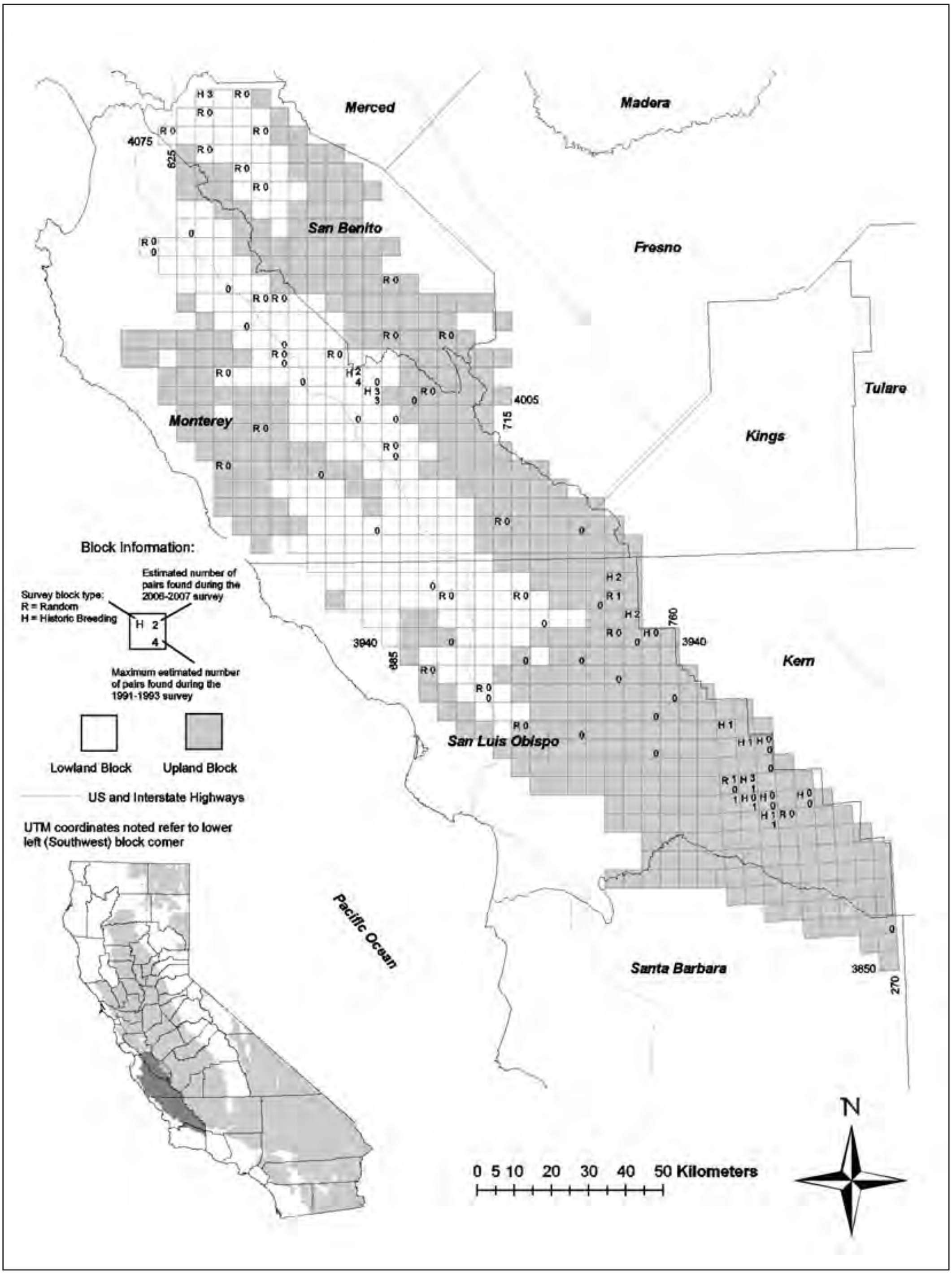

FIGURE 8. Results from the Central-western Interior region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Central-western Interior region are shown in the inset

CENTRAL-WESTERN COAST

This is one of the three coastal regions we did not survey during 2006-2007. In the 1991-1993 survey, eight pairs of Burrowing Owls were detected in the region; seven pairs were near Salinas, Monterey County, and a single pair was in northern Santa Barbara County (DeSante et al. 2007). The Salinas owls were distributed between two areas; five pairs were at the Salinas Airport and two pairs were near the town of Boronda. Visits to both of those sites by local birders in the last decade have yielded no detections, and foraging habitat adjacent to the airport colony has been developed (D. Roberson, *pers. comm.*). The single pair from northern Santa Barbara County was present in 1992, but could not be relocated when the same survey block was revisited in 1993 (DeSante et al. 2007). Consequently Burrowing Owls are likely extirpated from the region (Table 4).

SOUTHWESTERN COAST

Because the few breeding owls present in this region are already well monitored, we did not survey the region. Kidd et al. (2007) determined that Burrowing Owl populations in western Santa Barbara, Ventura, and Los Angeles counties had been extirpated; however, they documented three breeding pairs in Orange County as recently as 2005. In a thorough assessment of the species' status in San Diego County, Lincer and Bloom (2007) determined there were between 41 and 46 pairs present; all but two were within our region boundaries, allowing for a count of between 39 and 44 pairs. The lower count of 39 plus the three pairs from Orange County yields an estimate of 42 pairs for the Southwestern Coast region (Table 4). The 1991-1993 "best estimate" for this region was 36 pairs, although only eight pairs were actually detected (DeSante et al. 2007). The apparent increase could be from the more thorough coverage provided by Lincer and Bloom (2007) or a slight but real increase in the region's owl population.

SOUTHWESTERN INTERIOR

We surveyed 11 randomly-selected blocks and 57 historic breeding blocks in this interior region (Fig. 9). The relatively large proportion of historic breeding blocks reflects the excellent pre-survey information we received from a UC Riverside graduate student studying the local Burrowing Owl population (Ginny Short, *pers. comm.*). Our surveys of random blocks yielded only a single pair, located in a lowland block at Ontario International Airport, San Bernardino County. However, we found 149 pairs utilizing diverse habitats on historic breeding blocks, yielding a total of 150 pairs of owls detected in the region.

The one pair of owls found on the three randomly-selected lowland blocks yielded a random-sample based estimate of 17 ±17 pairs throughout the lowland subregion. Since this estimate was lower than the total number of pairs found in the lowland subregion (pooling data detections from random and historic breeding blocks) our "best estimate" for the number of owl pairs in the lowland subregion is the actual number of pairs counted: 37. Since no Burrowing Owls were detected on any of the eight randomly-selected upland blocks, our random-sample based estimate for the upland subregion is zero pairs. However, we found 113 pairs on upland historic breeding blocks, so our best estimate for the upland subregion is the actual number of pairs found: 113. Summing our counts from lowland and upland blocks, our estimate for the Southwestern Interior region is 150 pairs, 33.9% fewer than were estimated to be present during the 1991-1993 survey (Table 4). We note, however, that the 1990s estimate was extrapolated from surveys of random blocks while our estimate is our actual count of all owls on random and historic breeding blocks, and was based on more extensive pre-survey information. Thus, comparing these "best estimates" may be somewhat problematic.

COACHELLA VALLEY

We surveyed eight randomly-selected blocks and 12 historic breeding blocks in this region (Fig. 10). Surveys of random blocks yielded just one pair of Burrowing Owls, while surveys of historic breeding blocks yielded 48 pairs, for a total of 49 pairs detected in the region. The highest densities of detections were clustered at the northern end of the region around the town of Desert Hot Springs and south to Interstate 10. Smaller numbers of owls (1-4 pairs per block) were detected along the Interstate 10 corridor as far south as the town of Mecca. A single pair was located on a randomly-selected block along

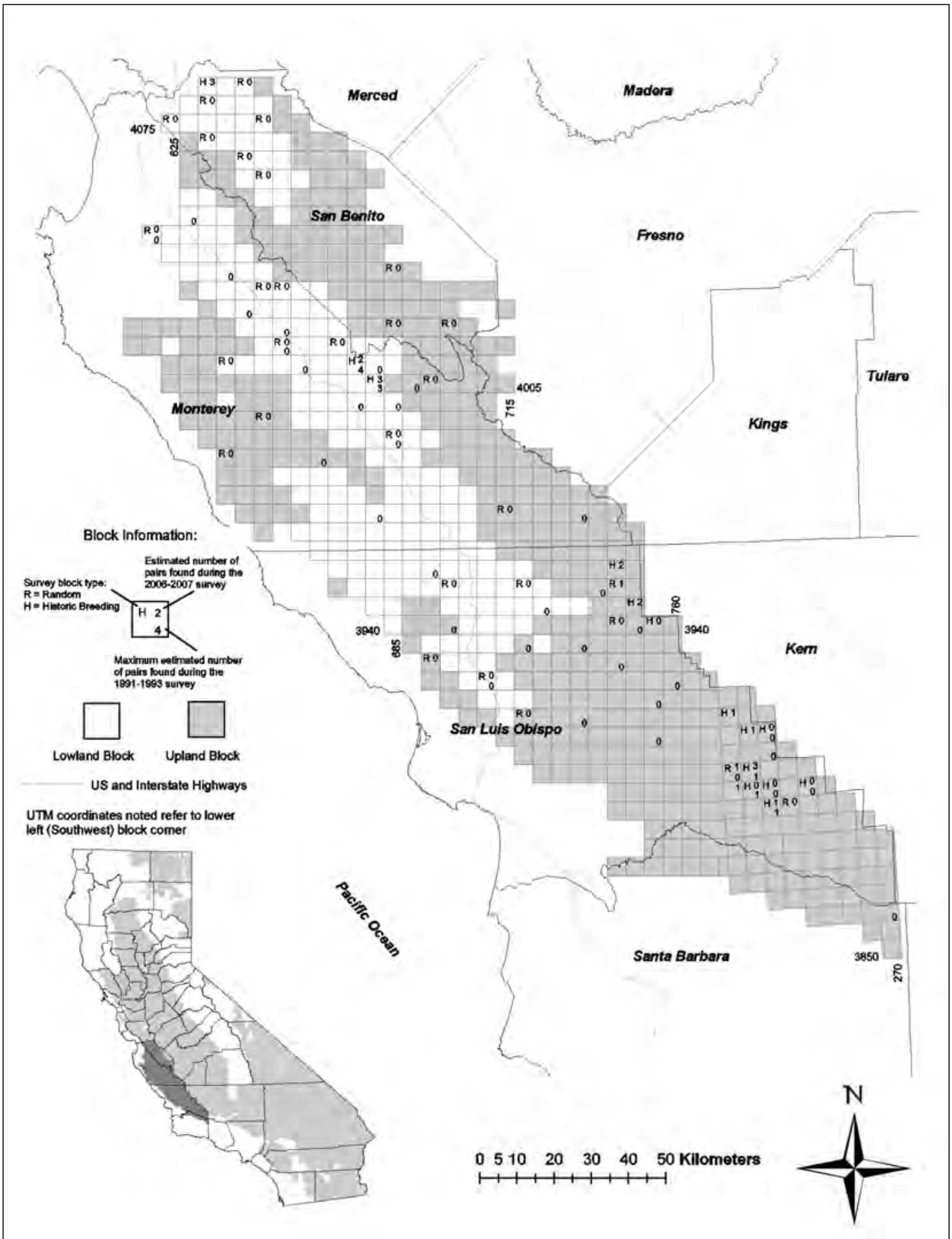

FIGURE 9. Results from the Southwestern Interior region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Southwestern Interior region are shown in the inset.

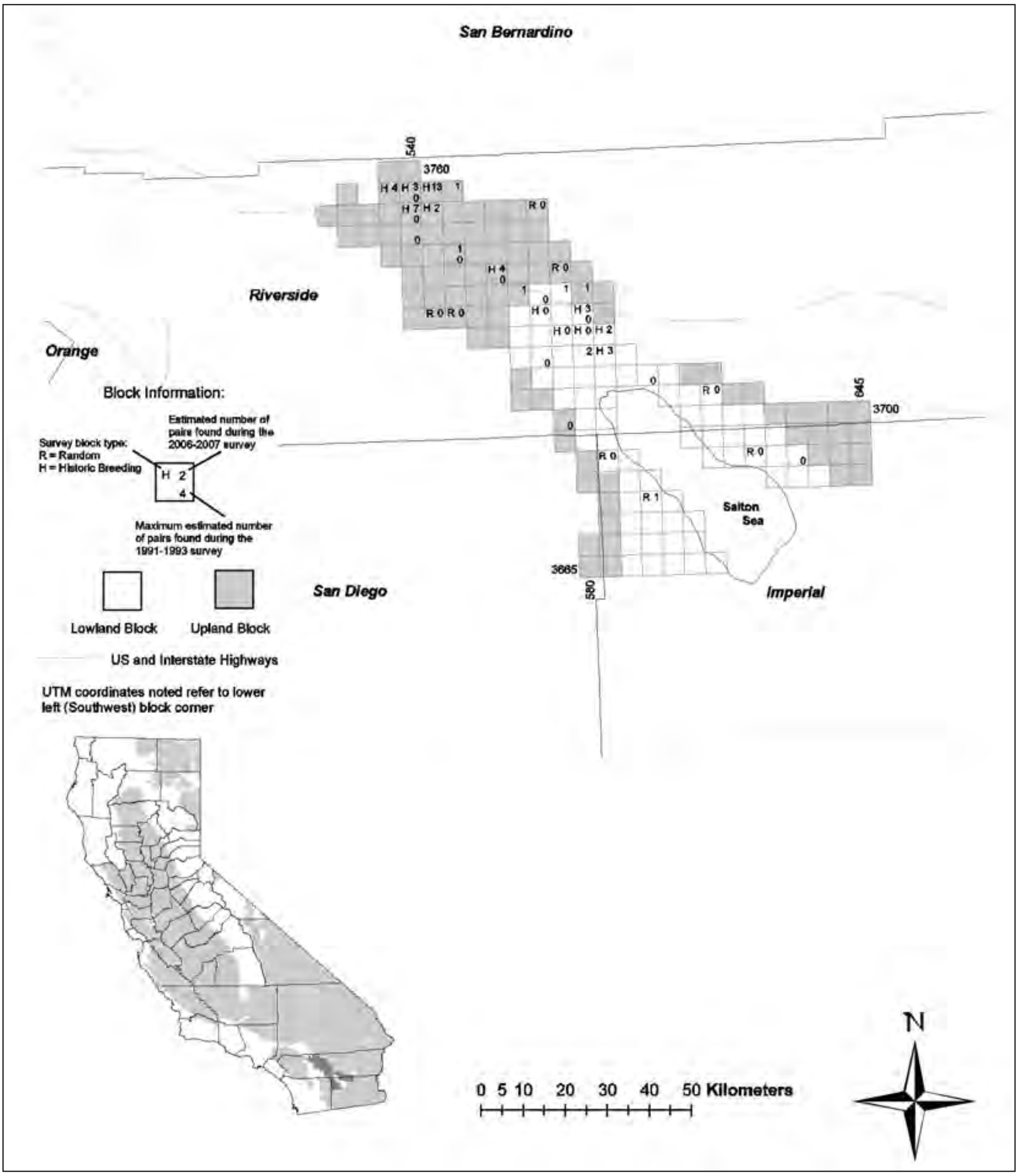

FIGURE 10. Results from the Coachella Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Coachella Valley region are shown in the inset.

the west side of the Salton Sea, at the southern end of Salton City.

In the four randomly-selected lowland blocks surveyed, we found one pair of owls, yielding a random-sample based estimate of 16 ± 16 pairs throughout the lowland subregion. This estimate was slightly greater than the total number of pairs found in the lowland subregion (one pair on randomly-selected blocks plus 11 pairs on historic breeding blocks), so it serves as our "best estimate" for owl pairs in the lowland subregion. No Burrowing Owls were detected on the four randomly-selected upland blocks, so our random-sample based population estimate for the upland subregion is zero pairs. However, we found 37 pairs on upland historic breeding blocks, so our "best estimate" for the upland subregion is the actual number of pairs we found: 37. Summing our estimate from the lowland subregion and our count on the upland blocks surveyed, our estimate for the Coachella Valley region is 53 pairs, a remarkable change from the 1991-1993 estimate of zero pairs (Table 4). Four historic breeding blocks (two upland blocks at the northern end of the region plus an additional upland and lowland block further south), in which we found multiple pairs, were also surveyed in the early 1990s (then also selected as random blocks), when no owls were detected. These results suggest the blocks may have been colonized since the 1991-1993 survey.

IMPERIAL VALLEY

We surveyed seven randomly-selected blocks and eight historic breeding blocks in this region (Fig. 11). Surveys of random blocks yielded 271 Burrowing Owl pairs, and surveys of historic breeding blocks yielded 250 pairs, for a total of 521 pairs detected.

In the five randomly-selected lowland blocks surveyed, we found 254 pairs, yielding a random-sample based estimate of 5,701 ± 2,244 pairs throughout the lowland subregion. This estimate was greater than the total number of pairs found in the lowland subregion (254 pairs on randomly-selected blocks plus 245 pairs on historic breeding blocks), so it serves as our "best estimate" for pairs in the lowland subregion. In the two randomly-selected upland blocks surveyed, we found 17 pairs of owls, yielding a random-sample based estimate of 707 ± 140 pairs throughout the upland subregion. This estimate was greater than the number of pairs we found in the upland subregion (17 pairs in randomly-selected blocks plus five pairs in historic breeding blocks), so it serves as our "best estimate" in the upland subregion. Summing our estimates for the lowland and upland subregions, our estimate for the Imperial Valley region is 6,408 ± 2,384 pairs, 2.5% fewer than the 6,571 pairs estimated during the 1991-1993 survey (Table 4), a statistically insignificant decline ($F_{1,12} = 0.3163$, $P = 0.584$).

MODOC PLATEAU/GREAT BASIN

We surveyed 13 randomly-selected blocks, and two historic breeding blocks in this region (Fig. 12). All blocks surveyed were classified as upland blocks, because the entire bioregion lies well above the upper bound of the lower elevation zones for all of our other survey regions.

We detected no Burrowing Owls on random blocks or historic breeding blocks, so our "best estimate" for the number of pairs in the region is zero pairs. Subsequent to our survey, breeding has been observed in Sierra Valley as recently as 2009 (Richard Carlson, *pers. comm.*), although information is lacking to determine whether this breeding location was active during 2006-2007 when we conducted our field work.

NORTHERN MOJAVE DESERT/EASTERN SIERRA NEVADA

We surveyed 36 randomly-selected blocks and two historic breeding blocks in this region; none of them yielded Burrowing Owl detections. However, one pair was detected incidentally on an otherwise unsurveyed block (see Wilkerson and Siegel, *in press*, for additional details).

WESTERN MOJAVE DESERT

We surveyed 48 randomly-selected blocks and 19 historic breeding blocks in this region. Our "best estimate", based on 25 pairs of owls detected on 42 pairs of owls detected on the random blocks, is 560 ± 268 pairs (see Wilkerson and Siegel, *in press*, for additional details).

EASTERN MOJAVE DESERT

We surveyed 43 randomly-selected blocks and two historic breeding blocks in the Eastern Mojave Desert region. Our "best estimate" for the region, based on one pair of owls detected on the randomly-selected blocks, is 32 ± 32 pairs (see Wilkerson and Siegel, *in press*, for additional details).

SONORAN DESERT

We surveyed 31 randomly-selected blocks, and 16 historic breeding blocks in the Sonoran Desert region. Our "best estimate" for the region, based on 179 pairs of owls detected

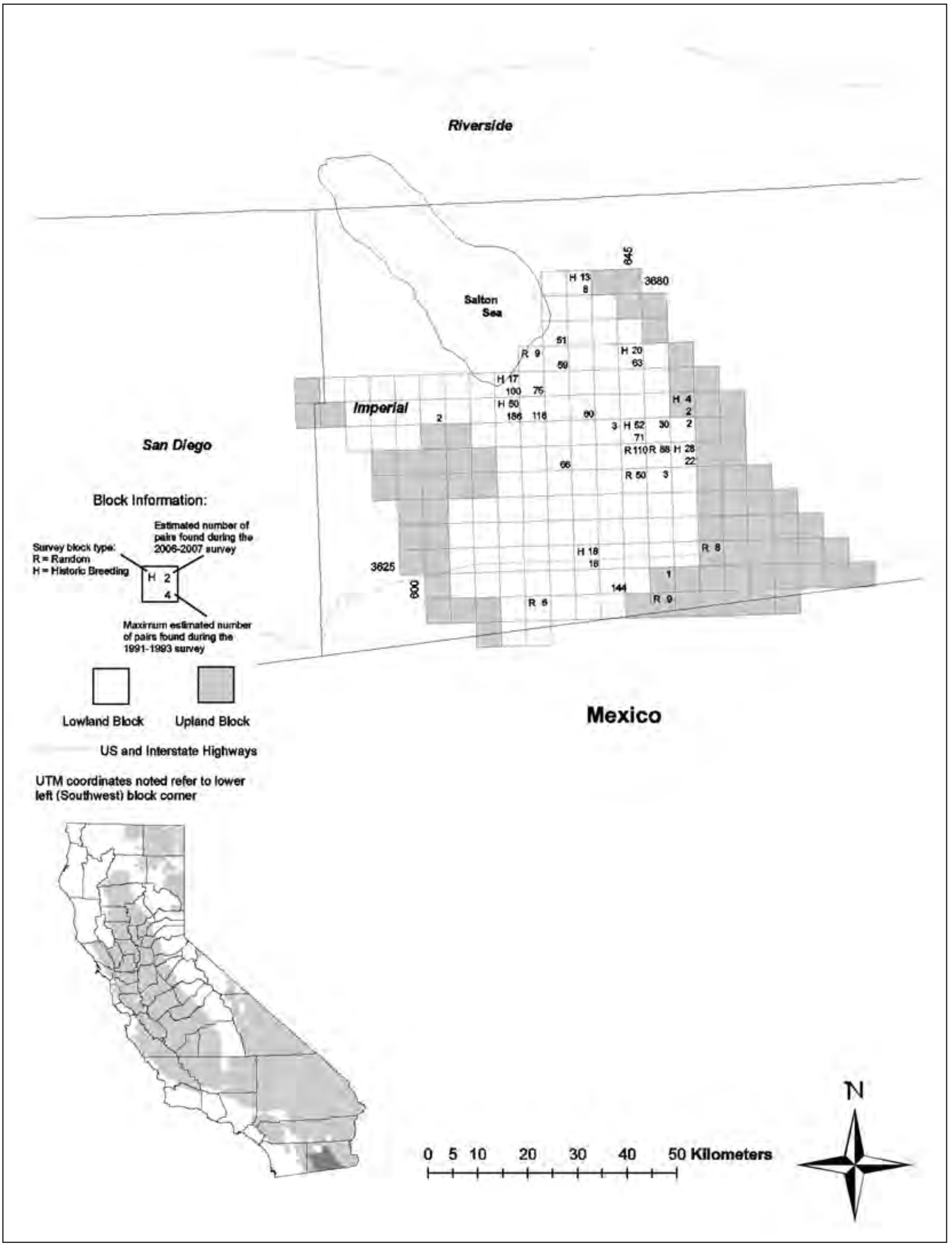

FIGURE 11. Results from the Imperial Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Imperial Valley region are shown in the inset.

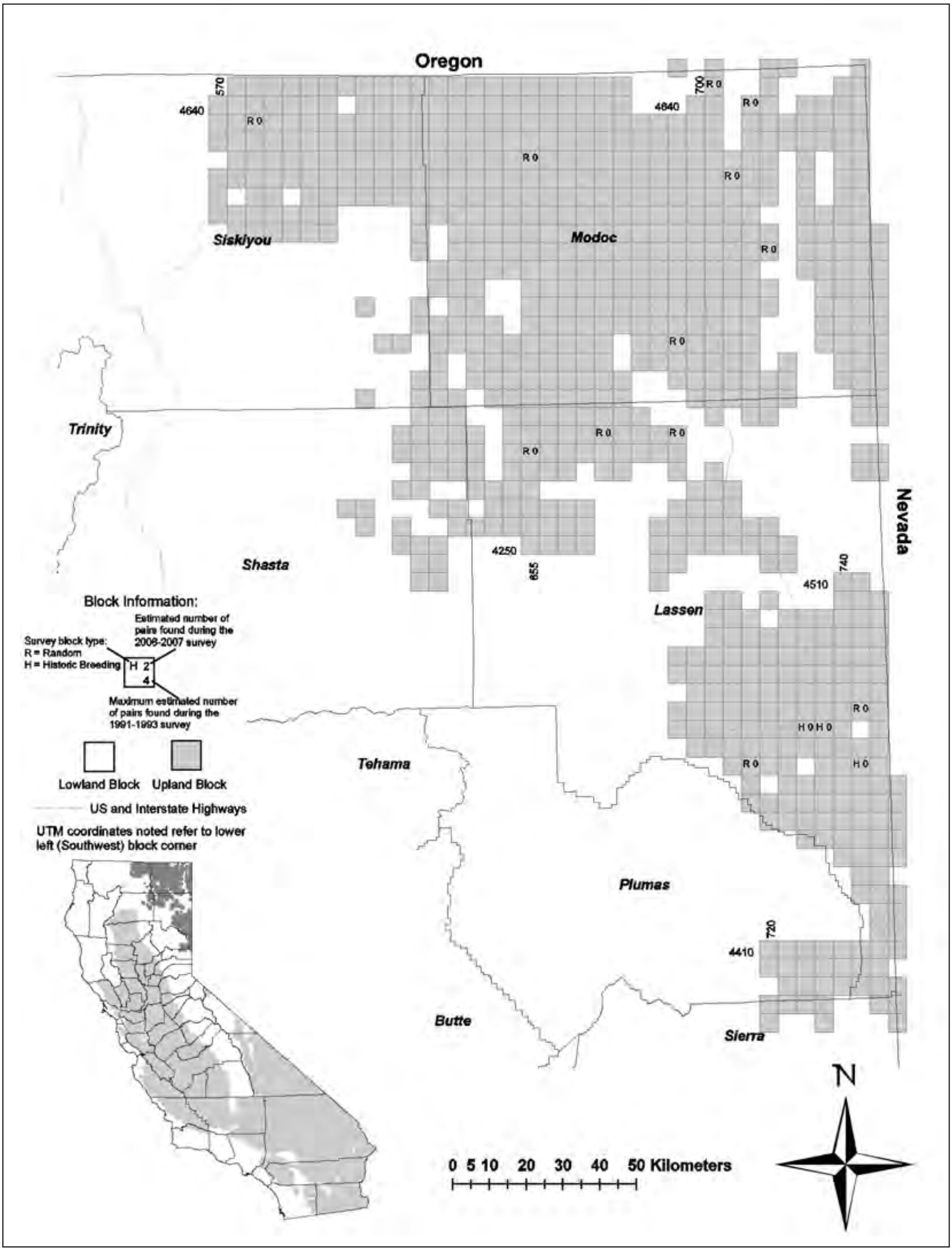

FIGURE 12. Results from the Modoc Plateau/Great Basin region of the 2006-2007 California Burrowing Owl survey. Shown are all 5-km x 5-km assigned to the region; in the case of this region, all blocks were classified as upland. The entire 2006-2007 survey area and the location of the Modoc Plateau/Great Basin region are shown in the inset.

exclusively within the Palo Verde Valley, and no owls detected elsewhere in the region, is our actual pair count in the Palo Verde Valley: 179 pairs (see Wilkerson and Siegel, *in press*, for additional details).

AGGREGATED STATEWIDE RESULTS

Aggregating results across all 2006-2007 survey regions yields a "best estimate" of 9,298 pairs of Burrowing Owls (Table 4). The population is highly concentrated in the Imperial Valley (68.9% of the California population) and to a lesser extent, the Southern Central Valley (12.0% of the statewide population) (Fig. 13). DeSante et al. (2007) reported very similar proportions of the estimated statewide population in 1991-1993 in these two regions.

Omitting the "new" survey regions (Modoc Plateau/Great Basin , Northern Mojave/Eastern Sierra Nevada, Western Mojave, Eastern Mojave, and Sonoran Desert), the aggregated "best estimate" for all regions that were previously surveyed in 1991-1993 is 8,526 pairs, 8% lower than the corresponding estimate generated from 1991-1993 (Table 4). Much of the apparent decline appears to be concentrated in two regions: the Northern Central Valley (231 pairs in 1991-1993 to 12 pairs in 2006-2007), and the Southern Central Valley (1,396 pairs in 1991-1993 to 1,113 pairs in 2006-2007). Other regions with reduced "best estimates" between 1991-1993 and 2006-2007 include the Middle Central Valley (-49 pairs), San Francisco Bay Interior (-46 pairs), Southwestern Interior (-77 pairs), and the Imperial Valley (-163 pairs, but the relatively high absolute numbers make this unlikely to be a meaningful change). In contrast to the overall pattern of declines, our 2006-2007 "best estimates" were higher than the corresponding 1991-1993 estimates for three regions: Central-western Interior (+46 pairs), Southwestern Coast (+6 pairs), and Coachella Valley (+53 pairs).

Because the statewide "best estimate" of the number of pairs is an aggregate of regional extrapolated population estimates and regional minimum counts there is no way to test the statistical significance of the apparent decline between 1991-1993 and 2006-2007. However, we can test for statistically significant change in our population estimates extrapolated only from surveys of randomly-selected blocks. DeSante et al. (2007) provided an extrapolated estimate of 9,127 ± 1,243 pairs for their entire study area; our 2006-2007 estimate extrapolated from randomly-selected blocks across the same survey regions is 8,128 ± 2,391 pairs (Table 4), a non-significant ($F_{1,710}$ = 0.0533, P = 0.817) reduction of 10.9%.

Including the "new" survey regions, our 2006-2007 estimate extrapolated from randomly-selected blocks is 9,187 ± 2,346 pairs (Table 4). Our "best estimate" for the same comprehensive area is a very similar 9,298 pairs (Table 4).

LAND OWNERSHIP AND HABITATS.

Similar to the findings reported by DeSante et al. (2007), we found that the vast majority of California's breeding Burrowing Owls occur on private lands (Table 5). Small numbers were also found on lands managed by four federal agencies, California state government, and local municipalities (Table 5).

The Burrowing Owls detected during our survey occupied a wide range of habitats, including natural grasslands, agricultural lands, and other human-modified areas (Table 6). Nearly one third of breeding sites were located on the banks of irrigation canals or other concrete or earthen water conveyance structures (Table 6).

DeSante et al. (2007) reported a strong association between Burrowing Owl breeding sites and the presence of ground squirrels. Our results corroborated this finding, but also revealed that association to be far weaker for owls nesting along irrigation canals and other water conveyance structures (Table 6). This weaker association presumably stems from owls not having to depend on ground squirrels for burrow excavation along canal banks, where earthen banks may be particularly easy to excavate, and concrete-lined banks often provide attractive nesting spaces between the concrete lining and the underlying soil.

OWL PERSISTENCE ON SURVEY BLOCKS OCCUPIED DURING THE 1991-1993 SURVEY

Considering blocks surveyed during both 1991-1993 and 2006-2007, in which owls were detected during the first (1991-1993) survey (N = 149), we found that abundance significantly declined (mean difference = -2.68 ± 0.50; t = -5.37; df = 148; P < 0.0001). The probability of detecting

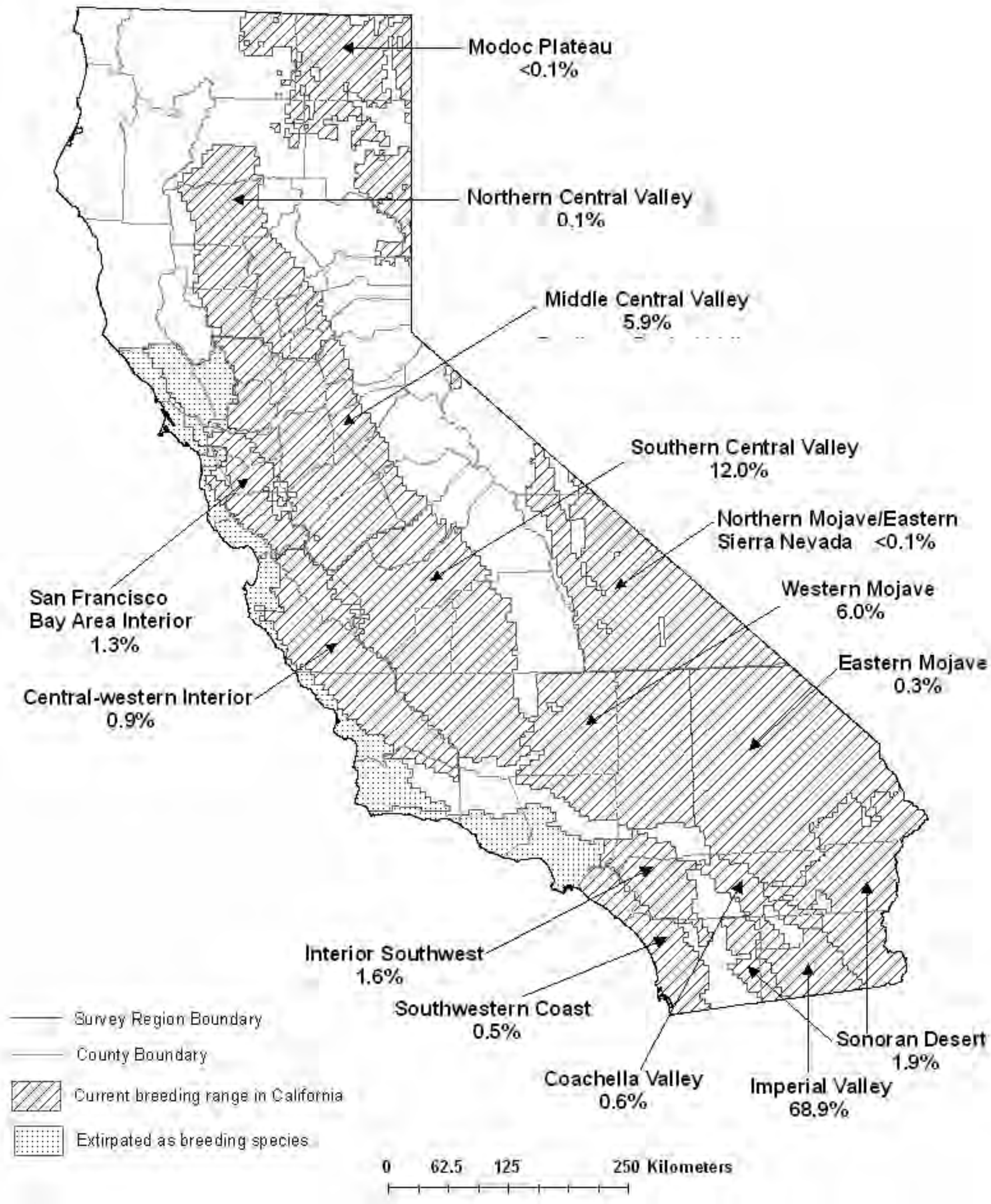

FIGURE 13. Current and former breeding range of Burrowing Owl in California, and percent of the 2006-2007 statewide breeding population estimated to occur in each region based on "best' estimates" (see Methods for explanation of "best" estimates) during the 2006-2007 survey.

TABLE 5. Number and percent of owl pairs detected during the 2006 and 2007 statewide Burrowing Owl survey, classified by land ownership or jurisdiction.

	Number of Burrowing Owl pairs detected	
Land ownership or jurisdiction	Randomly-selected blocks only	Randomly-selected blocks and historic breeding blocks
Private	415 (96.7%)	1,592 (90.6%)
Federal		
Bureau of Land Management	2 (0.5%)	18 (1.0%)
Department of Defense	12 (2.7%)	50 (2.8%)
NASA	0	11 (0.6%)
National Wildlife Refuge System	0	38 (2.2%)
Local government	0	26 (1.5%)
State government	0	22 (1.3%)
Tribal	0	1 (0.1%)
Total	429	1,758

TABLE 6. Primary habitats indicated by field observers at sites where Burrowing Owl pairs were found, and prevalence of ground squirrels at those sites.

Primary habitat	No. of breeding sites[a]	No. of sites where ground squirrel presence was assessed	Percentage of assessed sites with ground squirrels present
Irrigation canal[b]	383	285	19
Natural grassland	211	211	92
Idle or fallow field	121	103	76
Field crop	114	10	60
Pasture	100	100	87
Brushland	75	75	67
Airport	45	45	91
Golf course	30	30	100
Levee	27	26	92
Railroad	26	26	85
Grain or hayfield	25	21	57
Row crop	14	6	43
Other	116	107	48
Total	1,287	1,045	64

[a]In many cases breeding sites encompassed multiple Burrowing Owl pairs.
[b]Here the term "irrigation canal" is used broadly to indicate any man-made concrete or earthen water conveyance structure.

owls on those blocks during the 2006-2007 survey increased as a function of the number of owls detected during the 1991-1993 survey (Fig. 14; $\chi^2_1 = 12.41$; $P = 0.0004$). For example, the predicted probability of detecting owls during the 2006-2007 survey in blocks where just one pair was detected during the 1991-1993 survey was about 0.36, compared to 0.93 in blocks where 25 pairs of owls were detected during the 1991-1993 survey.

DISCUSSION

Our survey method likely contains some systematic sources of error. As DeSante et al. (2007) pointed out, the inability of observers to

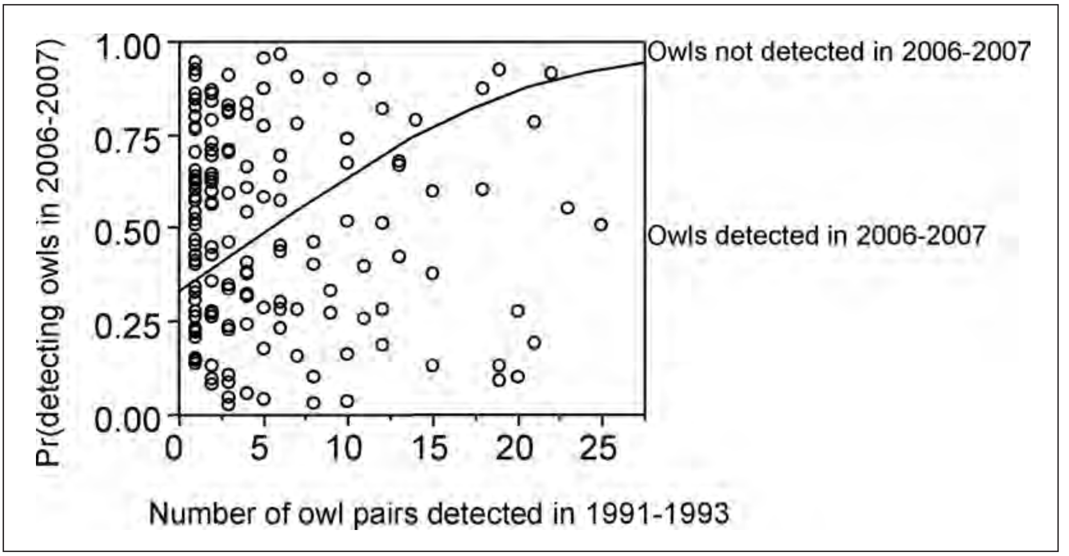

FIGURE 14. Probability of detecting owls during the 2006-2007 survey in blocks where owls were detected in 1991-1993 as a function of the number of owl pairs detected on the block in 1991-1993. The predicted probability of detection in 2006-2007 is shown by the curve. Data points below the curve are blocks on which owls were detected during both surveys; data points above the curve represent blocks where owls were detected in 1991-1993 but not detected in 2006-2007. Data points are plotted at their 1991-1993 owl pair (x-axis) values and randomly jittered in the probability (y-axis) space (below or above the curve, depending on whether owls were present in 2006-2007) to show the distribution of the data.

reliably detect all owls in sampled areas (Conway and Simon 2003, Conway et al. 2008), particularly in areas with limited or no road access may tend to bias our estimates low. Additionally, observers generally assumed that whenever they detected a single adult Burrowing Owl, it represented a breeding pair. To the extent that unmated adult birds may have been detected, this could result in an upward bias in our estimate of breeding pairs. Another potentially confounding factor was that surveyors were unable to gain access to some military installations and private landholdings; if such areas were more or less likely to be occupied by owls than other areas, bias in one direction or the other could have been introduced into our estimates. Finally, our survey methodology incorporated no means for assessing detection probability, which in some environments (such as desert areas with very low road density) may have been quite low. Perhaps of even greater concern than detection probability being low is that it could have varied substantially across survey blocks or survey regions with different physiographic characteristics.

Nevertheless, we believe the sheer volume of data collected counterbalances some of the methodological limitations described above, and ensures that the broader patterns in distribution and abundance are meaningful. Additionally, because our methods adhered to those established by DeSante et al. (2007), any biases affecting our results likely affected the 1991-1993 study, too, so that comparisons between the two surveys are appropriate. Finally, our survey documented the exact locations of 1,758 Burrowing Owl pairs (18.9% of the estimated total) across California, information that should be of great use for ongoing and future conservation efforts.

The generally large variances associated with our regional and statewide population estimates extrapolated from randomly-selected blocks indicate that our statistical power to detect changes in abundance was rather weak. Indeed, the Northern Central Valley was the only region for which our 2006-2007 population estimate differed significantly from the 1991-1993 estimate of DeSante et al. (2007). Moreover, many of our regional "best estimates" were not obtained by extrapolating data from the randomly-selected blocks, but rather by simply counting all of the owl pairs that could be found in either randomly-selected or historical breeding blocks. We had no means for assessing statistical significance of such estimates from the corresponding 1991-1993 "best estimates", many of which were generated in the same manner. Nevertheless, inspection of our results, and qualitative comparisons with results from the 1991-1993 survey, still yield some important conclusions.

The major patterns in Burrowing Owl distribution and abundance across California described by DeSante et al. (2007) have not changed dramatically since 1991-1993, when the species was already extirpated or nearly extirpated from the San Francisco Bay Area Coast, Central-western Coast, and Southwestern Coast regions. The Imperial Valley still accounts for slightly more than two-thirds of the estimated statewide population, and the Southern Central Valley remains the second largest Burrowing Owl population center. Populations in other regions of the state that were surveyed in 1991-1933 all remain much smaller than those in the two most heavily populated regions.

While not statistically significant, we observed apparent declines in two urban areas: San Francisco Bay Area Interior Region and the Bakersfield area in the Southern Central Valley region. The San Francisco Bay Area Interior region's breeding owl population is both small and well-known by local birders and researchers, making it very likely that the "best estimates" from both the 1991-1993 and 2006-2007 surveys reflect very nearly all the owl pairs actually present. Consequently, the apparent loss of 27.9% of the population, from 165 to 119 pairs since the early 1990s survey, is somewhat alarming. This loss includes the last known pairs of owls in both Sonoma and San Mateo counties, and suggests that Burrowing Owls have now been extirpated as a breeding species in the entire San Francisco Bay Area, except for Alameda and Santa Clara counties, where populations have also declined. It should be noted that Burrowing Owl populations can fluctuate annually, so our lower count of owls in the region does not necessarily indicate a deterministic decline. However, the increasingly restricted distribution of the species throughout the region would seem to indicate that such a trend is real.

In the greater Bakersfield area, heavy losses (nine blocks lost a total of 96 pairs) appear to be associated with recent land conversion from agriculture to urban, though a finer resolution spatial assessment would be helpful to determine whether such land conversion really has driven the losses. In any case, it seems that like the San Francisco Bay Area, the greater Bakersfield area is in danger of losing most if not all of its once substantial Burrowing Owl population. This is particularly unfortunate because the species exhibits a remarkable degree of tolerance for human alteration of natural habitats (Klute et al. 2003, Chipman et al. 2008), often nesting within landfills, golf courses, airports, and vacant lots within urban areas (Haug et al. 1993, Trulio 1997). This tolerance of humans and their activities would seem to provide ample opportunity for successful conservation efforts, even in the context of urban areas with growing human populations. One result, showing that the likelihood of Burrowing Owls persisting through 2006-2007 on survey blocks where they were present in 1991-1993 was strongly and positively related to the number of owls that were present on the blocks in 1991-1993, underscores the precariousness of dwindling urban-area populations, and the need for rapid action to prevent local extirpation.

In contrast to areas where we noted declines, we also noted areas where Burrowing Owls may have increased since the 1991-1993 survey: the Central-Western Interior region and the Coachella Valley. However, we surveyed a much greater number of upland blocks in contrast to the earlier survey in the Central-Western Interior region, so the apparent increase could be an artifact due to increased surveys effort. In contrast, the apparent increase (from zero to 53 owl pairs) in the Coachella Valley seems more likely to indicate a real increase in owl presence, especially because we found multiple Burrowing Owl pairs on four blocks in the region that were also surveyed in the early 1990s, but yielded no detections at that time. Interestingly, none of the pairs we found in Coachella Valley appeared to be associated with agriculture or water conveyance structures;

rather they occupied a variety of relatively arid habitats including brushland, desert scrub, and natural grasslands, and appear to be clustered on the outskirts of urban development.

Large confidence intervals make comparing our statewide population estimate with that of DeSante et al. (2007) during 1991-1993 difficult, especially since the difference in the estimates is relatively small. Three quarters of owl pairs in our aggregated population estimate reside in the densely occupied Imperial Valley, where the standard error associated with our regional estimate is well over 2,000 pairs. Thus, the lack of precision in this single regional estimate could easily mask a real statewide decline, or for that matter, potentially even obscure a statewide increase. Future survey efforts could perhaps minimize the problem of low statistical power by focusing monitoring efforts on smaller areas selected for high owl population density or other factors, and sustaining those efforts for multiple successive breeding seasons.

Our survey of the "new" survey regions covering the Modoc Plateau/Great Basin, Mojave Desert, and Sonoran Deserts represents the first systematic survey of Burrowing Owls across vast portions of California. We found Burrowing Owls to be distributed heterogeneously among these regions, with few or no owls in the Modoc Plateau/Great Basin, Northern Mojave/Eastern Sierra Nevada, Eastern Mojave, or Sonoran Desert regions (excluding the Palo Verde Valley). However, we found much larger aggregations of burrowing Owls in the Western Mojave region, and in one small area of the Sonoran Desert—the Palo Verde Valley.

CONSERVATION IMPLICATIONS

A comprehensive conservation strategy for Burrowing Owl in California is under development by California Department of Fish and Game and its partners (Burkett and Johnson, 2008). Here we provide a few conservation-related conclusions and recommendations that stem directly from our results:

1) Despite the apparent robustness of the population in the Imperial Valley, smaller populations elsewhere in the state, particularly in and near urban areas, appear to have continued to decline since the 1991-1993 survey.

2) The vast majority of the state's breeding Burrowing Owls continue to nest on private lands; any meaningful conservation efforts must therefore engage private stakeholders.

3) Across much of California, Burrowing Owl nesting remains closely associated with the presence of ground squirrels, another factor that must be considered in developing successful conservation measures.

4) In a few key areas, particularly the Imperial Valley and the Palo Verde Valley, Burrowing Owls are not closely associated with ground squirrels, and instead rely heavily on the banks of concrete and earthen water conveyance structures for nesting sites. Comprehensive conservation planning for Burrowing Owl in California must take into consideration the importance of these artificial structures.

5) Although Burrowing Owl detections were scarce across most of the land area of the newly surveyed Modoc Plateau/Great Basin and southern California desert regions, substantial populations persist in the Sonoran Desert (Palo Verde Valley) and the western Mojave Desert regions (particularly in and around the Antelope, Apple, and Lucerne valleys). We estimate the western Mojave Desert region to contain ~6% of California's breeding Burrowing Owls, superseded in numerical importance to the statewide population only by the Imperial Valley and the Southern Central Valley regions. Successful conservation planning for this species must address the particular needs of these substantial desert populations (Wilkerson and Siegel, *in press*).

6) A statewide conservation strategy will likely need to incorporate a statewide monitoring program to assess the effectiveness of conservation measures. Our study demonstrates the potential value of citizen-science participation in single-species studies, particularly of raptors or other highly charismatic species like Burrowing Owls that are relatively easy to find and identify. While many of our volunteer observers were highly skilled birders, and in some cases, even wildlife professionals, others had little or no birding experience. With a fairly modest investment of time and money for recruiting, training, and supporting volunteer surveyors, we were able to extend our survey across a vast area. Engaging citizen-scientists in monitoring could reduce the cost and extend the scope of any owl monitoring project, and may also yield less tangible benefits — participants in

citizen science monitoring programs can reap an increased awareness and appreciation of study organisms and their habitats, which may then translate into tangible actions on their behalf (Evans et al. 2005).

ACKNOWLEDGMENTS

This project was made possible by funding from the National Fish and Wildlife Foundation, California Department of Fish and Game, Pacific Gas and Electric Company, and an anonymous donor. We thank Esther Burkett at California Department of Fish and Game for supporting this project in numerous ways, David DeSante at The Institute for Bird Populations for sharing his knowledge and providing survey advice, and Jim Saracco at The Institute for Bird Populations for statistical advice. Sue Townsend and David Ainley provided helpful comments on the manuscript. We thank the ESRI Conservation Program for software support.

We thank the following individuals for serving as volunteer coordinators for their counties or areas in 2006, in 2007, or in both years: Marie Barrett, Rich Cimino, Chris Conard, Jeff Davis, Jimm Edgar, Mike Fisher, Dawn Garcia, Dan Guthrie, Darrell Hutchinson, Cheryl Johnson, Robin Leong, Krista Maney, Jessica Martini, Catherine Portman, Tom Ryan, Debra Shearwater, Ginny Short, Ian Taylor, Ruth Troetschler, Dave Wagner, and Carie Wingert. Other individuals who did not serve as coordinators but nevertheless contributed substantial local information and/or logistic help included Roger Higson (Palo Verde Valley) and Ryan Young (Antelope Valley).

We are especially grateful to the following volunteers for participating in the survey of one or more survey blocks: Jennifer Albright, Chris Alderete, Diana Alleman, Lisa Allen, Russell Almaraz, Jerry W. Ambrose, Mary Ann Ambrose, Sundeep Amin, Chloe Anderson, Simon Avery, Joellyn Avery, Patricia Bacchetti, Jason Bachiero, Valerie Baldwin, Jack Barclay, Marie Barrett, Margaret Barson, Peggy Bartels, Candice Basham, Jeff Beauchamp, David Bell, Joyce Bender, Judy Bendix, Debbie Benham, Vern Benhart, Nicola Bennert, Josh Bennett, Murray Berner, Linda Bernhart, Milton Blatt, Diane Bodwin, Anita K. Booth, Brian Botham, Dawn Bradley, Steve Brady, Tricia Bratcher, Theresa Brennan, Craig Breon, Beverly Brock, Charles R. Brown, Philip Brown, Debbi Brusco, Julie Bryson, Virginia Buchholz, Maureen Buffington Santo, Cheri Buskirk, Dotty Calabrese, Karlene Campo, David Carr, Chuck Carroll, Randi Cassellius, Joyce Chang, Tony Chapelle, Sophie Chiang, David Chilton, Kirsten Christopherson, Jeff Church, Rich Cimino, Mareyn Clements, Richard Clements, Neil Clipperton, Wendy Cole, Barbara Coley, Roger Coley, James M. Collier, Judith A. Collier, Chris Conard, David Cook, Daniel S. Cooper, Curt Cotner, Erica Craven, Anne Crealock, Lori Cuesta, Cindy Curtis, Ken Curtis, Kirsten Dahl, Virginia L. Dallas-Dull, Larry Davidson, Jeff N. Davis, Karen DeMello, Susan Dieterich, Joan Dodson, Jim Dodson, Jed Douglas, Peter Drumer, Doug Drynan, Jim Dunn, Natasha Dvorak, R. Eckland, Jimm Edgar, Arthur L. Edwards, Linda Edwards, Lorna Elness, Mark Elness, Madi Elsea, Kevin Enus-Rempel, Laura Erickson, Janeann Erickson, Jake Estis, Mary Fajekers, Jonathan Feenstra, Stacey Feigekonwiesr, Hank Feilen, Jane Fielder, Megan Fisher, Mike Fisher, Tim Fitzer, Kasey Foley, Joel Forty, Bennie Fouch, Scott Frazer, Linda Freeman, Mary Freeman, Nick Freeman, Parker Fritch, Lillian Fuji, Harold Fukuma, Barry Furst, Dawn Garcia, Melisa Garcia, Maureen Geiger, Harriet Gerson, Brian Gibson, Neil Gilbert, Steven Glover, Dave Goodward, Debbie Green, John F. Green, Richard Greene, Linda Greene, Christina Greutink, Dan Guthrie, Samantha Hafter, Portia Halbert, Catherine Halley, Devon Hammond, Lindsay Harman, Kristey Harrington, Carmen Hashagen, Ken Hashagen, Cole Hawkins, Priscilla Hawkins, Steve Hayashi, Ursula Heffernon, Lynn Hemink, J. Herman, Philip Higgins, Jon Hilbert, Carolyn Hinshaw, Allan Hollander, Lindsay Holt, Amber Holt, Kathryn Hood, Scott Huber, Liam Huber, Sherry Hudson, Bobby Huss, Darrell Hutchinson, Meighan Jackson, Sue James, Tim Jenkins, Phil Johnson, Vernon Johnson, Dave Johnston, Jennifer Jones, Douglas Joo, Linda Jordan, Ginny Kaminski, Jerry Kaminski, Martin Karsch, Lola Kashyap, Maral Kasparian, Guy Kay, David Keeling, Elena Keeling, Mary Keitelman, Lazan Keitelman, Ruth Kennedy, Stephen King, Judy Klink, Oliver Klink, Joanna Koob, Eva Kristofik, Nathan Krumm, Tim LaFlame, Kimya Lambert, Aleatha W. Landry, Steve Laymon, Cathie LaZier, Rod Lee, Sara Lee, Lora Leerskov, Robin

Leong, John Lewis, Phyllis Lindley, Inna Litvin, Ivette Loredo, Kent D. Lou, Calvin D. Lou, Raymond Lukens, John Luther, Bill Lydecker, Greta Lydecker, Sarah Lydecker, Betty MacDonald, John MacDonald, Chris Macintosh, Jeanne Macneil, Shelly Magier, Ernie Maier, Colleen Martin, Cheryl McCloskey, Kally McCormick, Walter J. McInnis, Gregory Meissner, Mary Beth Metcalf, Susanne Methvin, Jay Milee, Ashley Miller, Mel Miller, Karen Mitchell, Richard Montijo, Alan Moore, Kris Moore, Richard Moore, Nancy Mori, Suzanne Morron, Gerald Mugele, Jerre Murphy, Gordon Murphy, Sue Murphy, Ted Murphy, Jean Myers, George Nash, Kelley Nelson, Nancy Nelson, Wallace Neville, Renee New, Maggie Nunes, Michelle Ocken, D. O'Keefe, Rodney Olsen, Jennifer O'Neal, Regina Orr, William Orr, Ed Pandolfino, Kay Partelow, Warren Patten, Jennifer Patten, Janna Pauser, Mark Paxton, Fraser Pembeiton, Barbara Pendergrass, David Perrin, Sarah Perrin, Marilynn Perry, Dawn Peterka, Paula Peterson, Randall Peterson, Susan Peterson, Carole Petrash, Shawn Petrash, David G. Philled, Sarah Pitzer, Ken Poerner, Kathy Porter, Marian Porter, Catherine Portman, Bob Power, Ted Raczek, Corina Rahmig, Troy Rahmig, Siddharthan Ramachandramurthi, Art Ramirez, George Rawley, Tricia Reed, Crispin Rendon, Virginia Rhodas, Michael Richard, Bob Richmond, Mike Richter, Matt Ritchie, Michael Robertson, Caroline Rodgers, Tobias Rohmer, Ann Romer, Sarah Ross, Patricia Rouzer, Jim Rowoth, Suzanne Ruckle, Tim Ruckle Jr., Tim Ruckle Sr., Ruth Rudesill, Michael Ruffino, Heather Ryan, Jeff Ryan, Thomas Ryan, Jennifer Rycenga, Donna Sadowy, Nancy Sage, John Santo, Fran Scarlett, Diana Scheel, Lexie Scheel, John Schick, Paul Schorr, Nancy Schorr, Mauricio Schrader, Steve Schwartz, Katie Schwartz, Steve Scott, Jeff Seav, Norman Self, Tracey Sharp, Kathy Sharum, Jackson Shedd, Kathy Shick, Robert Shields, Carolyn Short, Ginny Short, Rodney Siegel, Mike Skram, Dale M. Smith, Greg Smith, Michael W. Smith, Curtis Snyder, Tate Snyder, Susan Stanton, Jim Steinert, Sarah Stier, Steve Stocking, Mike Stockton, Brad Stovall, Bruce Strang, Nancy Strang, Linda Swanson, Dan Tankersley, Ian Taylor, Lynn R. Thomas, Jennifer Thompson, Christine Tischen, Christine Tisher, Gene Troetschler, Ruth Troetschler, Jeff Trow, Lisa Twiford, Linda Vallee, Ann Verdi, Chuck Verturri, Jamie Visinoni, Jim Waddell, Lisa Wadley, Dave Wagner, Annette Waite, Lucy Waite, Dee Warenycia, Dean Webb, Daniela Wersin, Kimberly West, Liz West, V. Wheeler, Jonathan Widdicombe, Bruce Wilcox, Bob Wilkerson, Anne Williams, Dan Williams, James Williams, M. Williams, Pam Williams, Bruce Williford, Michael Wilson, Carrie Wingert, Gary Woods, Lois Wren, Rick Wulbern, Faith Yamane, Chad Young, Ryan Young, and Bill Zachman.

We thank the following individuals for surveying numerous blocks as part of IBP's full-time field crew: Mary Coolidge (2007 crew leader), Ilma Dancourt, Corey Kaleshnik, Amanda LeClerc, Timothy McClung, Alison Mohoric, Becky Parsons, Matthew Simes, Chantal Villeneuve, Zach Wallace, and Aaron Works. This is Contribution No. 392 of The Institute for Bird Populations.

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EXHIBIT 3

House
Agricultural
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Providing expertise in agricultural science, management, and appraisal since 1977

Review of the Agricultural Elements of the World Logistics Center Project

Moreno Valley, California

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The revision number of this report is 4473. The publishing date of this report is 2013-04-04.

This report supercedes any previous version having a smaller revision number or older publishing date than shown above.

Contents

1 Introduction

1.1 Purpose of this study The purpose of this study is to comment on the agricultural resources impact findings of the proposed World Logistics Center project (hereinafter referred to as the SUBJECT PROJECT, or *project*) in Moreno Valley, California, as described in the *World Logistics Center Project Draft Environmental Impact Report (SCH no. 2012021045)*, (hereinafter referred to as DEIR).

1.2 Identification of subject property According to the City of Moreno Valley's website, the proposed World Logistics Center project area covers 3,918 acres in eastern Moreno Valley. The entire area is covered by a General Plan Amendment that will designate 2,635 acres for logistics development, 20 acres for public utility uses, and 1,159 acres for permanent open space. The remaining 104 acres will be used for utility extensions to serve the World Logistics Center project[1]

[1] ⟨http://www.moval.org/misc/wcl-deir.shtml; retrieved 2013-Apr-01⟩.

While the majority of the property is within the city limits of Moreno Valley, the project includes the annexation by the City of Moreno Valley of 85 acres on the north side of Alessandro Boulevard at Gilman Springs Road.

1.3 Authorization This study, prepared by House Agricultural Consultants (hereinafter "HAC" or "Consultant") is authorized under contract by Cathy D. Lee, Associate Attorney, Lozeau Drury LLP, Oakland, California.

1.4 Report authors Gregory House is the lead consultant of this study and co-author of this report. Henry House assisted with analysis and writing this report. Our résumés are included in the appendices to this report.

1.5 Scope of work In the course of this study we have undertaken or performed the following:

- Reviewed the *World Logistics Center Project Draft Environmental Impact Report (SCH no. 2012021045)*,(DEIR), especially Section 1 Executive Summary, Section 4.2 "Agricultural and Forestry Resources"; and Appendix C, "Agricultural Resources", including *World Logistics Center, An Agricultural Industry Analysis of the Inland Empire* prepared March 2012 by Andrew Chang & Company, LLC; *Agricultural Resources Assessment for the World Logistics Specific Plan Draft Environmental Impact Report* prepared May 2012 by Parson Brinckerhoff; and a letter regarding *Economic Viability of Agriculture in the East Inland Empire* written March 18, 2009 to Matt Englhard, Regional Development Officer, First Industrial Realty Trust, Inc. Irvine, CA from Thomas R. Jirovsky, Senior Managing Director, CRBE Consulting, Los Angeles, CA.

- Examined California Department of Conservation Farmland Mapping and Monitoring Program's *Riverside County Important Farmland 2010* map, published 2010.

- Examined and collected data from table A-25, "Riverside County 2008–2010 Land Use Conversion" by California Department of Conservation Division of Land Resource Protection, ⟨http://redirect.conservation.ca.gov/DLRP/fmmp/county_info_results⟩.

- Reviewed California Department of Conservation Farmland Mapping and Monitoring Program, *2010 Field Report, Riverside County*, ⟨http://redirect.conservation.ca.gov/DLRP/fmmp/county_info_results⟩.

- Researched the soil of the subject property via the *Soil Survey of Riverside Area, California* published by the United States Department of Agriculture Bureau of Soils, 1917.

- Researched the soil of the subject property on the USDA-NRCS internet website, ⟨http:// websoilsurvey.nrcs.usda.gov⟩.

- Examined Google Earth images of subject property and surrounding parcels, recent and historical.

- Reviewed *Moreno Valley General Plan*; Chapter 7, "Conservation" and especially "Agricultural Resources" sections 7.7.1 and 7.7.2

- Reviewed and collected data from Riverside County's crop reports, 2006 to 2011, published by the Riverside County Agricultural Commissioner.

- Reviewed personal agronomic and economic information files dated October 2012 on a Moreno Valley farm property located west of Pigeon Pass Road.

- Researched current and recent irrigation water costs in five water districts of central and southern California via internet and personal files;

- Reviewed the USDA's *Land Evaluation and Site Assessment: A Guidebook for Rating Agricultural Lands, Second Edition* (by J. Pease and R. Coughlin, prepared for USDA/NRCS and published by the Soil and Water Conservation Society, 2003).

- Reviewed *Overview of Legal Restraints on Agricultural Land Mitigation Programs*, February 16, 201 by Osha R. Meserve, Soluri Meserve, A Law Corporation;

- Reviewed *Mitigation of Farmland Loss* prepared by the American Farmland Trust for USDA NRCS, September 2002;

- Reviewed *Saving Farmland, Growing Cities*, January 14, 2013 by the American Farmland Trust;

- Reviewed *Milk Must Move Farther to Serve South-state Plants*, Ching Lee, Ag Alert, March 27, 2013.

1.6 Consultant's qualifications Since 1977, House Agricultural Consultants has provided clients with a wide range of agricultural appraisal, consulting, and management services. Clients include farmers, landowners, institutions, insurance companies, law firms, municipalities, public agencies, non-governmental organizations, and many others. A sample list of clients is included in the appendices to this report.

Gregory House is a qualified expert witness on agricultural viability, crop productivity, and farming practices in California Superior Court, United States Tax Court, and United States Bankruptcy Court. Mr. House has 35 years of experience as an agricultural consultant throughout California and the western states, and over that time he has worked on numerous environmental impact reports and other land evaluation and planning projects involving agriculture, including the use of the LESA model and other analytical tools. He is also a farmer of 30 years. Coco Ranch, the family farm, produces organic apples and other organic tree fruits on 40 acres of land near Dixon, California.

Mr. House's résumé is included in the appendices. Mr. House is credentialed by the American Society of Farm Managers and Rural Appraisers as an Accredited Farm Manager and as an Accredited Rural Appraiser. He is accredited by the American Society of Agronomy as a Certified Professional Agronomist and Certified Crop Advisor. Mr House holds a professional license from the state of California as a Certified General Appraiser, number AG-001999.

Mr. House's appraisal expertise encompasses the appraisal and appraisal consulting on agricultural conservation easements throughout California as well as related wildlife habitat easements. He has performed conservation easement appraisals for The Nature Conservancy, Yolo Land Trust, Solano Land Trust, and the Sacramento Valley Conservancy. Mr. House is a nine-year former member of the Board of Directors of the Yolo Land Trust.

2 Factual data

2.1 Site use Currently approximately 2,452 acres or 90 percent of the 2,910-acre Specific Plan area is actively farmed to dry land (not irrigated) winter wheat, according to the DEIR[2], and another 897 acres, or 81 percent of the 1,104-acre open space properties that are owned by the state or public utilities are also actively farmed to dry land winter wheat at this time.

[2] chapter 4.2.1 Existing Setting

2.2 General-plan designation and zoning According to the DEIR, the City's 2006 General Plan Land Use Element has no "agricultural" land use designation, but growing crops is permitted in all of the City's zoning categories.

Most of the project area is within the current Moreno Highlands Specific Plan and is designated for a mix of Business Park, Open Space, Residential, Commercial, Mixed Use, and Public Facilities land uses (see Section 4.10, Land Use and Planning). The land uses proposed are Logistics Development (LD), Light Logistics (LL), Logistics Support (LS), and Open Space (OS).

2.3 Soils of subject property The soils of the subject property are largely Class II soils as rated by the United States Department of Agriculture's Land Capability Classification System. Twenty-five (25) acres of the property are identified as Unique Farmland by the California Department of Conservation's Farmland Mapping and Monitoring Program (FMMP). The majority of the remaining land is identified as Farmland of Local Importance" by the FMMP.

2.4 Availability of water for agriculture The subject property is currently dry farmed, that is, the crops grown are not irrigated. The Agricultural Resources Assessment prepared May 2012 by Parson Brinckerhoff states that water could be made available to the property by Eastern Municipal Water District (EMWD) if delivery pipelines were installed.

3 Impacts

3.1 Direct impacts: LESA analysis To assess the direct impact of the project on the agricultural resource of the subject property, the DEIR uses the California LESA model, which is mentioned in the CEQA Guidelines as an acceptable method of determining the level of significance of any impacts to agricultural resources. The California LESA model is used widely in California, and benefits the agricultural resources of the state through its objectivity and the possibility of uniform findings regarding impacts on agriculture by urban development projects.

The application of the California LESA model to the subject property in the DEIR resulted in a final score of 63.5, which falls within the "considered a significant impact" scoring decision category because both the LE and the SA subscores were above 20.

Nevertheless the DEIR finds that mitigation for this impact is infeasible. We disagree, and discuss potential mitigation strategies in section 5, below.

3.2 Cumulative impacts The EIR accompanying the City of Moreno Valley's 2006 General Plan determined that the conversion of agricultural land to nonagricultural uses throughout the City represented a significant cumulative impact. It is also highly significant that the City recognized its central role in creating this impact.

> As the transition from agricultural to urban and suburban uses continues, the extent to which agriculture and supporting economic activities contribute to the economic base of the City is reduced.

However, the City decided that loss of agriculture in the area was acceptable:

> In its adoption of the 2006 General Plan, the City recognized that these losses were offset by the economic activities and social benefits that typically accompany urban development. In connection with the City's conclusion that a significant cumulative impact would result from implementation of the General Plan, the City adopted findings and facts and a Statement of

> Overriding Considerations indicating that social and economic factors outweighed the significant cumulative impacts associated with conversion of agricultural land to non-agricultural use.

The DEIR clearly notes that the project will result in a significant cumulative impact both in the conversion of the 25 acres of Unique Farmland on the property and the 3,389 acres of Farmland of Local Importance, including 3,349 acres that are currently being dry farmed, from potential agricultural production in Riverside County:

> The County continues to experience a net loss of Unique Farmland and Farmland of Local Importance, and the develoment of the project would contribute to the countywide net loss of designated farmland. Therefore, though cumulative agricultural impacts associated with implementation of the WLC project would be significant and unavoidable since there is no feasible mitigation for this impact.

We disagree with the conclusion that mitigation for this cumulative loss is unavoidable, and discuss potential mitigation strategies in section 5, below.

4 Agricultural analysis

4.1 Physical resources 4.1.1 CLIMATE Moreno Vally has an excellent climate for the production of a wide variety of fruits, vegetables, grains and other staples. The 1917 edition of the Riverside Soil Survey by the United States Department of Agriculture (USDA) describes a wide variety crops suitable to the area including oranges, lemons, peaches, apricots, grapes, walnuts, grain crops (e.g., wheat, barley and oats), field corn and sweet corn, vegetables, small fruits, alfalfa, sugar beets, and potatoes. Dairies and poultry production was also common at that time.

The Agricultural Resources Assessment prepared by Parsons Brinckerhoff for the DEIR mentions that the current major agricultural uses conducted in Moreno Valley are grazing, fruit orchards, dry farming, potato and fruit crop farming, and poultry farming.

4.1.2 SOILS The soils of the subject property are highly rated by USDA and would support the crops mentioned in 1917, and many others. Grain and grapes are crops discussed in the soil survey that were being grown without irrigation water in 1917. However, it is clear that the addition of irrigation water will increase crop yields.

4.1.3 WATER The DEIR presents conflicting information concerning the price and availability of water for crops and livestock in Moreno Valley. The Agricultural Resources Assessment prepared by Parsons Brinckerhoff in section 1.4 states that the cost of agricultural water is $53 per acre-foot in the winter and $90 per acre foot in the summer. It later states in section 2.2.2 that the cost of recycled water varies from $38 per acre foot to $250 per acre foot, and that additional pipeline would be required to service the project site with recycled water bring the cost of the water to well over $100 per acre foot.

The same study summarily states that the "cost of irrigation water makes the production of irrigated crops economically infeasible in the Moreno Valley area." This is unsupported, and easily refuted by inquiry into the cost of water in such areas as the Central Valley of California. For instance, the water cost in the Arvin Edison Water Storage District (southern Kern County), the cost per acre foot of irrigation water is $130[3], in Westlands Water District (Fresno County) the

[3] source: personal files of AEWSD water bills

cost per acre foot is \$100 to \$400[4], in the Del Puerto Water District (Merced County), irrigation water costs \$55 to \$225 per acre foot[5], and in the Fallbrook Water District (San Diego County), irrigation water costs \$1,400 per acre foot.[6] From this we discern that the stated EMWD rates for irrigation water would not be excessive relative to many highly productive agricultural areas of California, and do not pose a substantial competitive disadvantage for Moreno Valley agriculture especially for the higher value crops such as fruits and vegetables suitable for growing in Moreno Valley as described in section 4.1.1, above.

The Agricultural Resources Assessment prepared by Parsons Brinckerhoff also states, again without support, "Commonly, in a low-rainfall area like Moreno Valley, a crop requires three acre feet of water per year and the profit from a majority of crops in California ranges from \$0 to \$500 per acre per year." This supposition does not take into account the wide variation in water usage by the many different crops that could be grown in Moreno Valley (see section 4.1.1 above) nor the timing of planting and harvest of such crops, nor rainfall that becomes stored soil moisture and thus contributes to crop evapotranspiration needs; nor advances in irrigation technology that could be utilized in Moreno Valley agriculture such as drip irrigation that reduce total irrigation water needs of crops.

We have recently (October, 2012) conducted a economic feasibility study of a 4-acre property in Moreno Valley that a local farmer wishes to use for the production of certified organic fruits and vegetables for sale to local stores and at farmers' markets. As part of that analysis we investigated water sources and concluded that water from Eastern Municipal Water District (EMWD) was the most reliable source. we calculated the crop water needs based on local Riverside area evapotranspiration data available from the University of California and the California Irrigation Management Information Service.[7] From this we concluded that the wide variety of fruits and vegetables intended to be grown on the property would require approximately 1.7 acre feet of applied irrigation water per year using drip irrigation, only about half of the 3 acre feet supposed in the Parsons Brinckerhoff report.

As an aside, it should be noted that a wide variety of crops can be grown with recycled water; the DEIR correctly notes there are strict guidelines for its use and prohibition for use in growing food crops; however this does not affect feed crops, fiber crops, biofuel crops, and high value crops such as vegetable seeds.

4.1.4 Location Moreno Valley is located at the edge of one of the world's largest metropolitan areas and offers a real opportunity for enterprising farmers to produce locally grown food for this huge population. As mentioned above, I have recently investigated a site within the City of Moreno Valley for a farmer-client who sells fruits and vegetables at 20 different farmers markets in the three county area of Los Angeles, Riverside, and Orange Counties. Opportunities exist for enterprising farmers to take advantage of this location for direct marketing of the wide variety of fruits, vegetables, eggs, meat, and milk products described in section 4.1.1, above.

4.2 Economic analysis The economic viability studies referenced in the DEIR focus on the decline of agriculture in Riverside County. Ironically, the key reason for the decline is urbanization, which converts farmland to urban uses, competes for water resources, and drives up the price of the remaining land. None of these results of urbanization are a surprise, and none are a problem

[4] source: ⟨http://science.kqed.org/quest/2012/05/04/q-a-with-jason-peltier-of-wwd/⟩ and Notice to Landowners of Proposed Water Rates, Charges and Land-Based Charges, Westlands Water District, January 4, 2013
[5] source: personal communication with landowner and water user, 2013
[6] source: *As water prices rise, farmers face the 'tipping point'*, Ag Alert, June 8, 2011
[7] ⟨www.ipm.ucdavis.edu/weather⟩

seen only in Riverside County. What is clear, however, and duly noted as a cumulative impact, is that continued urbanization of the area will continue to convert farmland, and accerbate these effects.

The DEIR referenced studies do not offer any tangible analysis of the economics of agricultural production in the area, however, and this is a serous deficiency of the "significant and unavoidable impact" finding of the DEIR. How can the DIER conclude no agriculture is viable without an analysis of its feasibility? The very fact that agriculture in the form of dry farmed wheat continues on the subject property begs the question that if it is not economically remunerative, why does it continue?

Information is available to conduct a well documented, considered feasibility study of agricultural enterprises in the Moreno Valley area. The University of California Cooperative Extension (UCCE) publishes an extensive collection of studies on the costs, income and profitability of hundreds of crops. A brief view of the archives for the Southeast Interior area of California, which includes Riverside County, indicates that UCCE studies are available on the profitability of such crops as alfalfa, avocados, barley, beans, broccoli, cabbage, cantaloupes, carrots, corn, grain, grapefruit, lemons, lettuce, melons and wine grapes. Any real attempt to analyze the feasibility of agriculture in Moreno Valley would reference these studies and examine them for relevant information concerning the viability of agriculture in the Moreno Valley area.

While it is clear that local trends are reducing agriculture in the area, what has not been examined is any new trends that might affect the viability of agriculture in the Moreno Valley area. For instance, new crops or new methods of farming and direct marketing of farm products. Moreover, the price of most agricultural commodities has risen substantially, some 30 to 50 percent in some cases, in the last several years. The Riverside County Agricultural Commissioner reports for 2011:

> This year's report represents a total gross valuation of $1,282,256,116, an increase of $188.6 million (17.2%) over the 2010 value and a new record for Riverside County. Agricultural crops rose 15.4% to $990,225,736, while Livestock and Poultry production increased nearly 24% to $202,030,380.

This does not sound like a dying industry.

In that previous mentioned economic feasibility study of a small property in Moreno Valley which we conducted last October, we concluded that the operation, which would utilize irrigation water from Eastern Municipal Water District (EMWD), would likely produce an annual net profit of approximately $60,000 per acre, after all expenses were paid.

5 Mitigation measures

5.1 DEIR finds mitigation infeasible The DEIR clearly states that the project presents a significant impact to the subject property and a significant cumulative impact to agricultural resources in the area. Mitigation, however, for these impact is deemed unreasonable and infeasible for two reasons: 1) Riverside County rejected a plan to create a development-funded agricultural mitigation bank in its General Plan Update in 2003; and 2) agriculture in the Inland Empire area which includes Moreno Valley, has been in a decline in the past decade.

5.2 Municipal agricultural mitigation is feasible There are numerous examples of cities in California that have chosen to conserve their agricultural resources independently of local county policies. The City of Davis, for instance, where we live, established an agricultural land mitigation requirement in 1995 and in 2007 increased the mitigation ratio such that 2 acres of farmland are conserved for every one acre converted to urban uses.

Numerous other cities in California also have agricultural mitigation requirements, including Stockton, Lathrop, Manteca, and Tracy in San Joaquin County; Brentwood in Contra Costa County; Elk Grove in Sacramento County; and Woodland in Yolo County. Bakersfield in Kern County in 2007 began requiring mitigation of agricultural land loss in 2007, Salinas in Monterey County has used agricultural conservation easements to limit its urban growth, and the City of Morgan Hill in Santa Clara County, a rapidly urbanizing area within Silicon Valley, is in the process of establishing an agricultural mitigation program that will utilize agricultural conservation easements paid for by developers[8].

5.3 Agricultural conservation easements Conservation easements have been used for decades to conserve agricultural land where it is threatened by conversion to other uses. The American Farmland Trust has recently written a paper entitled *Saving Farmland, Growing Cities* which describes conservation easements in easy to understand terms.

> Conservation easements are a means of permanently preserving farmland under legal covenants voluntarily agreed to by landowners. Their purchase provides compensation to landowners who want to recover equity from their property while continue to farm it, something that would be impossible if they were to sell the land for non-agricultural purposes. Not only does this provide an innovative solution that recognizes private property rights, but it also provides an injection of capital into the agricultural economy.
>
> ... Funding for conservation easements can come from many sources...
>
> An increasingly popular alternative is to require developers who convert farmland to pay a fee to preserve a comparable amount of land or to acquire the land itself for preservation. This can also satisfy the requirement that environmental impacts od development be offset or mitigated nder the California Environmental Quality Act."

5.4 Example agricultural mitigation programs The DEIR notes the rejection of a agricultural mitigation bank by Riverside County in 2003, and leaves unanswered the question: are there other mitigation strategies worth examining?

The California cities mentioned above have a variety of strategies to implement their agricultural preservation programs. Some have opted for a in-lieu mitigation fee (which will later be used by the city to purchase a conservation easement), others require the develop to purchase a conservation easement directly. The ratio of land conserved to land converted is typically 1:1 although the City of Davis has a 2:1 requirement. The latter method of requiring developers to purchase the conservation easements, utilized by both Yolo County and the City of Davis, has several advantages: low administration costs, the cost of the easement is current market value for the developer, and there is less likely to be a closed or fixed market of available properties as easement sources; the former method, a mitigation in-lieu fee, involves greater administrative costs by the governing agency, and can lead to a price floor on the purchase price of the conservation easements such as experienced in Elk Grove in the late 2000's.

A successful strategy to keep the price of the conservation easements affordable for developers (who typically plan to factor the cost of the easements into their overall finished home or commercial real estate product sales price) is for the municipality to permit the conserved agricultural land to be some distance from the city limits, thus reducing speculative influence on the price of the easement. Simply put, it is common to find property that is second or third tier from the city

[8] Gregory House, co-author of this report is consultant to Morgan Hill on the creation of this program

limits to be less costly than property immediately adjacent. Since the principal effect of the agricultural conservation easement is to extinguish any current or future potential subdivision or urban development rights, the further a property is from development in space and time, the less costly will be the price of the conservation easement.

We recently conducted a study of 25 conservation easements in northern and central California which supports the observation that the farther from existing development the lower the cost of the easement. Our study, which included easements in seven counties from Merced to Yolo and several urban areas with high land costs (agricultural land values at $30,000 to $50,000 per acre), indicated there is a wide range in the cost of the easement relative to the fee value of the land. The range (of the cost of the agricultural conservation easement as a percent of the fee value of the property) spanned from a low of 15 percent in Monterey County in 2000 to a high of 73 percent in Solano County in 2006. At the high end were properties immediately adjacent to urban areas, freeways, etc. At the low end were properties in largely rural areas, much less or not at all affected by real estate speculation on urban development.

Agricultural land-conversion mitigation is feasible and being conducted by numerous cities, as well many counties in California. It is a serious lack of the DEIR that it does not examine any of the current mechanisms being employed in so many parts of California, nor attempt to consider the feasibility of implementing an agricultural mitigation program.

5.5 A potential alternative conservation strategy The DEIR references the decision of Riverside County to drop its agricultural mitigation bank in 2003 because of a California Appeals Court decision know as *Friends of the Kangaroo Rat versus the California Department of Corrections*, in which the court opined that purchasing a conservation easement does not in fact save any land nor does it develop new farmland.

If Moreno Valley is serious about conserving agricultural land, it might consider requiring as a mitigation measure the development of irrigation on the very highly rated soils of the nearby dry land farming areas. This could be done with the recycled irrigation water discussed in the Agricultural Resource Assessment prepared by Parsons Brinckerhoff for the DEIR, which notes that "EMWD plans to continue to extending the distribution infrastructure for recycled water." Nothing would be more supportive of agriculture in the area than to increase the availability of irrigation water, and then place a conservation easement on that land which prohibits urban development.

5.6 Motivations for agricultural land preservation in Moreno Valley Will Rodgers is famously quoted in 1932 as saying "Buy land. They ain't making anymore of the stuff." Underlying this quote is the powerful argument that good productive agricultural soils such as the subject property has are rare and a precious resource.

There are many reasons to conserve agriculture in the Moreno Valley:

– Moreno Valley, including the subject property has many physical advantages for agricultural production including a benign climate, good soils and sufficent water at a cost competitive in southern California and many areas of the Central Valley of California.

– Moreno Valley's location creates huge marketing opportunities for direct marketing of agricultural produce to the four-county area of Los Angeles, Orange, Riverside and San Bernardino urban area.

– Moreno Valley's location also creates a cost of transportation advantage for commodity crops and products needing processing, such as fresh milk in the nearby metropolitan areas. For several years California dairies have participated in a price pooling that attempts to standardize raw milk prices to milk processors throughout the state. Since the cost of transporting the raw milk to the bottling plants is a significant cost, the farther the milk source is from the plants, the higher the transportation cost charged to the dairyman. With the increasing costs of fuel for transport, milk processors south of the Techacapi Mountains are finding it increasingly difficult to source adequate amounts of raw milk. The situation is a growing problem without an immediate solution.[9] This creates an opportunity for Riverside County dairyman that a decade ago did not exist.

– Agriculture is a vibrant industry that is very adaptable and quickly changes to meet new challenges and opportunities. New opportunities on the horizon include dry farming of biofuel crops; urban farming and direct marketing of high value food crops such as fruits, vegetables, eggs and honey; and changing economics in milk production. Moreno Valley has potential in all of these agricultural opportunities.

– There is a huge and growing interest in urban agriculture and small farming among people of all ages, but especially young people under 30 years of age. The Secretary of Agriculture recently called for the development of 100,000 new farmers during his tenure at USDA, most of whom are acknowledged to be, and intended to be, young persons. USDA has implemented many new programs to effect this sea-change, including a new program of low-interest micro-loans for new and beginning farmers.

– Growing interest in sustainable urban planning is examining the importance of local agriculture to the long term food security and resilience of local economies. With the inevitable increases in food transportation costs, it is incumbent upon the City of Moreno Valley to plan for its long term sustainability. As food is essential, so is agriculture to a sustainable and vibrant local economy.

6 Conclusion

While the DEIR does correctly find significant impacts directly and cumulatively as as result of the project, the DEIR fails to seriously examine potential mitigation strategies and instead has offered flawed and conflicting arguments that mitigation for the loss of agricultural land are infeasible and uneconomic.

The DEIR's argument that agricultural acreage is declining in Riverside County due to urban development is true but actually supports the finding of cumulative impacts and fails to look at the underlying circularity of the cause, that is, the more the urban development, the more agriculture will decline.

The DEIR's argument that agriculture is uneconomic in Riverside County and Moreno Valley is contradicted by the fact that agriculture continues on the subject property, apparently to this day; by current statistics published by the Riverside County Agricultural Commissioner; and by my personal research into the feasibility of small scale agriculture in Moreno Valley. The DEIR actually lacks a thorough agricultural economics study, and has not seriously examined the agricultural economics of any number of crops suitable to the area, or the demand for these crops in the area, or the potential for farmers to step forward to farm the land. Instead, the DEIR relies on an outdated study that not only fails ito consider many new important trends in agricultural marketing and prices received by farmers, but also fails to examine the importance of agriculture to the long term sustainability of Moreno Valley as as community.

The DEIR's argument that mitigation for agricultural land conversion is infeasible because Riverside County decided in 2003 to drop a requirement in its General Plan Update for a mitigation land bank avoids the recent decade of agricultural land conservation going on throughout California. THE DEIR fails to consider whether some other program of mitigation might be feasible

9 see *Milk must move father to serve south-state plants*, Ag Alert, March 27, 2013

given the many new conservation strategies that have been devised by municipalities and counties in many parts of California.

7 Certification

I certify that, to the best of my knowledge and belief:

The statements of fact contained in this report are true and correct.

The reported analyses, opinions, and conclusions are limited only by the reported assumptions, and are my personal, unbiased professional analyses, opinions, and conclusions.

I have no present or prospective interest in the property that is the subject of this report, and I have no personal interest or bias with respect to the parties involved.

My compensation is not contingent upon the reporting of a predetermined conclusion that favors the cause of the client, the attainment of a stipulated result, or the occurrence of a subsequent event.

This consulting report has been made in conformity with, and is subject to, the requirements of the Professional Code of Ethics and the Standards of Professional Practice of the American Society of Farm Managers and Rural Appraisers, and the American Registry of Certified Professionals in Agronomy, Crops and Soils.

I have not made a personal inspection of the property that is the subject of this report.

I personally prepared the prepared the analyses, conclusions, and opinions set forth in this study and am the author of this report. Mr Henry House assisted with the analysis and writing of this report.

Gregory A. House, AFM, ARA, CPAg

8 Appendix: Consultants' qualifications

Qualifications
of
Gregory A. House

Agricultural Consultant
Agronomist
Professional Farm Manager
Rural Appraiser
Farmer

Experience

Agricultural Consultant, House Agricultural Consultants, providing agricultural science, economics, management, and appraisal services, 1983–present

Farmer, 1987–present. Organic apples, peaches, cherries, apricots, and field crops

Corporation Secretary & Consulting Agronomist, Hannesson, Riddle & Associates, Inc., 1977–1983.

Professional Affiliations

- American Society of Farm Managers & Rural Appraisers
- American Society of Agronomy
- Crop Science Society of America
- Soil Science Society of America
- California Certified Organic Farmers
- California Farm Bureau

Accreditations

- Accredited Farm Manager (A.F.M.), American Society of Farm Managers & Rural Appraisers, Certificate #501
- Certified Professional Agronomist (CPAg.), American Registry of Certified Professionals in Agronomy, Crops. & Soils, Ltd. Certificate # 2319
- Certified Crop Advisor (C.C.A.), American Society of Agronomy
- Accredited Rural Appraiser (A.R.A.), American Society of Farm Managers & Rural Appraisers, Certificate #749
- Certified General Appraiser, State of California License # AG 001999

These credentials have continuing education requirements with which I am in compliance.

Qualifications of Gregory A. House, continued

Education

- B.S., Crop Ecology, University of California, Davis, 1975, with Honors
- Numerous courses from the University of California Extension in agricultural economics, crop management, real estate, & hazardous waste management
- Courses of the American Society of Farm Managers and Rural Appraisers:
  - Principles of Rural Appraisal
  - Advanced Rural Appraisal
  - Eminent Domain
  - Report Writing School
  - Economics of Farm Management
  - Principles of Farm Management
  - Standards and Ethics
  - Permanent Plantings Seminar
  - Standards and Ethics for Farm Managers
  - ASFMRA Code of Ethics
  - National Uniform Standards of Professional Appraisal Practice
- Courses of the Appraisal Institute:
  - Basic Valuation Procedures
  - Real Estate Statistics and Valuation Modeling
  - Advanced Income Capitalization
  - Valuation of Conservation Easements Certificate Program
  - Condemnation Appraising: Principles and Applications

Expert Witness Court Testimony

- Superior Court Qualified Expert Witness in the following counties: Alameda, Colusa, Fresno, Kern, Madera, Monterey, San Joaquin, San Luis Obispo, Santa Barbara, Santa Cruz, Solano, Sonoma, Sutter
- United States Tax Court Qualified Expert Witness
- United States Bankruptcy Court Qualified Expert Witness
- A list of depositions and trial appearances is available upon request

Qualifications of Gregory A. House, continued

Appointments & Activities

- Instructor, "Principles of Farm Management", an Internet course of the American Society of Farm Managers and Rural Appraisers, 1996 to 2007
- President, California Chapter American Society of Farm Managers & Rural Appraisers 1994–1995; Secretary-Treasurer, 1984 to 1990
- Board of Directors, Yolo Land Trust, 1993–2001
- Board of Directors, American Red Cross, Yolo County Chapter 1987–1989
- Member, Yolo County Right to Farm Grievance Committee 1992–1995
- Vice Chairman, Management Education Committee, American Society of Farm Managers and Rural Appraisers, 1998–2000 (committee member since 1986)
- Yolo County LAFCo Agricultural Forum LESA subcommittee, 1999
- California Certified Organic Farmers

  Treasurer of the Board of Directors, 1998–2003

  Executive Director, 1999-2000

  Chairman of Certification Committee, Yolo Chapter, 1993-2005

  Member of the Finance Committee, 1998-current
- CCOF Foundation Going Organic Program, Management Team member and Chapter Leader, 2006-current
- USDA Organic Grant Panel member, 2002
- City of Davis Open Space and Habitat Commission, 2006–current, Chairman 2008-2009
- Member, Fruit Orchard Technical Advisory Group, Filoli Gardens, Woodside, California
- Member, Organic and Sustainable Agriculture Program Steering Committee, University of California Cooperative Extension, Yolo and Solano Counties, California, 2008-current

Speaking Engagements

Guest Lecturer, University of California at Davis, Agricultural Economics 145, Farm and Rural Resources Appraisal, on professional farm appraisal (1985–1997)

- Guest Lecturer, University of California at Davis, Agricultural Economics Department, Course 140, "Farm Management", on adoption of new technologies, farm budgeting, cash flow management, cost accounting, etc. (1985–present)
- Guest Lecturer, University of Florida at Gainesville, Vegetable Crops Department, seminar on transition to organic agriculture, (November, 1994)
- Featured Speaker, 1995 Eco-Farm Conference, Asilomar, California , on economics of organic apple production
- Guest Speaker, Community Alliance with Family Farmers, on farm management and agricultural economics, 1996 and 1997
- Instructor, American Society of Farm Managers and Rural Appraisers, Course M-12, "Standards and Ethics for Professional Farm Managers", March, 1997
- Guest Speaker, American Horticultural Society, "Challenges of Organic Stone Fruit Production", Sacramento, California, July 2001
- Organizer and Presenter, Going Organic Kickoff Meetings, November 2005 and December 2006
- Master of Ceremonies, California Certified Organic Farmers, Annual Meeting, February, 2006, Sacramento, California
- Featured Speaker, 2012 Eco-Farm Conference, Asilomar, California, "Imitating Natural Systems: Towards an Indigenous Agro-Forestry"

Publications

- "Principles of Farm Management", Course M-10, a 40-hour professional credit Internet educational offering of the American Society of Farm Managers & Rural Appraisers
- "Conservation Issues in Agriculture", a unit of Course M-25, a 15-hour professional credit Internet educational offering of the American Society of Farm Managers & Rural Appraisers
- "A Primer on Organic Agriculture," an article in *2006 Trends in Agricultural Land and Lease Values*, a publication of the California Chapter of the American Society of Farm Managers & Rural Appraisers
- "Case Study: Using Indigenous Agroforestry Management Techniques to Support Sustainability in Production Agriculture", a paper-poster presented at Harlan II, An International Symposium on Biodiversity in Agriculture: Domestication, Evolution and Sustainability, September 14-18, 2008, University of California, Davis

Qualifications
of
Henry House

Experience

Agricultural Consultant, House Agricultural Consultants, providing agricultural science, economics, management, and appraisal services, 1999–present. Special emphasis on the following crops: Almonds, apples, avocados, cherries, citrus, melons, oriental vegetables, tomatoes; special emphasis on the following livestock: cattle, sheep, poultry.

Education

- B.S., Natural History, University of California, Davis, 1999, with Honors, coursework in agronomy, botany, ecology, entomology, geology, hydrology, nematology, plant pathology, pomology, soil biology, sustainable agriculture, statistics, and wildlife biology
- Numerous courses from the Appraisal Institute
- Post graduate coursework in Chemistry, Organic Chemistry, Calculus, Statistics, University of California, Davis, 2006-2010

Appointments

- Assistant instructor, "Principles of Farm Management", an Internet course of the American Society of Farm Managers & Rural Appraisers, current
- Course proctor, "M-25: Enhanced Client Services", an Internet course of the American Society of Farm Managers & Rural Appraisers, current
- Board of Directors, Davis Farmers Market Association, 2001–2003
- Board of Directors, Linux Users' Group of Davis, 2000–present
- Volunteer for U.C. Davis Arboretum, 1996–present

Professional Skills

- GIS technology including raster and vector analysis
- Statistical Analysis including regression analysis and anova
- Computer programming languages: C, C++, Ruby, and Perl

House Agricultural Consultants
Partial Listing of Clients Served

Allied Insurance Group

American Farmland Trust

Balverne Winery & Vineyards
Sonoma County, California

Bank of America

Best, Best & Kreiger, LLP
Riverside, California

California Giant Berry Farms

California Department of Fish & Game
Wildlife Conservation Board

California Department of Justice

City of Davis

City of Fairfield

City of Morgan Hill

City of Sacramento, City Attorney

Continental Casualty Company
Chicago, Illinois

County of Solano

County of Yolo

Downey, Brand, Seymour & Rohwer
Sacramento, California

Glenn-Colusa Irrigation District

Hamel Ranch Partnership
Davis, California

Harris Farms, Inc.

Farmers' Home Administration (U.S.D.A.)
Sacramento, California

Internal Revenue Service, District Counsel
San Francisco, California

McMahon-Graf Partners
Winters, California

Morrison & Foerster
San Francisco, California

Oakdale Irrigation District

Pajaro Valley Water Management Agency
Watsonville, California

Phillips 66 Company

Republic Indemnity Company of America
San Francisco, California

Royal & Sun Alliance

Sacramento Valley Conservancy

Sacramento Valley Farm Credit Banks

San Andreas Farms
Fresno County, California

San Joaquin Council of Governments

San Luis Delta Mendota Water Authority

Sanwa Bank, N.A.
Sacramento, California

Solano Land Trust

Stanford Management Company
Stanford University

The Nature Conservancy

The Prudential Agricultural Group
Sacramento, California

The Travelers Insurance Company

The Trust for Public Land

U. S. Fish & Wildlife Service

U. S. Departments of Justice & Treasury

University of California, Davis

Yolo Land Trust

Wells Fargo Bank, N.A.

EXHIBIT 4

ECONOMIC DEVELOPMENT SUMMARY

COMMERCIAL/RETAIL PROJECTS

Moreno Valley Mall: New retailers now open at the 1.1 million sq. ft. Moreno Valley Mall include:

- ✓ **Round 1 Bowling & Amusement** - 46,000 sq. ft. family oriented entertainment center featuring 18-bowling lanes, darts, billiards, arcade games, karaoke and food & beverage service - NOW OPEN.
- ✓ **Lucy's Apparel** - 1,200 sq. ft. children's formal clothing store - NOW OPEN.
- ✓ **Ballet Theatre Company** - 4,795 sq. ft. dance studio - NOW OPEN.
- ✓ **Body Basics -** 7,400 sq. ft. apparel store specializing in comfort wear, situated on the 1st floor - NOW OPEN.
- ✓ **Butter Bake Shop -** 581 sq. ft. Bake shop featuring baked bread and treats - TENANT IMPROVEMENTS UNDERWAY.
- ✓ **Rue 21**- Popular and affordable fashions for guys and girls in a 7,500 sq. ft. retail store - NOW OPEN.
- ✓ **Shellshock -** 851 sq. ft. apparel and accessorises store near the food court - NOW OPEN.
- ✓ **Triple O Lazer Tag** - 4,377 sq. ft. team or individual sport and recreational facility on the 2nd floor - NOW OPEN.
- ✓ **Vanguard Art Gallery** - 1,385 sq. ft. art gallery on 2nd floor - NOW OPEN.
- ✓ **Mente Maestra 247** - 4,377 sq. ft. retail store selling books, videos, vitamins and herbs on 2nd floor - TENANT IMPROVEMENTS UNDERWAY.
- ✓ **Solo Wear -** 2,150 sq. ft. Men's & women's clothing store - NOW OPEN.

TownGate Center and Plaza: Community shopping centers at the SWC of Frederick St. and SR 60. Tenants inclu **Burlington Coat Factory, Ross Dress For Less, Catherine's, Regency Theatres, Chase Bank, Wells Fargo, Bank of America, California Bank & Trust, BJ's, Chili's, Acapulco, Olive Garden, Dollar Tree and**

- ✓ **TJ Maxx and HomeGoods -** 51,000 sq. ft. super store - NOW OPEN.
- ✓ **Don Patron Mexican Grill** - Occupies the former El Gran Burrito, next to Tegency Theatres - NOW OPEN.
- ✓ **Chipolte Mexican Grill -** 2,040 sq. ft. quick-service restaurant featuring gourmet burritos and bowls - NOW OPEN.
- ✓ **Ulta Beauty** - 10, 000 sq. ft. Beauty, Cosmetics, Fragrance, Salon - LEASE EXECUTED - PLANS SUBMITTED.

TownGate Crossing: 250,000 sq. ft. shopping center expanding at the SEC of Day St. and SR 60. Anchors include **Lowe's, Sports Authority & 99¢ Only Store.**

- ✓ **Anna's Linens** - NOW OPEN.
- ✓ **Big Bowl** - NOW OPEN.
- ✓ **Super Cuts -** Men's and women's hair salon to be situated next to Panera Bread - NOW OPEN.

TownGate Promenade: 353,000 sq. ft. shopping center at the SEC of Day St. and Campus Pkwy. Tenants include **Applebee's, Mimi's Café, Panda Express, Bakers, anchored by Costco, Ayres Hotel & Spa and Hampton Inn.**

- ✓ **Carino's Italian Grill** - PROJECT CONSTRUCTION SUSPENDED/IN ESCROW.
- ✓ **24-Hour Fitness**: Proposed Super Sport Club - PURCHASE AGREEMENT EXECUTED/PLANS SUBMITTED.

TownGate Square: A mixed-use development project anchored by **WinCo Foods** with 136,000 sq. ft. of

- ✓ **Robertson's Ready Mix** - CONSTRUCTION UNDERWAY FOR RELOCATION TO NEW SITE.

- ✓ **Miguel's Jr. Restaurant** - 2,800 sq. ft. fast-casual restaurant, with drive-thru - PURCHASE AGREEMENT EXECUTED/PLANS SUBMITTED.

Canyon Springs Plaza: 417,000 sq. ft. community commercial center at the SWC of Day St. and Ironwood Ave.

- ✓ **Go Natural Gas - CNG Fueling Station** - NOW OPEN.
- ✓ **Lumber Liquidators** - National hardwood flooring retail store - NOW OPEN.
- ✓ **I.E. Banquets** - 9,447 sq. ft. banquet facility - APPROVED.
- ✓ **Wizard's Party House** - "Jump and Fun" 7,500 sq. ft. Jump/Party room - TENANT IMPROVEMENTS UNDERWAY.

Moreno Valley Center - 100,000 sq. ft. Commercial center at the NEC ElderAve and Perris Blvd.

- ✓ **Destiny Home Health Agency** - 2,500 sq. ft. - Home health caregiver services agency - NOW OPEN.

Moreno Valley Plaza: Multi-phase renovation of 341,000 sq. ft. commercial shopping center anchored by **Office Depot, Superior Warehouse, Big Lots, Feas, Harbor Freight Tools**, and **CitiTrends** at the SWC of Sunnymead Blvd. and Heacock St.

- ✓ **McDonald's** - 3,838 sq. ft- fast food restaurant with drive-thru - NOW OPEN.
- ✓ **Family Dollar** - 8,023 sq. ft. retail store - NOW OPEN.
- ✓ **Harbor Freight Tools** - 15,280 sq. fti. retail store, occupying former Factory 2 U space - NOW
- ✓ **Sunnymead Florist** - 811 sq. ft. floral shop - NOW OPEN.
- ✓ **Moreno Valley Plumbing Supplies** - 1,400 sq. ft. retail store - NOW OPEN.
- ✓ **Millan's Bridal & Tuxedos** - 1,200 sq. ft. - Special occasion clothing store - IN PLAN CHECK.
- ✓ **Twera's Salon** - 800 sq. ft. hair salon - TENANT IMPROVEMENTS UNDERWAY.

Moreno Valley Village: Community shopping center at Perris Blvd. and Elder Ave.

- ✓ 3rd location for **Fitness 19** who will occupy the 10,420 sq. ft. former Discount Mart near Perris Blvd. and Elder Ave. - TENANT IMPROVEMENTS UNDERWAY.
- ✓ **Bargain Spot, Inc.** - 1,450 sq. ft. convenience store - TENANT IMPROVEMENTS UNDERWAY.

Palm Plaza: 52,000 sq. ft. Neighborhood commercial center on Sunnymead Blvd.

- ✓ **Everyday Thrift & Cards** - 1,979 sq. ft. Retail store - TENANT IMPROVEMENTS UNDERWAY.
- ✓ **Inland Empire Customs** - 2,112 sq. ft. motorcycle parts & accessory shop - NOW OPEN.

Stoneridge Towne Centre - 579,295 sq. ft. commercial center at the SEC o fSR60 and Nason St., anchored by **Super Target, Dress Barn, Kohl's, Office Max** and includes **U.S. Bank, Wachovia Bank, Visterra Credit Union, Chili's** and **Bob's Big Boy Restaurant.**

- ✓ **Audeo Charter Training Center** - 2,674 sq. ft. facility - NOW OPEN.
- ✓ **China One** - 1,600 sq. ft. Chinese restaurant - NOW OPEN.
- ✓ **Alberto's Mexican Food -** New casual restaurant - LEASE/TENANT IMPROVEMENTS UNDERWAY.

Sunnymead and Indian: Planned two building commercial development tataling 16,350 sq. ft. on 2.2 acres, located on Sunnymead Blvd., west of Indian Ave. at Back Way - APPROVED.

Sunnymead and Heacock: Millan's Bridal & Tuxedo - 1,200 sq. ft. Special Occasion Apparel Shop - NOW OPEN.

Sunnymead Village: Neighborhood shopping center at the SWC Alessandro/Perris.

- ✓ **WNW Fashion** - 900 sq. ft. Women's clothing store - NOW OPEN.

Sunnymead Towne Center - 220,000 sq. ft. Commercial Center at the SWC of Alessandro/Perris Blvd.

- ✓ **Garden of Roses** - 941 sq. ft. Floral & Gift shop - TENANT IMPROVEMENTS UNDERWAY.
- ✓ **Ispot Business Center** - 1,516 sq. ft. Business Center specializing in printing, copies & computers - TENANT IMPROVEMENTS UNDERWAY.
- ✓ **Moreno Wellness Club -** 1,213 sq. ft. Nutrition & Aerobic exercise center - TENANT IMPROVEMENTS UNDERWAY.

Moreno Beach Plaza: 368,000 sw. ft. shopping center anchored by **Walmart Super Center** including **Payless Shoes, Schools First Credit Union.**

- ✓ **Sprint** - 3,00 sq. ft. retail store specializing in celluar equipment and accesssories - NOW OPEN.
- ✓ **U.S. Bank -** 1,000 sq. ft. branch inside Walmart Super Center, 3rd location in Moreno Valley - NOW OPEN.
- ✓ **LA Fitness-** 40,770 sq. ft. sports club to occupy former Circuit City and Staples building - LEASE/TENANT IMPROVEMENT PLANS UNDERWAY.

Moreno Valley Commerce Center: 110,863 sq. ft. commercial center.

- ✓ **InTouch BioSolutions** - Bio-Medical Laboratory - NOW OPEN.
- ✓ **Kwik Shipplus -** 1,300 sq. ft. mail, shipping services store - TENANT IMPROVEMENTS UNDERWAY.

Moreno Valley Marketplace - 93,788 sq. ft. neighborhood shopping center at the NWC of Cactus Ave. and Moreno Beach Dr., anchored by **Stater Bros.**, and includes **Wells Fargo, Jack in the Box, Subway** and **Fantastic Sam's**.

- ✓ **Little Bambino's Pizza** - 1,560 sq. ft. take-out pizza restaurant – TENANT IMPROVEMENTS UNDERWAY.
- ✓ **Rancho Belago's Dance Company** – NOW OPEN.
- ✓ **Platinum Nutrition** - 1,700 sq. ft. retail store, specializing in natural supplements and smoothies – NOW OPEN.
- ✓ **Rancho Belago Realty** - 1,202 sq. ft. real estate office - NOW OPEN.

Alessandro Plaza: An existing commercial center, anchored by **24hr Fitness Center** east of Heacock on

- ✓ **Universal Strike**: Renovation of existing 40,000 sq. ft. bowling alley to include arcade – NOW OPEN.
- ✓ **Gus Jr. Restaurant** – New name and owner for existing 1,800 sq. ft. drive-thru restaurant – NOW OPEN.
- ✓ **Dance to Your Health** - 1,322 sq. ft. Dance studio - TENANT IMPROVEMENTS UNDERWAY.

Alessandro and Heacock: Relocation of existing restaurant and addition of mini-mart. 2,213 total sq. ft., Philippine restaurant, **P.I. Grill** to occupy 1,213 sq. ft., plus 1,000 sq. ft mini-mart, **Phillipine Island Palangke**, to be located to the SEC – TENANT IMPROVEMENTS UNDERWAY.

Alessandro and Indian: 1,200 sq. ft. fish and wing restaurant at the SWC - IN PLANNING.

Alessandro and Graham:

- ✓ Proposed 5,044 sq. ft. retail center at the NEC, including a **7-Eleven** store, **UPS Store**, **Flame Broiler** and **Wash Bank** carwash – UNDER CONSTRUCTION.

Alessandro and Lasselle: Proposed 140,000 sq. ft. retail center at NEC,anchored by 95,000 sq. ft. **WinCo Foods**, plus additional retail/restaurant space - APPROVED/PROJECT SCHEDULE ON HOLD.

Alessandro and Moreno Beach:

- ✓ 4,000 sq. ft. **Chevron gas station/car wash/convenience store** at SWC – CONSTRUCTION UNDERWAY.

Butterfield Valley Village:

- ✓ **Boost Mobile** – 2,508 sq. ft. cellular phone and accessories store – NOW OPEN.
- ✓ **Rainbow Nail Supply -** 950 sq. ft. nail shop - TENANT IMPROVEMENTS UNDERWAY.

Cactus and Elsworth: Renovation of existing 3,000 sq. ft. restaurant to **Gus Jr. Burgers** – NOW OPEN.

Cactus and Goldencrest: Value Windows & Doors – 126,418 sq. ft. manufacturing facility – IN PLAN CHECK.

Cactus and Veterans Way: 14,208 sq. ft. recycling facility **California Recycling Inc**. – IN PLANNING.

Elsworth and Goldencrest: 4,344 sq. ft. facility for **Southern Illinois University** - TENANT IMPROVEMENTS UNDERWAY.

Elsworth Plaza: A mixed-use retail/office/restaurant project with three new buildings totaling 30,000 sq. ft. near the SWC of Alessandro Blvd. and Elsworth St. – New tenants include:

- ✓ **Airy Body Care, Estates Furniture, Cabinets & Flooring, Gin Tay Hair Salon, Marinaj Banquet & Events Hall**, and **Graphix Lab, LLC** – NOW OPEN.
- ✓ **Pavilion Pizza -** 1,200 sq. ft. pizza to go shop - TENANT IMPROVEMENTS UNDERWAY.

Family Dollar: 8,320 sq. ft. store just south of CVS at the SWC of JFK and Perris Blvd. – UNDER CONSTRUCTION.

Hometown Square: 14,900 sq. ft. store renovated for new **Dollar General** near the NWC of Perris Blvd. and Cottonwood Ave. – NOW OPEN.

- ✓ **Las Picante Restaurant -** Rebuild existing 2,700 sq. ft. Mexican restaurant - TENANT IMPROVEMENTS UNDERWAY.

Iris Plaza: 2,926 sq. ft. dance studio **Tutu Barre** – NOW OPEN.

Lakeside Plaza: Neighborhood shopping center at the NWC of Lasselle and Iris Ave.

- ✓ **Starbucks Coffee** – 1,500 sq. ft. store – NOW OPEN.
- ✓ **Better Be Donuts** – 1,239 sq. ft. donut stop – NOW OPEN
- ✓ **Tobacco Leaf -** 1,078 sq. ft. store - TENANT IMPROVEMENTS UNDERWAY.

Lakeside Terrace: Neighborhood shopping center at the NEC of Lasselle St. and Iris Ave.

- ✓ **Café Gossip** – Korean BBQ/Teriyaki restaurant. A second location for this local favorite – NOW OPEN.
- ✓ **Dollar Tree** – 10,579 sq. ft. retail store – NOW OPEN.

Lakeshore Village Marketplace: 140,000 sq. ft. neighborhood shopping center anchored by Ralph's.

- ✓ **Subway** – 1,040 sq. ft. restaurant – NOW OPEN.
- ✓ **S Bar & Grill** – 3,200 sq. ft. dine-in restaurant – NOW OPEN.

Menlo Recycling: 9,089 sq. ft. recycling center near the SWC of Goldencrest Dr. and Elsworth St. – NOW OPEN.

O'Reilly Automotive: 7,453 sq. ft. retail store at the SWC of JFK and Perris Blvd. – IN PLANNING.

Perris Blvd. and Atwood Ave: 1000 sq. ft. **"Perris Internet Café"** - TENANT IMPROVEMENTS UNDERWAY.

Perris and Elder: Major renovations to existing **McDonald's** restaurant – NOW OPEN.

Perris and Eucalyptus: **Bestteks** 550 sq. ft. computer repair, maintenace and web design business – NOW OPEN.

Pigeon Pass and Hemlock: Dunn Edwards paint store - NOW OPEN.

Rancho Belago Plaza: Retail/commercial center with two new buildings and a total of 14,000 sq. ft., located at the SWC of JFK and Moreno Beach Drives – APPROVED/PROJECT SCHEDULE ON HOLD.

HOTEL/HOSPITALITY

Cactus and Elsworth: Proposed four-story Hawthorn Inn & Suites with 79-guest rooms – APPROVED.

Komar Cactus Plaza: Proposed four-story Marriott TownePlace Suites with 110-guest rooms – IN PLANNING.

Olivewood Plaza Drive: Proposed three-story Sleep Inn Suites with 66-guest rooms – APPROVED.

MEDICAL/OFFICE

Alessandro Clinica Medica Familiar: New dental and medical clinic in former Hollywood Video building at NWC of Alessandro and Indian - NOW OPEN.

Corporate Plaza: 2,493 sq. ft. Riverside Physician Services medical office located at 13800 Heacock St. – NOW OPEN.

Integrated Care Communities: 99-bed skilled care nursing facility in 44,252 sq. ft. Brodiaea Ave., west side of Nason St. – APPROVED/IN PLAN CHECK.

Jacobs Development: 8-acre mixed-use project with 24,000 sq. ft. medical office, 3 buildings totaling 13,000 sq. ft. for Business Park/R and D, plus 80,000 sq. ft., (398 units w/caretakers quarters) self- storage at the SWC of Graham St. and Alessandro Blvd. – APPROVED/PROJECT ON HOLD.

Kaiser - Moreno Valley Medical Campus: 75,000 sq. ft. medical office complex for Kaiser Permanente on Iris Ave., west of Moreno Valley Community Hospital – NOW OPEN.

Med-Hanit Alem Medical Clinic: 1,000 sq. ft. Primary Care Medical Clinic, NWC Eucalyptus/Perris - TENANT IMPROVEMENTS UNDERWAY

Moreno Valley Professional Village: 130,000 sq. ft. medical/office at the SWC of Alessandro Blvd. and Veterans' Way. Tenants include: **Moreno Valley Family Health Center, Moreno Valley Dental Clinic, DaVita Canyon Springs Dialysis and Westech College.**

- ✓ **Taco Bell** – Fast food, drive-thru restaurant. Taco Bell's first GREEN facility – NOW OPEN.
- ✓ **Westech College** – Addition of 12,560 sq. ft. to expand educational facility to 25,160 sq. ft. – NOW O

Olivewood Plaza: 22,758 sq. ft. three-story office building on 1.10 acres located north of Sunnymead Blvd. and west of Graham St. – APPROVED/PROJECT ON HOLD.

Real Living Premier Realty: 12,520 sq. ft. two-story office building located at 23180 Hemlock Ave. – NOW

Red Tower Center: 10,798 sq. ft. shopping center located at Red Maple and Perris Blvd. New tenant:

- ✓ **Pacific Dental Clinic** - 1,200 sq. ft. dental office at 25025 Red Maple – NOW OPEN.

Renaissance Village of Moreno Valley: A proposed 140-bed senior assisted living facility on the SWC of Moreno Beach Dr. and Brodiaea Ave. for a total of 98,400 sq. ft. on 7.33 acres – APPROVED AND IN PLAN CHECK.

Riverside Pediatric Medical Group/Mommy and Me: 3,000 sq. ft. outpatient medical offices located at 24226 Sunnymead Blvd. – NOW OPEN.

Social Security Administration: 19,679 sq. ft. office/hearing facility on the 3rd floor of building at NWC of Cactus and Veterans Way – NOW OPEN.

TownGate Square: 170,000 sq. ft. of office space at the SEC of Gateway Dr., and Day St. – APPROVED.

INDUSTRIAL

Alere Property Group:

- ✓ 756,340 sq. ft. distribution center on the east side of Heacock St., north of Cardinal Way. **Lowe's**
- ✓ 423,015 sq. ft. distribution center at Indian St. and San Michele Rd. – APPROVED AND IN PLAN CHECK.

First Industrial Realty Trust:

- ✓ **First Apache** - 569,200 sq. ft. industrial complex warehouse facilities at Perris and Storm Channel – NEW OWNER/PLAN CHECK.
- ✓ **First Inland Logistics Center** – an 865,960 sq. ft. industrial/distribution facility in two buildings. North side of Nandina Ave., west of Perris Blvd.- 691,960 sq. ft. leased and occupied by **Harbor Freight Tools** - TENANT IMPROVEMENTS UNDERWAY.

Cemex Materials: Proposed concrete plant on Nandina Ave. west of Indian St. – APPROVED.

Centerpointe Business Park: Ridge Property Trust is developing more than 2.66 million sq. ft. in 12 buildings (includes Minka Lighting, ResMed, Serta Mattress, Frazee Paint and U.S. Postal Service Distribution Center) – between Alessandro Blvd., Frederick St., Cactus Ave. and Heacock St. – SIX BUILDINGS OCCUPIED; THREE ADDITIONAL BUILDINGS APPROVED.

- ✓ **Harbor Freight Tools** – Occupies a 779,016 sq. ft. distribution center at NWC of Cactus Ave. and Graham St. Expansion plans of 507,720 sq. ft., totaling 1.28 million sq. ft. – APPROVED.
- ✓ 607,430 sq. ft. distribution/warehouse facility at the NWC of Brodiaea Ave. and Graham St. – APPROVED.

Gateway Business Park: 34 Industrial condos between 5,000 and 10,000 sq. ft., (184,036 total sq. ft.) south of Alessandro Blvd., west of Day St. – APPROVED/PROJECT ON HOLD.

Highland Fairview:

- ✓ 1.82 million sq. ft. distribution center for **Skechers USA**, along SR60 between Redlands Blvd. and Theodore St. – NOW OPEN
- ✓ Proposed specific plan for **World Logistic Center** – master planned 41 million sq. ft. corporate park on 2,800 acres south of SR 60 and east of Redlands Blvd. – IN PLANNING/EIR UNDERWAY.

IDS/Real Estate Group: Nandina Distribution Center – Two building complex with total of 1.82 million sq. ft., situated at NWC of Nandina Ave. and Indian St.

- ✓ **Building A**, 413,598 sq. ft. – APPROVED AND IN PLAN CHECK.
- ✓ **Building B**, 769,320 sq. ft. – UNDER CONSTRUCTION.

Komar: 283,100 sq. ft. industrial/distribution building on 13.75 acres at the SEC of Heacock Ave., and San Michele Rd. – APPROVED.

Panattoni Development Company: Inland Empire Global Logistics Center – 1.56 million sq. ft. building at the SWC of Indian St. and Iris Ave. – APPROVED/ IN PLAN CHECK.

Overton Moore Properties - Centerpointe Logistics Center:

- ✓ 522,774 sq. ft. logistics-distribution building on 25.9 acres at the NWC of Cactus Ave. and Frederick St. – UNDER CONSTRUCTION.

Prologis: 2,224,419 sq. ft. proposed in six buildings on the south side of SR60 between Pettit St. and Quincy St. – IN PLANNING/EIR UNDERWAY.

Rados: Proposed seven building project at NEC of Heacock St. and Iris Ave. with total of 619,127 sq. ft.

- ✓ 6 buildings ranging from 23,700 sq. ft. to 49,160 sq. ft. – APPROVED.
- ✓ Proposed 409,598 sq. ft. warehouse distribution center – APPROVED.

Ridge Property Trust - Westridge Commerce Center:

- ✓ 943,800 sq. ft. building along the south side of SR60 between Quincy St. and Redlands Blvd. – APPROVED/IN PLAN CHECK.

Robertson's Ready-Mix: Relocation of concrete plant for Old 215 Frontage Rd., south of Alessandro Blvd. – UNDER CONSTRUCTION.

Ross Stores Moreno Valley Distribution Center:

- ✓ 2nd Phase added 612,000 sq. ft., plus additional 285,000 sq. ft. mezzanine to the existing 686,000 sq. ft. building for a total of 1.58 million sq. ft. – EXPANSION COMPLETED/NOW OPEN.

Trammell Crow Company: I-215 Logistics Center – Industrial warehouse in two buildings at the NWC totaling 1,250,000 sq. ft. industrial/distribution building at the NEC of Heacock St. and San Michele Rd. – UNDER CONSTRUCTION.

United Natural Foods Inc.: 613,174 sq. ft. warehouse distribution facility on Goldencrest Drive – EXPANSION COMPLETE/NOW OPEN.

Vogel Engineers Inc/Sares-Regis: 1,616,133 sq. ft. warehouse distribution building on 71.15 acres along north side of Oleander Storm Drain between Indian St. and Perris Blvd. – APPROVED/IN PLAN CHECK.

Western Realco: March Business Center - 1,484,407 sq. ft. in four buildings at SEC of Iris Ave. and Heacock St. – APPROVED.

EXHIBIT 5

Under the California Environmental Quality Act (CEQA), local agencies have a very important role to play in California's fight against global warming – one of the most serious environmental effects facing the State today. Local agencies can lead by example in undertaking their own projects, insuring that sustainability is considered at the earliest stages. Moreover, they can help shape private development. Where a project as proposed will have significant global warming related effects, local agencies can require feasible changes or alternatives, and impose enforceable, verifiable, feasible mitigation to substantially lessen those effects. By the sum of their actions and decisions, local agencies will help to move the State away from "business as usual" and toward a low-carbon future.

Included in this document are various measures that may reduce the global warming related impacts at the individual project level. (For more information on actions that local governments can take at the program and general plan level, please visit the Attorney General's webpage, "CEQA, Global Warming, and General Plans" at http://ag.ca.gov/globalwarming/ceqa/generalplans.php.)

As appropriate, the measures can be included as design features of a project, required as changes to the project, or imposed as mitigation (whether undertaken directly by the project proponent or funded by mitigation fees). The measures set forth in this package are examples; the list is not intended to be exhaustive. Moreover, the measures cited may not be appropriate for every project. The decision of whether to approve a project – as proposed or with required changes or mitigation – is for the local agency, exercising its informed judgment in compliance with the law and balancing a variety of public objectives.

Mitigation Measures by Category

Energy Efficiency

Incorporate green building practices and design elements.	The California Department of Housing and Community Development's Green Building & Sustainability Resources handbook provides extensive links to green building resources. The handbook is available at http://www.hcd.ca.gov/hpd/green_build.pdf. The American Institute of Architects (AIA) has compiled fifty readily available strategies for reducing fossil fuel use in buildings by fifty percent. AIA "50 to 50" plan is presented in both guidebook and wiki format at http://wiki.aia.org/Wiki%20Pages/Home.aspx.

Meet recognized green building and energy efficiency benchmarks.	For example, an ENERGY STAR-qualified building uses less energy, is less expensive to operate, and causes fewer greenhouse gas emissions than comparable, conventional buildings. http://www.energystar.gov/index.cfm?c=business.bus_index. California has over 1600 ENERGY STAR-qualified school, commercial and industrial buildings. View U.S. EPA's list of Energy Star non-residential buildings at http://www.energystar.gov/index.cfm?fuseaction=labeled_buildings.locator. Los Angeles and San Francisco top the list of U.S. cities with the most ENERGY STAR non-residential buildings. http://www.energystar.gov/ia/business/downloads/2008_Top_25_cities_chart.pdf. Qualified ENERGY STAR homes must surpass the state's Title 24 energy efficiency building code by at least 15%. Los Angeles, Sacramento, San Diego, and San Francisco-Oakland are among the top 20 markets for ENERGY STAR homes nationwide. http://www.energystar.gov/ia/new_homes/mil_homes/top_20_markets.html. Builders of ENERGY STAR homes can be more competitive in a tight market by providing a higher quality, more desirable product. See http://www.energystar.gov/ia/partners/manuf_res/Horton.pdf. There are a variety of private and non-profit green building certification programs in use in the U.S. See U.S. EPA's Green Building / Frequently Asked Questions website, http://www.epa.gov/greenbuilding/pubs/faqs.htm. Public-Private Partnership for Advancing Housing Technology maintains a list of national and state Green Building Certification Programs for housing. See http://www.pathnet.org/sp.asp?id=20978. These include the national Leadership in Energy and Environmental Design (LEED) program, and, at the state level, Build it Green's GreenPoint Rated system and the California Green Builder program. Other organizations may provide other relevant benchmarks.
Install energy efficient lighting (e.g., light emitting diodes (LEDs)), heating and cooling systems, appliances, equipment, and control systems.	Information about ENERGY STAR-certified products in over 60 categories is available at http://www.energystar.gov/index.cfm?fuseaction=find_a_product. The California Energy Commission maintains a database of all appliances meeting either federal efficiency standards or, where there are no federal efficiency standards, California's appliance efficiency standards. See http://www.appliances.energy.ca.gov/. The Electronic Product Environmental Assessment Tool (EPEAT) ranks computer products based on a set of environmental criteria, including energy efficiency. See http://www.epeat.net/AboutEPEAT.aspx. The nonprofit American Council for an Energy Efficient Economy maintains an Online Guide to Energy Efficient Commercial Equipment, available at http://www.aceee.org/ogeece/ch1_index.htm. Utilities offer many incentives for efficient appliances, lighting, heating and cooling. To search for available residential and commercial incentives, visit Flex Your Power's website at http://www.fypower.org/.

Use passive solar design, e.g., orient buildings and incorporate landscaping to maximize passive solar heating during cool seasons, minimize solar heat gain during hot seasons, and enhance natural ventilation. Design buildings to take advantage of sunlight.	See U.S. Department of Energy, Passive Solar Design (website) http://www.energysavers.gov/your_home/designing_remodeling/index.cfm/mytopic=10250. See also California Energy Commission, Consumer Energy Center, Passive Solar Design (website) http://www.consumerenergycenter.org/home/construction/solardesign/index.html. Lawrence Berkeley National Laboratories' Building Technologies Department is working to develop innovative building construction and design techniques. Information and publications on energy efficient buildings, including lighting, windows, and daylighting strategies, are available at the Department's website at http://btech.lbl.gov.
Install light colored "cool" roofs and cool pavements.	A white or light colored roof can reduce surface temperatures by up to 100 degrees Fahrenheit, which also reduces the heat transferred into the building below. This can reduce the building's cooling costs, save energy and reduce associated greenhouse gas emissions, and extend the life of the roof. Cool roofs can also reduce the temperature of surrounding areas, which can improve local air quality. See California Energy Commission, Consumer Energy Center, Cool Roofs (webpage) at http://www.consumerenergycenter.org/coolroof/. See also Lawrence Berkeley National Laboratories, Heat Island Group (webpage) at http://eetd.lbl.gov/HeatIsland/.
Install efficient lighting, (including LEDs) for traffic, street and other outdoor lighting.	LED lighting is substantially more energy efficient than conventional lighting and can save money. See http://www.energy.ca.gov/efficiency/partnership/case_studies/TechAsstCity.pdf (noting that installing LED traffic signals saved the City of Westlake about $34,000 per year). As of 2005, only about a quarter of California's cities and counties were using 100% LEDs in traffic signals. See California Energy Commission (CEC), Light Emitting Diode Traffic Signal Survey (2005) at p. 15, available at http://www.energy.ca.gov/2005publications/CEC 400 2005 003/CEC 400 2005 003.PDF. The California Energy Commission's Energy Partnership Program can help local governments take advantage of energy saving technology, including, but not limited to, LED traffic signals. See http://www.energy.ca.gov/efficiency/partnership/.
Reduce unnecessary outdoor lighting.	See California Energy Commission, Reduction of Outdoor Lighting (webpage) at http://www.energy.ca.gov/efficiency/lighting/outdoor_reduction.html.

Use automatic covers, efficient pumps and motors, and solar heating for pools and spas.	During the summer, a traditional backyard California pool can use enough energy to power an entire home for three months. Efficiency measures can substantially reduce this waste of energy and money. See California Energy Commission, Consumer Energy Center, Pools and Spas (webpage) at http://www.consumerenergycenter.org/home/outside/pools_spas.html. See also Sacramento Municipal Utilities District, Pool and Spa Efficiency Program (webpage) at http://www.smud.org/en/residential/saving-energy/Pages/poolspa.aspx.
Provide education on energy efficiency to residents, customers and/or tenants.	Many cities and counties provide energy efficiency education. See, for example, the City of Stockton's Energy Efficiency website at http://www.stocktongov.com/energysaving/index.cfm. See also "Green County San Bernardino," http://www.greencountysb.com at pp. 4-6. Businesses and development projects may also provide education. For example, a homeowners' association (HOA) could provide information to residents on energy-efficient mortgages and energy saving measures. See The Villas of Calvera Hills, Easy Energy Saving Tips to Help Save Electricity at http://www.thevillashoa.org/green/energy/. An HOA might also consider providing energy audits to its residents on a regular basis.

Renewable Energy and Energy Storage

Meet "reach" goals for building energy efficiency and renewable energy use.	A "zero net energy" building combines building energy efficiency and renewable energy generation so that, on an annual basis, any purchases of electricity or natural gas are offset by clean, renewable energy generation, either on-site or nearby. Both the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC) have stated that residential buildings should be zero net energy by 2020, and commercial buildings by 2030. See CEC, 2009 Integrated Energy Policy Report (Dec. 2009) at p. 226, available at http://www.energy.ca.gov/2009publications/CEC-100-2009-003/CEC-100-2009-003-CMF.PDF; CPUC, Long Term Energy Efficiency Strategic Plan (Sept. 2008), available at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/.
Install solar, wind, and geothermal power systems and solar hot water heaters.	The California Public Utilities Commission (CPUC) approved the California Solar Initiative on January 12, 2006. The initiative creates a $3.3 billion, ten-year program to install solar panels on one million roofs in the State. Visit the one-stop GoSolar website at http://www.gosolarcalifornia.org/. As mitigation, a developer could, for example, agree to participate in the New Solar Homes program. See http://www.gosolarcalifornia.org/builders/index.html. The CPUC is in the process of establishing a program to provide solar water heating incentives under the California Solar Initiative. For more information, visit the CPUC's website at http://www.cpuc.ca.gov/puc/energy/solar/swh.htm. To search for available residential and commercial renewable energy incentives, visit Flex Your Power's website at http://www.fypower.org/.

Install solar panels on unused roof and ground space and over carports and parking areas.	In 2008 Southern California Edison (SCE) launched the nation's largest installation of photovoltaic power generation modules. The utility plans to cover 65 million square feet of unused commercial rooftops with 250 megawatts of solar technology – generating enough energy to meet the needs of approximately 162,000 homes. Learn more about SCE's Solar Rooftop Program at http://www.sce.com/solarleadership/solar-rooftop-program/general-faq.htm. In 2009, Walmart announced its commitment to expand the company's solar power program in California. The company plans to add solar panels on 10 to 20 additional Walmart facilities in the near term. These new systems will be in addition to the 18 solar arrays currently installed at Walmart facilities in California. See http://walmartstores.com/FactsNews/NewsRoom/9091.aspx. Alameda County has installed two solar tracking carports, each generating 250 kilowatts. By 2005, the County had installed eight photovoltaic systems totaling over 2.3 megawatts. The County is able to meet 6 percent of its electricity needs through solar power. See http://www.acgov.org/gsa/Alameda%20County%20-%20Solar%20Case%20Study.pdf. In 2007, California State University, Fresno installed at 1.1-megawatt photovoltaic (PV)-paneled parking installation. The University expects to save more than $13 million in avoided utility costs over the project's 30-year lifespan. http://www.fresnostatenews.com/2007/11/solarwrapup2.htm.
Where solar systems cannot feasibly be incorporated into the project at the outset, build "solar ready" structures.	U.S. Department of Energy, A Homebuilder's Guide to Going Solar (brochure) (2008), available at http://www.eere.energy.gov/solar/pdfs/43076.pdf.
Incorporate wind and solar energy systems into agricultural projects where appropriate.	Wind energy can be a valuable crop for farmers and ranchers. Wind turbines can generate energy to be used on-site, reducing electricity bills, or they can yield lease revenues (as much as $4000 per turbine per year). Wind turbines generally are compatible with rural land uses, since crops can be grown and livestock can be grazed up to the base of the turbine. See National Renewable Energy Laboratory, Wind Powering America Fact Sheet Series, Wind Energy Benefits, available at http://www.nrel.gov/docs/fy05osti/37602.pdf. Solar PV is not just for urban rooftops. For example, the Scott Brothers' dairy in San Jacinto, California, has installed a 55-kilowatt solar array on its commodity barn, with plans to do more in the coming years. See http://www.dairyherd.com/directories.asp?pgID=724&ed_id=8409 (additional California examples are included in article.)

Include energy storage where appropriate to optimize renewable energy generation systems and avoid peak energy use.	See National Renewable Energy Laboratory, Energy Storage Basics (webpage) at http://www.nrel.gov/learning/eds_energy_storage.html. California Energy Storage Alliance (webpage) at http://storagealliance.org/about.html. Storage is not just for large, utility scale projects, but can be part of smaller industrial, commercial and residential projects. For example, Ice Storage Air Conditioning (ISAC) systems, designed for residential and nonresidential buildings, produce ice at night and use it during peak periods for cooling. See California Energy Commission, Staff Report, Ice Storage Air Conditioners, Compliance Options Application (May 2006), available at http://www.energy.ca.gov/2006publications/CEC-400-2006-006/CEC-400-2006-006-SF.PDF.
Use on-site generated biogas, including methane, in appropriate applications.	At the Hilarides Dairy in Lindsay, California, an anaerobic-lagoon digester processes the run-off of nearly 10,000 cows, generating 226,000 cubic feet of biogas per day and enough fuel to run two heavy duty trucks. This has reduced the dairy's diesel consumption by 650 gallons a day, saving the dairy money and improving local air quality. See http://www.arb.ca.gov/newsrel/nr021109b.htm; see also Public Interest Energy Research Program, Dairy Power Production Program, Dairy Methane Digester System, 90-Day Evaluation Report, Eden Vale Dairy (Dec. 2006) at http://www.energy.ca.gov/2006publications/CEC 500 2006 083/CEC 500 2006 083.PDF. Landfill gas is a current and potential source of substantial energy in California. See Tom Frankiewicz, Program Manager, U.S. EPA Landfill Methane Outreach Program, Landfill Gas Energy Potential in California, available at http://www.energy.ca.gov/2009_energypolicy/documents/2009-04-21_workshop/presentations/05-SCS_Engineers_Presentation.pdf. There are many current and emerging technologies for converting landfill methane that would otherwise be released as a greenhouse gas into clean energy. See California Integrated Waste Management Board, Emerging Technologies, Landfill Gas-to-Energy (webpage) at http://www.ciwmb.ca.gov/LEACentral/TechServices/EmergingTech/default.htm.

Use combined heat and power (CHP) in appropriate applications.	Many commercial, industrial, and campus-type facilities (such as hospitals, universities and prisons) use fuel to produce steam and heat for their own operations and processes. Unless captured, much of this heat is wasted. CHP captures waste heat and re-uses it, e.g., for residential or commercial space heating or to generate electricity. See U.S. EPA, Catalog of CHP Technologies at http://www.epa.gov/chp/documents/catalog_of_%20chp_tech_entire.pdf and California Energy Commission, Distributed Energy Resource Guide, Combined Heat and Power (webpage) at http://www.energy.ca.gov/distgen/equipment/chp/chp.html. The average efficiency of fossil-fueled power plants in the United States is 33 percent. By using waste heat recovery technology, CHP systems typically achieve total system efficiencies of 60 to 80 percent. CHP can also substantially reduce emissions of carbon dioxide. http://www.epa.gov/chp/basic/efficiency.html. Currently, CHP in California has a capacity of over 9 million kilowatts. See list of California CHP facilities at http://www.eea-inc.com/chpdata/States/CA.html. The Waste Heat and Carbon Emissions Reduction Act (Assembly Bill 1613 (2007), amended by Assembly Bill 2791 (2008)) is designed to encourage the development of new CHP systems in California with a generating capacity of not more than 20 megawatts. Among other things, the Act requires the California Public Utilities Commission to establish (1) a standard tariff allowing CHP generators to sell electricity for delivery to the grid and (2) a "pay as you save" pilot program requiring electricity corporations to finance the installation of qualifying CHP systems by nonprofit and government entities. For more information, see http://www.energy.ca.gov/wasteheat/.

Water Conservation and Efficiency

Incorporate water-reducing features into building and landscape design.	According to the California Energy Commission, water-related energy use – which includes conveyance, storage, treatment, distribution, wastewater collection, treatment, and discharge – consumes about 19 percent of the State's electricity, 30 percent of its natural gas, and 88 billion gallons of diesel fuel every year. See http://www.energy.ca.gov/2007publications/CEC 999 2007 008/CEC 999 2007 008.PDF. Reducing water use and improving water efficiency can help reduce energy use and greenhouse gas emissions.
Create water-efficient landscapes.	The California Department of Water Resources' updated Model Water Efficient Landscape Ordinance (Sept. 2009) is available at http://www.water.ca.gov/wateruseefficiency/landscapeordinance/technical.cfm. A landscape can be designed from the beginning to use little or no water, and to generate little or no waste. See California Integrated Waste Management Board, Xeriscaping (webpage) at http://www.ciwmb.ca.gov/organics/Xeriscaping/.

Install water-efficient irrigation systems and devices, such as soil moisture-based irrigation controls and use water-efficient irrigation methods.	U.S. Department of Energy, Best Management Practice: Water-Efficient Irrigation (webpage) at http://www1.eere.energy.gov/femp/program/waterefficiency_bmp5.html. California Department of Water Resources, Landscape Water Use Efficiency (webpage) at http://www.water.ca.gov/wateruseefficiency/landscape/. Pacific Institute, More with Less: Agricultural Water Conservation and Efficiency in California (2008), available at http://www.pacinst.org/reports/more_with_less_delta/index.htm.
Make effective use of graywater. (Graywater is untreated household waste water from bathtubs, showers, bathroom wash basins, and water from clothes washing machines. Graywater to be used for landscape irrigation.)	California Building Standards Commission, 2008 California Green Building Standards Code, Section 604, pp. 31-32, available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf. California Department of Water Resources, Dual Plumbing Code (webpage) at http://www.water.ca.gov/recycling/DualPlumbingCode/. See also Ahwahnee Water Principles, Principle 6, at http://www.lgc.org/ahwahnee/h2o_principles.html. The Ahwahnee Water Principles have been adopted by City of Willits, Town of Windsor, Menlo Park, Morgan Hill, Palo Alto, Petaluma, Port Hueneme, Richmond, Rohnert Park, Rolling Hills Estates, San Luis Obispo, Santa Paula, Santa Rosa, City of Sunnyvale, City of Ukiah, Ventura, Marin County, Marin Municipal Water District, and Ventura County.
Implement low-impact development practices that maintain the existing hydrology of the site to manage storm water and protect the environment.	Retaining storm water runoff on-site can drastically reduce the need for energy-intensive imported water at the site. See U.S. EPA, Low Impact Development (webpage) at http://www.epa.gov/nps/lid/. Office of Environmental Health Hazard Assessment and the California Water and Land Use Partnership, Low Impact Development at http://www.coastal.ca.gov/nps/lid-factsheet.pdf.
Devise a comprehensive water conservation strategy appropriate for the project and location.	The strategy may include many of the specific items listed above, plus other innovative measures that are appropriate to the specific project.
Design buildings to be water-efficient. Install water-efficient fixtures and appliances.	Department of General Services, Best Practices Manual, Water-Efficient Fixtures and Appliances (website) at http://www.green.ca.gov/EPP/building/SaveH2O.htm. Many ENERGY STAR products have achieved their certification because of water efficiency. See California Energy Commission's database, available at http://www.appliances.energy.ca.gov/.

Offset water demand from new projects so that there is no net increase in water use.	For example, the City of Lompoc has a policy requiring new development to offset new water demand with savings from existing water users. See http://www.cityoflompoc.com/utilities/pdf/2005_uwmp_final.pdf at p. 29.
Provide education about water conservation and available programs and incentives.	See, for example, the City of Santa Cruz, Water Conservation Office at http://www.ci.santa-cruz.ca.us/index.aspx?page=395; Santa Clara Valley Water District, Water Conservation at http://www.valleywater.org/conservation/index.shtm; and Metropolitan Water District and the Family of Southern California Water Agencies, Be Water Wise at http://www.bewaterwise.com. Private projects may provide or fund similar education.

Solid Waste Measures

Reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard).	Construction and demolition materials account for almost 22 percent of the waste stream in California. Reusing and recycling these materials not only conserves natural resources and energy, but can also save money. For a list of best practices and other resources, see California Integrated Waste Management Board, Construction and Demolition Debris Recycling (webpage) at http://www.ciwmb.ca.gov/condemo/.
Integrate reuse and recycling into residential industrial, institutional and commercial projects.	Tips on developing a successful recycling program, and opportunities for cost-effective recycling, are available on the California Integrated Waste Management Board's Zero Waste California website. See http://zerowaste.ca.gov/. The Institute for Local Government's Waste Reduction & Recycling webpage contains examples of "best practices" for reducing greenhouse gas emissions, organized around waste reduction and recycling goals and additional examples and resources. See http://www.ca-ilg.org/wastereduction.
Provide easy and convenient recycling opportunities for residents, the public, and tenant businesses.	Tips on developing a successful recycling program, and opportunities for cost effective recycling, are available on the California Integrated Waste Management Board's Zero Waste California website. See http://zerowaste.ca.gov/.
Provide education and publicity about reducing waste and available recycling services.	Many cities and counties provide information on waste reduction and recycling. See, for example, the Butte County Guide to Recycling at http://www.recyclebutte.net. The California Integrated Waste Management Board's website contains numerous publications on recycling and waste reduction that may be helpful in devising an education project. See http://www.ciwmb.ca.gov/Publications/default.asp?cat=13. Private projects may also provide waste and recycling education directly, or fund education.

Land Use Measures

Ensure consistency with "smart growth" principles – mixed-use, infill, and higher density projects that provide alternatives to individual vehicle travel and promote the efficient delivery of services and goods.	U.S. EPA maintains an extensive Smart Growth webpage with links to examples, literature and technical assistance, and financial resources. See http://www.epa.gov/smartgrowth/index.htm. The National Oceanic and Atmospheric Administration's webpage provides smart growth recommendations for communities located near water. See Coastal & Waterfront Smart Growth (webpage) at http://coastalsmartgrowth.noaa.gov/. The webpage includes case studies from California. The California Energy Commission has recognized the important role that land use can play in meeting our greenhouse gas and energy efficiency goals. The agency's website, Smart Growth & Land Use Planning, contains useful information and links to relevant studies, reports, and other resources. See http://www.energy.ca.gov/landuse/. The Metropolitan Transportation Commission's webpage, Smart Growth / Transportation for Livable Communities, includes resources that may be useful to communities in the San Francisco Bay Area and beyond. See http://www.mtc.ca.gov/planning/smart_growth/. The Sacramento Area Council of Governments (SACOG) has published examples of smart growth in action in its region. See Examples from the Sacramento Region of the Seven Principles of Smart Growth / Better Ways to Grow, available at http://www.sacog.org/regionalfunding/betterways.pdf.
Meet recognized "smart growth" benchmarks.	For example, the LEED for Neighborhood Development (LEED-ND) rating system integrates the principles of smart growth, urbanism and green building into the first national system for neighborhood design. LEED-ND is a collaboration among the U.S. Green Building Council, Congress for the New Urbanism, and the Natural Resources Defense Council. For more information, see http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148.
Educate the public about the many benefits of well-designed, higher density development.	See, for example, U.S. EPA, Growing Smarter, Living Healthier: A Guide to Smart Growth and Active Aging (webpage), discussing how compact, walkable communities can provide benefits to seniors. See http://www.epa.gov/aging/bhc/guide/index.html. U.S. EPA, Environmental Benefits of Smart Growth (webpage) at http://www.epa.gov/dced/topics/eb.htm (noting local air and water quality improvements). Centers for Disease Control and Prevention (CDC), Designing and Building Healthy Places (webpage), at http://www.cdc.gov/healthyplaces/. The CDC's website discusses the links between walkable communities and public health and includes numerous links to educational materials. California Department of Housing and Community Development, Myths and Facts About Affordable and High Density Housing (2002), available at http://www.hcd.ca.gov/hpd/mythsnfacts.pdf.

Incorporate public transit into the project's design.	Federal Transit Administration, Transit-Oriented Development (TOD) (webpage) at http://www.fta.dot.gov/planning/planning_environment_6932.html (describing the benefits of TOD as "social, environmental, and fiscal.") California Department of Transportation (Caltrans), Statewide Transit-Oriented Development Study: Factors for Success in California (2002), available at http://transitorienteddevelopment.dot.ca.gov/miscellaneous/StatewideTOD.htm Caltrans, California Transit-Oriented Development Searchable Database (includes detailed information on numerous TODs), available at http://transitorienteddevelopment.dot.ca.gov/miscellaneous/NewHome.jsp. California Department of Housing and Community Development, Transit Oriented Development (TOD) Resources (Aug. 2009), available at http://www.hcd.ca.gov/hpd/tod.pdf.
Preserve and create open space and parks. Preserve existing trees, and plant replacement trees at a set ratio.	U.S. EPA, Smart Growth and Open Space Conservation (webpage) at http://www.epa.gov/dced/openspace.htm.
Develop "brownfields" and other underused or defunct properties near existing public transportation and jobs.	U.S. EPA, Smart Growth and Brownfields (webpage) at http://www.epa.gov/dced/brownfields.htm. For example, as set forth in the Local Government Commission's case study, the Town of Hercules, California reclaimed a 426-acre brownfield site, transforming it into a transit-friendly, walkable neighborhood. See http://www.lgc.org/freepub/docs/community_design/fact_sheets/er_case_studies.pdf. For financial resources that can assist in brownfield development, see Center for Creative Land Recycling, Financial Resources for California Brownfields (July 2008), available at http://www.cclr.org/media/publications/8-Financial_Resources_2008.pdf.
Include pedestrian and bicycle facilities within projects and ensure that existing non-motorized routes are maintained and enhanced.	See U.S. Department of Transportation, Federal Highway Administration, Bicycle and Pedestrian Program (webpage) at http://www.fhwa.dot.gov/environment/bikeped/. Caltrans, Pedestrian and Bicycle Facilities in California / A Technical Reference and Technology Transfer Synthesis for Caltrans Planners and Engineers (July 2005), available at http://www.dot.ca.gov/hq/traffops/survey/pedestrian/TR_MAY0405.pdf. This reference includes standard and innovative practices for pedestrian facilities and traffic calming.

Transportation and Motor Vehicles

Meet an identified transportation-related benchmark.	A logical benchmark might be related to vehicles miles traveled (VMT), e.g., average VMT per capita, per household, or per employee. As the California Energy Commission has noted, VMT by California residents increased "a rate of more than 3 percent a year between 1975 and 2004, markedly faster than the population growth rate over the same period, which was less than 2 percent. This increase in VMT correlates to an increase in petroleum use and GHG production and has led to the transportation sector being responsible for 41 percent of the state's GHG emissions in 2004." CEC, The Role of Land Use in Meeting California's Energy and Climate Change Goals (Aug. 2007) at p. 9, available at http://www.energy.ca.gov/2007publications/CEC-600-2007-008/CEC-600-2007-008-SF.PDF. Even with regulations designed to increase vehicle efficiency and lower the carbon content of fuel, "reduced VMT growth will be required to meet GHG reductions goals." *Id.* at p. 18.
Adopt a comprehensive parking policy that discourages private vehicle use and encourages the use of alternative transportation.	For example, reduce parking for private vehicles while increasing options for alternative transportation; eliminate minimum parking requirements for new buildings; "unbundle" parking (require that parking is paid for separately and is not included in rent for residential or commercial space); and set appropriate pricing for parking. See U.S. EPA, Parking Spaces / Community Places, Finding the Balance Through Smart Growth Solutions (Jan. 2006), available at http://www.epa.gov/dced/pdf/EPAParkingSpaces06.pdf. Reforming Parking Policies to Support Smart Growth, Metropolitan Transportation Commission (June 2007) at http://www.mtc.ca.gov/planning/smart_growth/parking_seminar/Toolbox Handbook.pdf. See also the City of Ventura's Downtown Parking and Mobility Plan, available at http://www.cityofventura.net/community_development/resources/mobility_parking_plan.pdf, and Ventura's Downtown Parking Management Program, available at http://www.ci.ventura.ca.us/depts/comm_dev/downtownplan/chapters.asp.
Build or fund a major transit stop within or near the development.	"'Major transit stop' means a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods." (Pub. Res. Code, § 21064.3.) Transit Oriented Development (TOD) is a moderate to higher density development located within an easy walk of a major transit stop. http://transitorienteddevelopment.dot.ca.gov/miscellaneous/NewWhatisTOD.htm. By building or funding a major transit stop, an otherwise ordinary development can become a TOD.

Provide public transit incentives such as free or low-cost monthly transit passes to employees, or free ride areas to residents and customers.	See U.S. Department of Transportation and U.S. EPA, Commuter Choice Primer / An Employer's Guide to Implementing Effective Commuter Choice Programs, available at http://www.its.dot.gov/JPODOCS/REPTS_PR/13669.html. The Emery Go Round shuttle is a private transportation service funded by commercial property owners in the citywide transportation business improvement district. The shuttle links a local shopping district to a Bay Area Rapid Transit stop. See http://www.emerygoround.com/. Seattle, Washington maintains a public transportation "ride free" zone in its downtown from 6:00 a.m. to 7:00 p.m. daily. See http://transit.metrokc.gov/tops/accessible/paccessible_map.html#fare.
Promote "least polluting" ways to connect people and goods to their destinations.	Promoting "least polluting" methods of moving people and goods is part of a larger, integrated "sustainable streets" strategy now being explored at U.C. Davis's Sustainable Transportation Center. Resources and links are available at the Center's website, http://stc.ucdavis.edu/outreach/ssp.php.
Incorporate bicycle lanes, routes and facilities into street systems, new subdivisions, and large developments.	Bicycling can have a profound impact on transportation choices and air pollution reduction. The City of Davis has the highest rate of bicycling in the nation. Among its 64,000 residents, 17 percent travel to work by bicycle and 41 percent consider the bicycle their primary mode of transportation. See Air Resources Board, Bicycle Awareness Program, Bicycle Fact Sheet, available at http://www.arb.ca.gov/planning/tsaq/bicycle/factsht.htm. For recommendations on best practices, see the many resources listed at the U.S. Department of Transportation, Federal Highway Administration's Bicycle and Pedestrian website at http://www.fhwa.dot.gov/environment/bikeped/publications.htm. See also Caltrans Division of Research and Innovation, Designing Highway Facilities To Encourage Walking, Biking and Transit (Preliminary Investigation) (March 2009), available at http://www.dot.ca.gov/research/researchreports/preliminary_investigations/docs/pi-design_for_walking_%20biking_and_transit%20final.pdf.
Require amenities for non-motorized transportation, such as secure and convenient bicycle parking.	According to local and national surveys of potential bicycle commuters, secure bicycle parking and workplace changing facilities are important complements to safe and convenient routes of travel. See Air Resources Board, Bicycle Awareness Program, Bicycle Fact Sheet, available at http://www.arb.ca.gov/planning/tsaq/bicycle/factsht.htm.

Ensure that the project enhances, and does not disrupt or create barriers to, non-motorized transportation.	See, e.g., U.S. EPA's list of transit-related "smart growth" publications at http://www.epa.gov/dced/publications.htm#air, including Pedestrian and Transit-Friendly Design: A Primer for Smart Growth (1999), available at www.epa.gov/dced/pdf/ptfd_primer.pdf. See also Toolkit for Improving Walkability in Alameda County, available at http://www.acta2002.com/ped toolkit/ped_toolkit_print.pdf. Pursuant to the California Complete Streets Act of 2008 (AB 1358, Gov. Code, §§ 65040.2 and 65302), commencing January 1, 2011, upon any substantive revision of the circulation element of the general plan, a city or county will be required to modify the circulation element to plan for a balanced, multimodal transportation network that meets the needs of all users.
Connect parks and open space through shared pedestrian/bike paths and trails to encourage walking and bicycling. Create bicycle lanes and walking paths directed to the location of schools, parks and other destination points.	Walk Score ranks the "walkability" of neighborhoods in the largest 40 U.S. cities, including seven California cities. Scores are based on the distance to nearby amenities. Explore Walk Score at http://www.walkscore.com/. In many markets, homes in walkable neighborhoods are worth more than similar properties where walking is more difficult. See Hoak, *Walk appeal / Homes in walkable neighborhoods sell for more: study*, Wall Street Journal (Aug. 18, 2009), available at http://www.marketwatch.com/story/homes-in-walkable-neighborhoods-sell-for-more-2009-08-18. By creating walkable neighborhoods with more transportation choices, Californians could save $31 million and cut greenhouse gas emissions by 34 percent, according to a study released by Transform, a coalition of unions and nonprofits. See Windfall for All / How Connected, Convenient Neighborhoods Can Protect Our Climate and Safeguard California's Economy (Nov. 2009), available at http://transformca.org/windfall-for-all#download-report.
Work with the school districts to improve pedestrian and bike access to schools and to restore or expand school bus service using lower-emitting vehicles.	In some communities, twenty to twenty-five percent of morning traffic is due to parents driving their children to school. Increased traffic congestion around schools in turn prompts even more parents to drive their children to school. Programs to create safe routes to schools can break this harmful cycle. See California Department of Public Health, Safe Routes to School (webpage) and associated links at http://www.cdph.ca.gov/HealthInfo/injviosaf/Pages/SafeRoutestoSchool.aspx. See also U.S. EPA, Smart Growth and Schools (webpage), available at http://www.epa.gov/dced/schools.htm. California Center for Physical Activity, California Walk to School (website) at http://www.cawalktoschool.com Regular school bus service (using lower-emitting buses) for children who cannot bike or walk to school could substantially reduce private vehicle congestion and air pollution around schools. See Air Resources Board, Lower Emissions School Bus Program (webpage) at http://www.arb.ca.gov/msprog/schoolbus/schoolbus.htm.

Institute teleconferencing, telecommute and/or flexible work hour programs to reduce unnecessary employee transportation.	There are numerous sites on the web with resources for employers seeking to establish telework or flexible work programs. These include U.S. EPA's Mobility Management Strategies: Commuter Programs website at http://www.epa.gov/otaq/stateresources/rellinks/mms_commprograms.htm; and Telework, the federal government's telework website, at http://www.telework.gov/. Through a continuing FlexWork Implementation Program, the Traffic Solutions division of the Santa Barbara County Association of Governments sponsors flexwork consulting, training and implementation services to a limited number of Santa Barbara County organizations that want to create or expand flexwork programs for the benefit of their organizations, employees and the community. See http://www.flexworksb.com/read_more_about_the_fSBp.html. Other local government entities provide similar services.
Provide information on alternative transportation options for consumers, residents, tenants and employees to reduce transportation-related emissions.	Many types of projects may provide opportunities for delivering more tailored transportation information. For example, a homeowner's association could provide information on its website, or an employer might create a Transportation Coordinator position as part of a larger Employee Commute Reduction Program. See, e.g., South Coast Air Quality Management District, Transportation Coordinator training, at http://www.aqmd.gov/trans/traing.html.
Educate consumers, residents, tenants and the public about options for reducing motor vehicle-related greenhouse gas emissions. Include information on trip reduction; trip linking; vehicle performance and efficiency (e.g., keeping tires inflated); and low or zero-emission vehicles.	See, for example U.S. EPA, SmartWay Transport Partnership: Innovative Carrier Strategies (webpage) at http://www.epa.gov/smartway/transport/what-smartway/carrier-strategies.htm. This webpage includes recommendations for actions that truck and rail fleets can take to make ground freight more efficient and cleaner. The Air Resources Board's Drive Clean website is a resource for car buyers to find clean and efficient vehicles. The web site is designed to educate Californians that pollution levels range greatly between vehicles. See http://www.driveclean.ca.gov/. The Oregon Department of Transportation and other public and private partners launched the Drive Less/Save More campaign. The comprehensive website contains fact sheets and educational materials to help people drive more efficiently. See http://www.drivelesssavemore.com/.
Purchase, or create incentives for purchasing, low or zero-emission vehicles.	See Air Resources Board, Low-Emission Vehicle Program (webpage) at http://www.arb.ca.gov/msprog/levprog/levprog.htm. Air Resource Board, Zero Emission Vehicle Program (webpage) at http://www.arb.ca.gov/msprog/zevprog/zevprog.htm. All new cars sold in California are now required to display an Environmental Performance (EP) Label, which scores a vehicle's global warming and smog emissions from 1 (dirtiest) to 10 (cleanest). To search and compare vehicle EP Labels, visit www.DriveClean.ca.gov.

Create a ride sharing program. Promote existing ride sharing programs e.g., by designating a certain percentage of parking spaces for ride sharing vehicles, designating adequate passenger loading and unloading for ride sharing vehicles, and providing a web site or message board for coordinating rides.	For example, the 511 Regional Rideshare Program is operated by the Metropolitan Transportation Commission (MTC) and is funded by grants from the Federal Highway Administration, U.S. Department of Transportation, the Metropolitan Transportation Commission, the Bay Area Air Quality Management District and county congestion management agencies. For more information, see http://rideshare.511.org/. As another example, San Bernardino Associated Governments works directly with large and small employers, as well as providing support to commuters who wish to share rides or use alternative forms of transportation. See http://www.sanbag.ca.gov/commuter/rideshare.html. Valleyrides.com is a ridesharing resource available to anyone commuting to and from Fresno and Tulare Counties and surrounding communities. See http://www.valleyrides.com/. There are many other similar websites throughout the state.
Create or accommodate car sharing programs, e.g., provide parking spaces for car share vehicles at convenient locations accessible by public transportation.	There are many existing car sharing companies in California. These include City CarShare (San Francisco Bay Area), see http://www.citycarshare.org/; and Zipcar, see http://www.zipcar.com/. Car sharing programs are being successfully used on many California campuses.
Provide a vanpool for employees.	Many local Transportation Management Agencies can assist in forming vanpools. See, for example, Sacramento Transportation Management Association, Check out Vanpooling (webpage) at http://www.sacramento-tma.org/vanpool.html.
Create local "light vehicle" networks, such as neighborhood electric vehicle systems.	See California Energy Commission, Consumer Energy Center, Urban Options - Neighborhood Electric Vehicles (NEVs) (webpage) at http://www.consumerenergycenter.org/transportation/urban_options/nev.html. The City of Lincoln has an innovative NEV program. See http://www.lincolnev.com/index.html.
Enforce and follow limits idling time for commercial vehicles, including delivery and construction vehicles.	Under existing law, diesel-fueled motor vehicles with a gross vehicle weight rating greater than 10,000 pounds are prohibited from idling for more than 5 minutes at any location. The minimum penalty for an idling violation is now $300 per violation. See http://www.arb.ca.gov/enf/complaints/idling_cv.htm.
Provide the necessary facilities and infrastructure to encourage the use of low or zero-emission vehicles.	For a list of existing alternative fuel stations in California, visit http://www.cleancarmaps.com/. See, e.g., Baker, *Charging-station network built along 101*, S.F. Chron. (9/23/09), available at http://articles.sfgate.com/2009-09-23/news/17207424_1_recharging-solar-array-tesla-motors.

Agriculture and Forestry (additional strategies noted above)

Require best management practices in agriculture and animal operations to reduce emissions, conserve energy and water, and utilize alternative energy sources, including biogas, wind and solar.	Air Resources Board (ARB), Economic Sectors Portal, Agriculture (webpage) at http://www.arb.ca.gov/cc/ghgsectors/ghgsectors.htm. ARB's webpage includes information on emissions from manure management, nitrogen fertilizer, agricultural offroad equipment, and agricultural engines. "A full 90% of an agricultural business' electricity bill is likely associated with water use. In addition, the 8 million acres in California devoted to crops consume 80% of the total water pumped in the state." See Flex Your Power, Agricultural Sector (webpage) at http://www.fypower.org/agri/. Flex Your Power, Best Practice Guide / Food and Beverage Growers and Processors, available at http://www.fypower.org/bpg/index.html?b=food_and_bev. Antle et al., Pew Center on Global Climate Change, Agriculture's Role in Greenhouse Gas Mitigation (2006), available at http://www.pewclimate.org/docUploads/Agriculture's%20Role%20in%20GHG%20Mitigation.pdf.
Preserve forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, groundwater recharge areas and other open space that provide carbon sequestration benefits.	"There are three general means by which agricultural and forestry practices can reduce greenhouse gases: (1) avoiding emissions by maintaining existing carbon storage in trees and soils; (2) increasing carbon storage by, e.g., tree planting, conversion from conventional to conservation tillage practices on agricultural lands; (3) substituting bio-based fuels and products for fossil fuels, such as coal and oil, and energy-intensive products that generate greater quantities of CO2 when used." U.S. EPA, Carbon Sequestration in Agriculture and Forestry, Frequently Asked Questions (webpage) at http://www.epa.gov/sequestration/faq.html. Air Resources Board, Economic Sectors Portal, Forestry (webpage) at http://www.arb.ca.gov/cc/ghgsectors/ghgsectors.htm.
Protect existing trees and encourage the planting of new trees. Adopt a tree protection and replacement ordinance.	Tree preservation and planting is not just for rural areas of the state; suburban and urban forests can also serve as carbon sinks. See Cal Fire, Urban and Community Forestry (webpage) at http://www.fire.ca.gov/resource_mgt/resource_mgt_urbanforestry.php.

Off-Site Mitigation

If, after analyzing and requiring all reasonable and feasible on-site mitigation measures for avoiding or reducing greenhouse gas-related impacts, the lead agency determines that additional mitigation is required, the agency may consider additional off-site mitigation. The project proponent could, for example, fund off-site mitigation projects that will reduce carbon emissions, conduct an audit of its other existing operations and agree to retrofit, or purchase verifiable carbon "credits" from another entity that will undertake mitigation.

The topic of off-site mitigation can be complicated. A full discussion is outside the scope of this summary document. Issues that the lead agency should consider include:

- The location of the off-site mitigation. (If the off-site mitigation is far from the project, any additional, non-climate related co-benefits of the mitigation may be lost to the local community.)

- Whether the emissions reductions from off-site mitigation can be quantified and verified. (The California Registry has developed a number of protocols for calculating, reporting and verifying greenhouse gas emissions. Currently, industry-specific protocols are available for the cement sector, power/utility sector, forest sector and local government operations. For more information, visit the California Registry's website at http://www.climateregistry.org/.)

- Whether the mitigation ratio should be greater than 1:1 to reflect any uncertainty about the effectiveness of the off-site mitigation.

Offsite mitigation measures that could be funded through mitigation fees include, but are not limited to, the following:

- Energy efficiency audits of existing buildings.

- Energy efficiency upgrades to existing buildings not otherwise required by law, including heating, ventilation, air conditioning, lighting, water heating equipment, insulation and weatherization (perhaps targeted to specific communities, such as low-income or senior residents).

- Programs to encourage the purchase and use of energy efficient vehicles, appliances, equipment and lighting.

- Programs that create incentives to replace or retire polluting vehicles and engines.

- Programs to expand the use of renewable energy and energy storage.

- Preservation and/or enhancement of existing natural areas (e.g., forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, and groundwater recharge areas) that provide carbon sequestration benefits.

- Improvement and expansion of public transit and low- and zero-carbon transportation alternatives.