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December 19, 2016

Honorable Mayor and City Council
City of Riverside
3900 Main Street, 3rd Floor
Riverside, CA 92522

Via hand delivery

Re: *Appeal re Sycamore Canyon Business Park Buildings 1 and 2 DEIR, State Clearinghouse # 2015081042; Planning cases P14-1072 (EIR), P14-1081 (DR), P14-1082 (MCUP), P16-0101 (GP), P16-0102 (PM), and P16-0103 (VR)*

Dear Honorable Mayor and City Council:

On behalf of the Golden State Environmental Justice Alliance ("GSEJA"), formerly Socal Environmental Justice Alliance, we are filing this appeal of the decision of the City of Riverside Planning Commission on December 15, 2016 regarding Planning cases P14-1072 (EIR), P14-1081 (DR), P14-1082 (MCUP), P16-0101 (GP), P16-0102 (PM), and P16-0103 (VR) for the reasons stated in the attached September 23, 2016 letter and attachments.

Sincerely,

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September 23, 2016

Patricia Brenes
City of Riverside
3900 Main Street, 3rd Floor
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Via Email & U.S. Mail

Re: *Comments on Sycamore Canyon Business Park Buildings 1 and 2 DEIR, State Clearinghouse # 2015081042*

Dear Ms. Brenes and the City of Riverside:

Pursuant to the California Environmental Quality Act ("CEQA"), this letter is to serve you with comments on behalf of the SoCal Environmental Justice Alliance ("SEJA") regarding the Sycamore Canyon Business Park Buildings 1 and 2 ("the Project") Draft Environmental Impact Report ("DEIR"). We understand the Project to comprise the removal of a blue line stream and its replacement with a 2.96 acre "mitigation area," and the construction and operation a logistics center consisting of two buildings located approximately 0.4 miles west of Sycamore Canyon Boulevard at the western terminus of Dan Kipper Drive and north and west of Lance Drive in the City of Riverside, California, along with its associated street and utility improvements on a 76 gross acre, 71 net acre set of parcels. Building 1 would be sited on Parcel 1 and approximately 1,012,995 square feet in size. Building 1 would have 147 dock doors located along the east and west sides of the structure and would be approximately 41 feet from grade. Building 2 would be sited on Parcel 2 to the north of Building 1. Building 2 will be approximately 362,174 square feet in size, which includes up to approximately 10,000 square feet of office space, and approximately 352,174 square feet of logistics/industrial use. Building 2 will have 45 dock doors along the south side of the structure and would be approximately 37 feet from grade. The two Buildings would have separate owners and the Project is being built on speculation with no future tenants identified.

Our comments track the sections of the DEIR as reorganized by you or your consultant. Thus, we go from Section 5.1 Aesthetics to Section 5.10 Land Use and Planning and then back to Section 5.3 Air Quality (we have no comments Section 5.2 Agriculture and Forestry).

Project Objectives

We believe your Project Objectives are tightly defined to require the construction of two logistics centers on the Project site. This is disappointing as they will pose a threat to residents and to the adjacent Sycamore Canyon Wilderness Park. The applicants and you could have chosen an office use, which would be compatible with the General Plan designation and zoning, and was recommended by at least one neighborhood group.

Comments on NOP

You received comments from among other entities the City of Moreno Valley, which calculated based on the ITE Trip Generation Manual that the Project would generate 1006 truck trips daily. Your assessment was that it would "only" generate 917. Please explain this discrepancy.

Friends of Riverside's Hills commented that the DEIR should assess impacts to the federally endangered Stephens' Kangaroo Rat ("SKR"), for which a Core Reserve exists immediately adjacent to the site in the Sycamore Canyon Wilderness Park. You failed to do this entirely, relying solely on the payment of a mitigation fee. The payment of a mitigation fee will not avoid mortality to any SKR on the Project site, and you did not survey for them. Friends also noted that the City's General Plan is adjacent to a residential neighborhood (two, actually) and will pollute; this is contrary to General Plan Policy AQ-1.3 which says to separate, buffer and protect sensitive receptors from significant sources of pollution to the greatest extent possible. An office use would have avoided this conflict.[1]

The Pechanga had extensive comments on impacts to Cultural Resources which we will discuss when we get to that section of the DEIR but also they mentioned in particular that the DEIR should address impacts from smog to rock art in the area which the DEIR does not do.

The Sycamore Highlands Action Group ("SHAG") commented that residents were led to believe that that site would be used for an office building or an appropriate light industrial building that would buffer the nuisance and environmental effects from the nearby distribution centers. The present use will significantly exacerbate those effects. SHAG noted that the Project would lead to significant noise pollution, light pollution, traffic impacts, and health impacts. SHAG specifically mentioned that the health impacts of cumulative projects should be assessed with this one, such that the diesel particulate matter ("DPM") from the other adjacent distribution centers *along with* the present Project would be honestly assessed. This was not done.

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[1] To the extent that you assert that office use would be precluded by the March Air Reserve Base Airport Compatibility Plan, we disagree: office uses are apparently not precluded because you are including them in the Project anyway. Indeed, the DEIR concedes that Zones D and C1 of the MARB/Inland Port Land Use Compatibility Plan permits residential uses on the site.

In oral comments on the NOP residents asserted that 2001 should be used as a baseline on noise, and that cumulative impacts from the World Logistics Center ("WLC") should be considered. The WLC was considered, but, as we note below, a number of other projects appear to have been left out. Commenters also noted that the NOP was apparently only sent to 18 homes in the area and that this was inadequate notice. We agree, and it appears that the NOP only gave an effective two days' notice for the community meeting.

Alternatives Analysis Summary

You did not evaluate an office use; you chose to evaluate a manufacturing use that was more intensive. You did not evaluate an alternative that allowed the blue line stream to continue running through the site, despite the requests of NOP commenters that you do so. You rejected a Reduced Density Alternative as economically infeasible. CEQA requires you to assess alternatives that *reduce* environmental impacts; your manufacturing use did not do this, and your choice of alternatives did not represent a reasonable range. With regard to your rejection of a 700,000 square foot and 300,000 square foot building as infeasible, this is cherry-picking, as the smaller building would be in this range anyway. You did not need to define the Project Objectives to have a building over 1,000,000 square feet in size and you haven't provided an economic analysis supporting your conclusion that only such a building would have a market.

Other CEQA Topics

The document refuses to acknowledge that the construction of two logistics centers on undeveloped land represents a significant and unreversible change, on the ground that the site is designated for development under the Sycamore Canyon Business Park Specific Plan ("SCBPSP"). This ignores reality: the site is undeveloped and presently contains a blue line stream, and you propose to develop it and eliminate the stream. This is by definition a significant and unreversible change. Also you state there will be no significant long term energy use. We beg to differ, based at very least on all the combustible diesel fuel that will go into the operation and use of the Project and the fact that you have failed to require rooftop solar, which you could have.

Project Site – Existing Conditions and Proposed Project

You acknowledge that the Project site is bordered by the Sycamore Canyon Wilderness Park to the west, residential development to the north and northwest, a Ralph's Distribution Center to the south, Big 5 and Flex Steel Distribution Centers to the east, and the recently approved Sycamore Canyon Business Center at the site's northeast corner. In light of all these intensive uses to the east and south and the sensitive uses to the west and north, a buffering use such as an office building or light manufacturing should have been considered. Neither were. The General Plan designates the site as Business/Office Park (B/OP). While the SCBPSP designates the site as industrial, this conflicts with the General Plan, which would have to be amended.

The Project proposes General Plan and Specific Plan amendments to eliminate planned circulation through the site. The Tentative Parcel Map would combine 17 existing parcels into 2 parcels and three lettered lots. Grading exceptions would be required. Building 1 would be 41 feet from grade and Building 2 would be 37 feet from grade. You claim that the buildings won't be visible from the residential areas because they will be below grade from them; however, in your Aesthetics discussion you contain renderings which belie this assertion.

Under "Sustainability Features," it appears that you largely intend to comply with green building codes; nothing more. You provide for "solar ready" roofs, not solar. You provide for three EV charging stations for the hundreds of cars that will be accessing the site; you do not provide for EV charging for the trucks. You provide for bicycle parking though this will exacerbate the risk of lung damage and asthma for employees given the use of the site. And you do not prohibit the use of transport refrigeration units ("TRUs") onsite though they will be in close proximity to residents and pose significant health threats to them according to the California Air Resources Board ("CARB").

Effects Found Not to Be Significant

We disagree with your conclusion that the following effects are not significant, as discussed in the following sections: aesthetics, cultural resources, biological resources, greenhouse gases ("GHGs"), hydrology and water quality.

Aesthetics

At 5.1-9 you note that the proposed trail will interfere with the fire access/maintenance road as presently planned. We question whether there will be room for any landscaping on this side of the development.

Here you acknowledge that Buildings 1 and 2 will be visible to the homes to the north and northwest. You indicate that the Buildings will have mounted lighting 34 and 32 feet above finished floor elevations, respectively. You try to suggest that the lighting will have no impact on residents or the adjacent Wilderness Park because these lights will have "no uptilt," but the light is going to disperse. With respect to the Wilderness Park you assert that the lighting will comply with the Sycamore Canyon Wilderness Park SKR Management Plan and Updated Conceptual Development Plan but you do not specify how. You acknowledge that the lighting will be sufficient for the distribution centers' 24/7 hours of operation, and you acknowledge that Building 2 is a mere 100 feet from the residential lots to the north. DEIR at 5.1-8.

Threshold A: Would the Project substantially affect a scenic vista? Here you acknowledge that construction of the Project has the potential to impact views of the Box Springs Mountains for homes to the west of the Project site, but you claim it won't due to the height of the Mountains. You have not provided any depictions to convince us of this, and the buildings could obstruct views of the lower parts of those Mountains. You further acknowledge that views from homes to the north of the Project site will be

impacted but say this isn't significant because the proposed Project is within an area zoned for industrial use. This is still a significant impact, which you fail to recognize, especially for homes to the northeast which presently have unobstructed views of the Sycamore Canyon Wilderness Park through the Project site.

Threshold B: Would the Project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings and historic buildings within a state scenic highway? You read this threshold to mean only impacts to a state scenic highway, but that reads out the first part of the sentence, which specifically makes the latter part of the sentence dependent upon it. This is not based on substantial evidence. You assert that the trees that will be lost as a result of development "are typical of riparian vegetation and not unique to the area," but they are natural, unlike those immature trees that you will plant in the proposed Mitigation Area. We disagree with your assessment.

Threshold C: Would the Project substantially degrade the existing visual character or quality of the site and its surroundings? Again you claim the riparian feature is not "unique." We disagree, as it is to the area. The fact that development is occurring "as intended per the General Plan 2025, the Sycamore Canyon Business Park Specific Plan, and the Zoning Code," does not detract from this being a significant impact.

You provide sample views from the residences to the west and north once landscaping is "mature" but you do not specify how long that will take. We project ten years. At 5.1-25 the view from the residences to the north from the second story discloses that the Project will totally obstruct their view of the hills in the distance. You also do not include a photo rendering of how views from the Sycamore Canyon Wilderness Park will be affected.

You assert that the development "will not substantially degrade the existing visual character or quality of the Project site or its surroundings," because the Project is consistent with views to the east and south of other logistics warehouses, and will eliminate illegal dumping, but the Project will eliminate open space which offers expansive views to the homes to the north, and any illegal dumping is not visible from those homes especially based on the photos provided.

Mitigation Measure ("MM") AES 1 provides for an eight-foot tall decorative block wall between the Project site and the homes to the north and west. This will not be sufficiently high to screen views of the trucks. The same is true for AES 4.

Threshold D: Would the Project create a new source of substantial light or glare which would adversely affect day or nighttime views in the area? You say "the" potential impact associated with exterior lighting is spill light or light trespass but you go on to acknowledge that glare can also be an impact, though you do not evaluate it. You seem to be asserting that MM HAZ 4, which requires compliance with the Zoning Code and Riverside County Airport Land Use Commission conditions of approval, will reduce impacts to less than significant. We disagree with your conclusion as not based on substantial evidence. The Zoning Code, according to you, requires "that on-site lighting

be arranged so as to reflect away from the adjoining property or any public streets, and that lighting not be directed skyward or in a manner than [sic] interferes with aircraft operation." Whether or not the building lights are directed skyward or toward the adjacent properties, there will be significant spill light given that they will be mounted 34 and 32 feet up. You say this will be so "except along the north building wall where the lights will be lowered to a level to provide safety while not producing glow into the neighboring yards *to the maximum extent feasible*," which you do not define. This is a significant impact for the properties to the north of Building 2 which will only be 100 feet from the property line. And you haven't addressed the properties facing the western portion of Building 2, which will only be 138 feet east of the property line. Finally, you have not addressed glare or light spill from the parking lot lighting which will face the residences to the west. *Compare* Figure 3-10 *with* Figure 3.1-1, Surrounding Area. That lighting is proposed at the maximum height permissible under the Zoning Code, 20 feet.

Next you state that "Existing large-scale light industrial uses to the east and south of the Project site provide night lighting in the area, and also "street lights on roadways within the Sycamore Canyon Business Park, including Dan Kipper Drive and Lance Drive . . . as well as on roadways within the residential subdivisions north and northwest of the Project site provide an additional source of existing lighting," and that "As a result, lighting from the proposed Project would not result in a substantial source of new light or glare." We disagree strongly. The backyards of the houses to the north and northwest face the Project site. The new lights will be *substantially* higher and closer than anything they are experiencing now.

In short, we disagree with your conclusion that impacts to aesthetics, light and glare are less than significant with mitigation.

Concerning your MM's, MM AES 9 requires the "same elements" as used in the front elevation, including office areas, at every corner of Buildings 1 and 2. To the extent this calls for windows, those windows will create a source of daytime glare that was not evaluated, particularly from the western elevations of Buildings 1 and 2 when the sun is setting. MM HAZ 4 is solely addressed to hazards from or to the nearby March Air Reserve Base and only prevents lights from being directed upwards.

Land Use and Planning

You skip from section 5.1 to section 5.10. We're not sure why, but to the extent that yu are trying to demonstrate in Section 5.10 (Land Use) that the Project was pre-ordained, we beg to differ for the reasons stated earlier.

Here you seek a "minor" CUP to allow for a warehouse of greater than 400,000 square feet pursuant to Riverside Municipal Code 19.150 Base Zones Permitted Land Uses, which requires discretionary review to look at the Riverside Good Neighbor Guidelines as to compatibility. We disagree with any conclusion that the Project is consistent with the Good Neighbor Guidelines, particularly since you did not designate truck routes to avoid residential neighborhoods as they require.

You assert that the Project is consistent with the SCBPSP because it recommends the development of light industrial, distribution warehousing or product assembly. Either light industrial or product assembly uses would result in far less intensive air quality and other impacts to adjacent residents. The DEIR concedes the backyards along the northwest portion of the site will be 138 feet from Building 2 and accordingly they won't be much further from the loading docks at Buildings 1 and 2. Building 1 will have dock doors and truck exhaust directly facing the residences.

You fail to analyze the Good Neighbor Guidelines in the DEIR, relegating the discussion to an appendix. This violates CEQA. *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal. 4th 412.

Threshold A: Will the Project physically divide an established community? We believe the answer is yes. The development of the Project will eliminate pedestrian access between the Very Low Density Residential to the west and the Medium Density Residential to the north. You are effectively placing an industrial use between two residential neighborhoods.

Threshold B: Would the Project conflict with any applicable land use plan, policy or regulation . . . adopted for the purpose of avoiding or mitigating an environmental effect? Here, the answer is again yes, based on conflicts between the Good Neighbor Guidelines and the Project. Specifically, as noted above, you should have designated truck routes to avoid residential areas and did not. Further, your health risk assessment did not address background levels of DPM from existing distribution facilities in the vicinity, and if it had, it would have found a significant impact.

Noise

As predicted by local residents, local nighttime noise levels exceeded the 45 dBA nighttime residential noise standard "for all hours," at least at location LT1, and ranged from 51.0 dBA to 58.1 dBA.[2] This is almost certainly due to the existing distribution center uses in the vicinity. This situation would almost certainly be exacerbated by the Project. For location LT2 the nighttime residential noise standard of 45 dBA was exceeded at 10 pm and from 4 am to 7 am.

You report that noise levels for single family residences which the Project is adjacent to, are per the General Plan 2025:

- Normally Acceptable at up to 60 dBA CNEL/L_{dn}
- Conditionally Acceptable at 60-65 dBA CNEL/L_{dn}

[2] You write "It is important to note that there is an existing wooden fence along the residential property line at location LT1 and the noise meter was placed on the Project side of the property line; thus, the noise level on the residential side may be lower." It is unlikely that the noise level is lower due to a wooden fence and if so it would only be minimally lower. Also there is a drop from the residential properties to the Project site. Therefore the noise more than likely travels to the residences as there is no barrier to stop it, as the residents report from their direct experience.

- Normally Unacceptable at 65-70 dBA CNEL/L_{dn}
- Conditionally Unacceptable at 70 dBA CNEL/L_{dn}

Nuisance sound limits per the Municipal Code are 70 dBA for industrial anytime (exterior) and 45 dBA night or 55 dBA day for residential (exterior), although for *Code Enforcement* purposes, the City grants 5 dBA leeway for 15 or 30 minutes per hour, or 10 dBA for five minutes or 15 dBA for 1 minute in any hour, or 20 dBA for (apparently) an instantaneous noise.

You quote the Municipal Code Section 7.35.010(B) which makes it unlawful to load and unload from 10 pm to 7 am "in such a manner as to cause a noise disturbance across a residential property line," but then you promptly disregard this standard.

At 5.12-19 you actually suggest that the immature landscaping to the north of the Project site will limit sound traveling from the site to the residences. Then you state that the Project will be designed to allow for "right-in, right out" access so as to limit the amount of traffic coming from Dan Kipper Drive. This makes no sense, you would need left-in, right out to achieve this result.

Threshold A: Noise levels in excess of local General Plan or noise ordinance. You concede that construction noise will reach 80 dBA L_{eq} at residences to the north and northwest and in Sycamore Canyon Wilderness Park and that even with the placement of a 12 foot noise barrier the impacts will be significant and unavoidable. With regard to operational noise you state impacts will be less than significant except as to receptor numbers 3 and 4 where the noise will exceed the exterior noise nighttime standard of 45 dBA L_{eq}. As to these two receptors you propose placing sound barriers *on their property.* You then conclude noise inside the residences would be 35 dBA L_{eq}, but you do not address whether the 45 dBA outdoor standard would still be exceeded. You concede the impact is significant and unavoidable because you cannot assure the residents will accept the barriers.

You then assert the maximum permissible noise threshold is 75 dBA for daytime and 65 dBA for nighttime. You get there by using the Code Enforcement leeway of 20 dBA for an instantaneous noise of less than one minute. Since the operational noise will not be instantaneous you have misapplied the Municipal Code to the severe detriment of your residents. You then assert that the maximum noise from backup beepers is 55 dBA L_{max}. This is in excess of the 45 dBA outdoor noise standard for residences, but you misread the Municipal Code again to justify your result. We also disagree with your implicit assertion (where you say that noise will be 44 dBA indoors, which you say is OK relative to the 45 dBA standard) that the cited Municipal Code provision addresses *indoor* noise. And this conclusion is again based on the assumption that you can place the noise barriers on private property under MM NOI 16.

You then move on to trash compactors which the applicants apparently intend to have operating outside. The trash compactors would, you say, generate levels of 59 dBA and 62 dBA at the top of the slope to the west which you claim would be dampened by 10

dBA by the NOI 16 barriers. Again, you are presuming they can be placed there. And you again are relying on your misreading of the Code to allow for 65 dBA nighttime noise.

At 5.12-33 it appears from Figure 5.12-7 that you have modeled all of 1 backup beeper at the nearest dock from Building 2 to the west. This is not representative as there will likely be multiple backup beepers going at once, including from Building 1, which while further to the south is completely exposed to the residences to the west and has 72 loading docks.

At 5.12-34 you summarize. You nowhere address operational noise impacts to Sycamore Canyon Wilderness Park. There will be no sound barrier present to protect the Park.

Threshold B: Would the Project cause the exposure of persons to or the generation of excessive groundborne vibration or groundborne noise levels? Here you contend at 5.12-37 that "According to the FTA, buildings can be exposed to ground-borne vibration levels up to 0.5 PPV without experiencing structural damage. Additionally, the FTA has determined that individuals can experience vibration levels up to 80 VdB (RMS) before being adversely affected by vibration." We think this is a serious mischaracterization of what the FTA said. With respect to buildings, some buildings are far more fragile and can only toleraste 0.25 in/sec PPV (FTA 2006). With respect to human response, what the FTA said was that 80 VdB relative to 10^{-6} in/sec would result in residential annoyance for *infrequent* events, but that for frequent events (e.g., rapid transit, or here, vibration from construction) annoyance occurs at about 72-73 VdB. *See* Figure 7-3, Typical Levels of Ground-Borne Vibration, from *Transit Noise and Vibration Impact Assessment*, Chapter 7 (included as Attachment A).

You then assert that Table 5.12-I shows that heavy construction equipment will be perceptible but not annoying. The Table doesn't show this. To the extent that 87 RMS is VdB, that *would* be considered annoying. You then assert that the vibration would be attenuated at 40 feet and that "the majority" of the construction equipment would be operating at a distance of 40 or more feet away from the residences. Here you assert that the nearest residential structure is 14 feet from the property line. This conflicts with what you said in the Aesthetics section. If it is true there is no substantial evidence for your 40 foot figure, and you don't translate to VdB so we cannot evaluate your conclusions. Under *Vineyard* and other cases you need to establish the path from your analysis to your conclusions and you have not done that here.

Threshold C: Would the Project create a substantial permanent increase in ambient noise levels existing without the Project? Unbelievably, in this section, you claim that the ambient noise levels will go *down* from existing levels at all but two receptors, at one of which noise will remain the same and at one of which it will increase by 10 dBA CNEL. This is not at all credible. Since you acknowledge that the only noise mitigation measure is the noise barrier at the residences which you do not know that you can impose, there is no basis for concluding that the noise from a vacant field will be less

than the noise from two large 24/7 distribution center buildings with truck bays in the hundreds.

Next you claim that even as to the one receptor where noise will go up by 10 dBA, the mitigated noise levels would still be within the GP 2025 "Normally Acceptable" compatibility criteria for neighborhood parkland use. This isn't neighborhood parkland, and in any event, you earlier stated the threshold was whether there was a substantial increase in noise, measured as 5 dBA, which at least that one receptor will experience. Also, it appears you have not modeled the noisiest uses identified in the immediately preceding section: you state here that the "dominant operational noise will generally include noise associated with diesel truck engines, exhaust systems, braking and fork lifts," in other words, you did not apparently model (1) the backup beepers, (2) the trash compactors, or (3) the HVAC systems. But above all, you have not explained how you reached the implausible conclusion that noise levels from the site would be reduced.

Next you get into off-site noise, which you should have modeled with the on-site noise but did not.

Concerning your mitigation measures, MM NOI 8 purports to limit haul truck deliveries to the same hours as for construction equipment, but the hours for deliveries of construction equipment are nowhere specified.

Public Services

Your discussion of Fire Protection does not address the comments of residents that "emergency responders stationed at the firehouse on Sycamore Canyon Blvd. will be unable to exit their facility or quickly traverse Sycamore Canyon Blvd. when responding to an emergency." NOP at 48 of PDF document.

Recreation

At 5.15-1 you acknowledge there are nine categories of parks in the City including neighborhood parks and wilderness reserve parks. You then try to call Sycamore Canyon Wilderness Park a "reserve/open space park," which obfuscates its true role. Then you assert (at 5.15-6) SKR Management Plan and Conceptual Development Plan calls for either a masonry wall or a fence per Standard Detail No. 5520. We believe the Management Plan prefers a masonry wall, in part due to the noise issue, and we think a wall should be placed there.

You also indicate here that the access to the Park which was previously planned via Kangaroo Court would instead by provided by an extremely narrow fire lane delineated in Figure 3-11 Conceptual Landscape Plan. Figure 3-7B shows that Kangaroo Court was to be a paved 2-lane road whereas the fire lane looks to be less than one lane and gravel. Yu state at 5.14-1 there will be a less than significant impact regarding fire "because *some* fire access will be maintained via the proposed on-site trail and parking lot." This

doesn't address whether the fire access will be adequate, and access via that fire lane would be the only access for the entire east end of the Park.

Transportation and Traffic

Figure 5.16-5 Project Trip Distribution (Trucks – Outbound) discloses that you assume only 5% of the truck traffic will merge onto the I-215 and SR 60 at Fair Isle Drive while 45% will go northbound on I-215 from Eastridge Ave/Eucalyptus. This is a convenient assumption but we do not think it has a basis in reality as the residents have observed from existing truck traffic. Unless you prohibit access at Fair Isle Drive (which you should) there is nothing to prevent far higher numbers of trucks traversing a residential neighborhood via the Sycamore Canyon Blvd./Fair Isle Drive route. You display similar optimism at Figure 5.16-6 Project Trip Distribution (Trucks – Inbound). We also do not see a basis for your conclusion that 15% of trucks will go to/from Sycamore Canyon Blvd. as opposed to taking Eastridge Avenue to the I-215 south, but this has far less consequences to the most affected residents.

As noted earlier, you claim to have relied upon the ITE Trip Generation Manual 9th edition, but your numbers are at odds with those generated by the City of Moreno Valley. *See* NOP Comments, PDF at 24, projecting 1006 truck trips versus the 917 you identify. Also you should have disclosed the number of truck trips in your Transportation and Traffic section but you did not.

At 5.16-18 Table 5.16-E Trip Generation Rates has Peak Hour trip rates where the numbers do not add up for trucks. This may have led to underestimates for your air quality analysis.

Threshold A: Would the Project conflict with an applicable plan ordinance or policy establishing measures of effectiveness for the circulation system? We believe Table 5.16-J represents an underestimate as to intersections 1 (I-215 Northbound Ramps/Fair Isle Drive/Box Springs Road) and 2 (Sycamore Canyon Blvd./Fair Isle Drive) based on your failure to assign a truly representative number of trips to and from the Project site along this route.

At 5.16-08 you indicate that you identified cumulative projects in the City of Riverside and the City of Moreno Valley. Your failure to identify cumulative projects in unincorporated Riverside County is a major omission. We are aware of at least two distribution center projects that would show up on the cumulative projects map if you had bothered to include them: the Alessandro Commerce Centre (off Alessandro Blvd.) and the Freeway Business Center (between old 215 Frontage Road and the I-215). These projects are highly significant to both traffic and air quality and should have been included.

At 5.16-45 you concede that the Northbound Ramps for I-215 at Fair Isle Drive/Box Spring will be at LOS F under EAC and EAPC conditions and that this is significant. However, for the reasons stated above we believe you have underestimated this impact.

Regarding queuing, you concede that the number of trucks projected to arrive at Building 2 in the AM peak hour may result in queuing by three or four trucks outside the facility. This violates Strategy 1a of the Good Neighbor Guidelines, attached as Attachment B. You claim that this won't result in parking on nearby residential streets because there is designated parking on Sycamore Canyon Blvd. and portions of Box Springs Blvd., and commercial parking elsewhere would violate RMC 10.52.155(a). That doesn't mean it won't happen. It is likely the trucks will stop, and idle, on Dan Kipper Drive and Lance Drive, increasing the pollutant load to which nearby residents are exposed. To the extent they are discouraged from parking on Dan Kipper Drive, they may well park on residential streets. This is a significant impact.

Threshold E: Will the Project result in inadequate emergency access? You acknowledge here that the fire lane will only be 12 feet wide and made of gravel. This is extremely narrow for fire vehicle access. And again you did not address the issue of Fire Station egress raised by SHAG.

Utilities and Service Systems

Threshold D: Would the Project have sufficient water supplies available to serve the Project from existing entitlements and resources, or are new and expanded entitlements required? Here you concede the Project's projected demand is 100 afy and that this demand is "almost double" the planned development for the Project site estimated in Western's 2010 UWMP. Actually, it is over double. You claim nevertheless that it is consistent with the "overall projected increase in commercial water demand within Western's Riverside Retail Area as set forth in the 2010 UWMP." This does not mean Western will have enough water. The projected increase will happen anyway from Western's additional and existing customers.

You say Metropolitan's 2010 UWMP shows it "has supply capabilities to meet expanded demands from 2015 through 2035 under single dry-year and multiple dry-year conditions," however, you then say "Metropolitan's Condition 3 water supply allocation," which you don't identify, and Western's water use reductions represent a more severe shortage condition than what occurred under the single-year or multiple dry-year scenarios identified by Metropolitan's 2010 UWMP. You claim that Western has modeled potential cutbacks under Metropolitan's WSAP in the WSA and that this analysis is more stringent than that required by SB610. You don't specify how. Apparently Western looked at 10-20 % reductions in imported supply, but Western may well experience more than that, based on past experience and future potential conditions in the Bay Delta. You rely on Western to conclude that water supplies "are sufficient," but we believe you have to exercise your independent judgment on the evidence, and you don't have a substantial evidence basis for reaching your conclusion here.

Air Quality

First, as to your discussion of criteria air pollutants and health impacts, we do not think you have adequately acknowledged the significant health impacts from ozone as required under *Bakersfield Citizens for Local Control.* First of all, certainly there are relevant studies that postdate 1993, and those studies have shown that children face a greater risk of asthma. Second, you don't appear to note anywhere that EPA recently adopted a more stringent standard. Third, you haven't admitted that the Basin is expected to take more than 17 years to come into attainment status.

With respect to Toxic Air Contaminants ("TACs"), you concede there is no safe level for them. You claim that the South Coast Air Quality Management District's ("SCAQMD's") MATES-IV study disclosed a 16 percent reduction from that of MATES-III for the Project area, but you don't address whether MATES-IV evaluated emissions from the many new distribution centers in the area. Meanwhile, CARB has proposed a bright-line limit of not placing a distribution center within 1000 feet of a residential center, and you are disregarding this.

Table 5.3-B discloses there were 41 days in 2014 that the area violated the older, less stringent federal standard of 0.075 ppm; that number will go up independent of this Project now due to the new federal standard. With respect to PM_{10} there were 17 exceedances and with respect to $PM_{2.5}$ there were 5.

Concerning the Riverside General Plan 2025 you assert that the Project is consistent with the following policies and we disagree as follows:

- *Objective AQ-1: Adopt land use policies that site polluting facilities away from sensitive receptors and vice versa; improve jobs-housing balance; reduce vehicle miles travelled and length of work trips; and improve the flow of traffic*: Here you are not siting polluting facilities away from sensitive receptors and you are not improving the flow of traffic, at a minimum.
- *Policy AQ-1.8: Promote 'Job/Housing Opportunity Zones' and incentives to support . . . jobs in housing-rich areas, <u>where the jobs are located an nonpolluting or extremely low-polluting entities:</u>* You are not following the underlined mandate here, at all.
- *Policy AQ-2.11: Develop ways to incorporate the "Good Neighbor Guidelines for Siting New and/or Modified Warehouse Distribution Facilities" into the Development Review process and Citywide air quality education programs:* You have ignored the Good Neighbor Guidelines with this development.

The Riverside Good Neighbor Guidelines come next.

- *Goal 1: Minimize exposure to diesel emissions to neighbors that are situated in close proximity to the warehouse/distribution center.* You could consider viable alternatives to a distribution center for the site, but you don't. The heavy manufacturing use you posit would, we believe, require a zone change.
- *Strategy 1a:* We already established you have violated Strategy 1a.

- *Strategy 1b: To the extent possible, locate driveways, loading docks, and internal circulation routes away from residential uses.* You could have located the loading docks to face onto Lance Drive only.
- *Strategy 1c* requires a health risk assessment when truck traffic areas of an industrial project are located within 1000 feet of sensitive receptors; your health risk assessment should have addressed impacts from the many other distribution centers in the vicinity as well as this one; it did not.
- *Goal 2, [which you skip but we've included] Eliminate diesel trucks from unnecessarily traveling through residential neighborhoods* – you haven't done this; instead you generated an overly optimistic traffic analysis that assumes only 5% of trucks will enter/exit the I-215 at Fair Isle Drive even though it is the most expeditious exit point for southbound traffic. Particularly since you project so few trucks will use the route it would have been easy to prohibit it.
- *Strategy 2a:* Same.
- *Strategy 2d: Require warehouse/distribution centers to provide signage or flyers that advise truck drivers of the closest restaurants [and] fueling stations.* You could have required food and fueling options on site, particularly since the site is so large. This would have prevented trucks from traversing the neighborhoods.
- *Goal 3: Eliminate trucks from using residential areas and repairing vehicles on the streets.* You have included no enforceable commitment here.

At 5.3-17 you note that CARB's Diesel Risk Reduction Program provides that by 2023 nearly all trucks and buses will need to have 2010 model year engines or the equivalent. You ignore that the City and this facility could require compliance with this mandate earlier.

Then you address the CARB Air Quality and Land Use Handbook, which should be a part of the administrative record for this Project since you have referred to it. It suggests prohibiting distribution centers within 1000 feet of residential neighborhoods. You reject this, asserting "These are recommendations, not mandates, and land use decisions will ultimately lie with the local agency which needs to balance other considerations." You are ignoring both the CARB Handbook and your own General Plan in rushing this Project through.

Threshold B: Would the Project violate any air quality standard or contribute substantially to an existing or projected air quality violation? With respect to operations you concede impacts would be significant at 339.39 lbs/day of NO_x emitted versus a daily threshold of 55 pounds. With respect to CO hotspots, you claim that there would have to be traffic like that at Veteran Avenue and Wilshire with an average daily vehicle count of 100,000 or more for there to be a CO violation. This depends on the relative emissions of trucks versus cars, which you have not addressed.

Threshold C: Would the Project result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is nonattainment? You acknowledge this impact as significant based solely on the individual Project's NO_x emissions.

Regarding cumulative impacts, you rely on SCAQMD guidance to conclude that cumulative impacts are not exceeded because the Project does not exceed project-specific thresholds. We do not believe it is appropriate to rely on the SCAQMD guidance as it flies in the face of multiple CEQA Guidelines as well as Pub. Resources Code §21083(b)(2). *See* Guidelines §§ 15130(a), 15064(h)(1), 15065(a)(3), 15355(b). CEQA does not excuse an EIR from evaluating cumulative impacts simply because the project-specific analysis determined its impacts would be less than significant. Gordon & Herson, "Demystifying CEQA's Cumulative Impact Analysis Requirements: Guidance for Defensible EIR Evaluation," *Cal. Env't'l. L. Reporter* 379, 381 (Sept. 2011)(Vol. 2011, Issue 9) (Attachment B).

Threshold D: Would the Project expose sensitive receptors to substantial pollutant concentrations? Here at 5.3-32 you claim your methodology was to split the site up into "eight equal areas of 36,100 square meters . . . each and the average (composite) distances from the centroids of the corresponding volume sources to the nearest residential and worker receptors were determined." If we understand this correctly, you assigned equal amounts of pollutants throughout the site. This is not proper as the pollution will be coming from the docks to the south side of Building 2 and the west side of Building 1 toward the residences to the west. We believe this would result in significant underestimates of exposure as it disperses pollution throughout the site in a way that does not fit with the reality of what will occur.

We also think it is counterintuitive and unlikely that the MICR for construction would be greater than that from operation, and this suggests an error in your modeling.

Biological Resources

It is apparent from your discussion that you did not survey for the SKR, even though the Project site is adjacent to a reserve for this species. Thus, there could well be and likely are SKR on the site that will be killed by the Project, and you have made no plans for their removal to avoid this.

You assert that the DBESP finds that the future drainage is "superior" to the present one because it will continue to convey runoff from the residential areas to the northwest of the Project site, because it will be planted with native riparian and riparian scrub habitat, because it will "meander like a naturally occurring drainage," and because it will supposedly provide better nesting habitat for birds. We find most of these assertions to be doubtful and in any event not convincing grounds for determining that the new, narrow drainage to be placed on a thin strip to the west of a massive trucking facility is going to be "superior" to the naturally occurring blue-line stream that exists now.

Threshold A: Will the Project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies or regulations or by the CDFW or USFWS? The answer is almost certainly yes as to the SKR and the San Diego black-tailed jackrabbit. Both species should be trapped and relocated.

We also disagree that you have fully mitigated regarding the burrowing owl and nesting birds, as discussed when we get to your mitigation measures.

Threshold B: Would the Project have a substantial adverse effect on any riparian habitat or other sensitive natural community? We note that you plan for a Habitat Mitigation & Monitoring Program which is not included with the documents for the DEIR. This excludes the public from meaningful review under CEQA. We do not see how the DBESP can determine that the created habitat will be superior in the absence of this HMMP.

Threshold D: Would the Project interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors? Here you state "Because the site was not contemplated for conservation (i.e., not a Criteria Cell) the Project site is not intended to be a link between the Sycamore Canyon Wilderness Park and the Box Springs Mountains." Whether it is *intended* to be such a linkage is not the issue. The fact that it may be functioning as such a link is substantiated by the presence of a willow flycatcher and a golden eagle on the site when the Project's consultants happened to be looking.

Threshold E: Would the Project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? You claim here the Project is consistent with Objective LU-7 of the General Plan 2025 "Preserve and protect significant areas of native wildlife and plant habitat, *including endangered species*." We disagree. You haven't surveyed for the SKR and don't plan to.

Threshold F: Would the Project conflict with the provisions of an adopted HCP or NCCP? Here you assert the Project will comply with Sections 6.1.2, 6.1.3, 6.1.4, 6.3.2, Appendix C, and Section 7.5.3 of the MSHCP. In at least a couple of instances we disagree with you.

First with regard to Section 6.1.2, you assert that you surveyed for the least Bell's vireo ("LBV") the southwestern willow flycatcher ("SWFL") and the western yellow-billed cuckoo. You did not. The applicants surveyed for the LBV *only*. For that matter, even though there were no protocol level surveys for the other species, the biologist did note a willow flycatcher which he could not identify which was likely a SWFL. With respect to the yellow-billed cuckoo the consultants merely stated that it was "not incidentally detected." These are not protocol-level surveys, and Section 6.1.2 clearly calls for focused surveys for *each species:* "If the mapping noted above identifies suitable Habitat for the species listed below, and the proposed project design does not incorporate avoidance of the identified Habitat, *focused surveys for <u>those</u> species shall be conducted.*" The species identified are the SWFL, the LBV, and the western yellow-billed cuckoo. *See* MSHCP, Section 6.1.2, Final MSHCP, Volume 1, Section 6 at 6-23. This document should be a part of the administrative record on this Project since you are citing to it.

Next you say "None of the Section 6.1.2 riparian bird species were found to be occupying the site." First of all, as noted above, you didn't look properly, and second, it appears you may well have identified a SWFL.

Next with regard to Section 6.1.4, Guidelines Pertaining to the Urban/Wildlands Interface, you present Table 5.4-B. As discussed in our own table, we don't believe you have complied:

Avoid discharge of untreated runoff from developed and paved areas into the MSHCP Conservation Area	You say in the "post-Project condition, runoff will leave the Project site via a storm drain" and that it will ultimately enter into the Sycamore Canyon Wilderness Park after going through an "existing water quality basin." (1) It's not clear that you have done anything to prevent incidental runoff from the paved portions on the western part of the site from running into the Mitigation Area, and (2) You have included no provisions of which you speak here for reducing the toxic load from the site going into the water quality basin.
"Land uses proposed in proximity to the MSHCP Conservation Area that use chemicals *or* generate bioproducts such as manure that are potentially toxic or may adversely affect wildlife species" are addressed. Applicants are to "incorporate measures to ensure that application of such chemicals does not result in discharge to the MSHCP Conservation Area."	First, there is apparently no prohibition on the use of pesticides on the landscaping, which would be of concern here. And you have not addressed the toxic load to runoff from the site as addressed above.
"Night lighting shall be directed away from the MSHCP Conservation Area to protect species within the MSHCP Conservation Area from direct night lighting."	You claim the lighting will be directed away from the Park but then you acknowledge that Building 1's lights will be 34 feet up and Building 2's 32 feet up. This effectively acknowledges there will be glow going into the Park. We will address this further immediately below this Table.
"Proposed noise generating land uses affecting the MSHCP Conservation Area shall incorporate setbacks, berms or walls to minimize the effects of noise on MSHCP Conservation Area resources . . . For	You claim that once the Project is completed, it "will include walls surrounding the truck yards and loading/docking areas." With respect to the actual interface between the Park and

planning purposes, wildlife in the MSHCP Conservation Area *should not be subject to noise that would exceed residential noise standards*."	the Project site, however, there will be no wall, but only a fence, made of wrought iron. This obviously will provide *no sound barrier at all.*[3]

The impacts of light pollution on species within the Park can be significant. Light pollution is a major problem which can significantly confuse migratory birds and otherwise disrupt wildlife foraging and breeding. *See e.g.*, CNN, "Light Pollution Threatens National Park," 1999. "The cumulative effects of behavioral changes induced by artificial night lighting on competition and predation have the potential to disrupt key ecosystem functions." Longcore & Rich, 2004. Many bird species fly at night and have evolved to migrate in the dark aided by star and moonlight, which will be blocked by artificial light sources. Birds can be attracted to lit structures, including streetlights, and can become disoriented. American Bird Conservancy, 2008. Disorientation often results in collisions with lit structures. *Id.* Bird species can also become entrapped in lit areas, refusing to move for the night, increasing their risk of predation. Longcore & Rich.

Particularly with regard to the SKR, the risk of predation from artificial light is an issue. COSEWIC 2006.

Light pollution need not be extensive to have a major impact on wildlife. Longcore & Rich found that desert rodents reduced foraging activity when exposed to a single camp lantern. And artificial lights over 100 miles away could still affect wildlife. CNN.

At 5.4-30 you begin discussing mitigation measures. MM BIO 1 proposes to mitigate impacts to nesting birds. Birds nest from January 1 through September 15, surveys February 1 through August 31 are not sufficient to protect them. *See* Attachments C1, C2, and C3. MM BIO 2 calls for passive relocation of the burrowing owl if it is found outside the nesting season. The DEIR should specify compliance with the 2012 CDFW Burrowing Owl Staff Report to the extent they are found present during the nesting season. MM BIO 3 calls for a HMMP to be developed and approved by USFWS and CDFW prior to grading. It should have been included with the DEIR. MM BIO 4 calls for a conservation easement but you say only "to an approved mitigation entity." The entity should be approved by CDFW pursuant to Gov. Code Section 65967. CDFW has only approved those entities listed at https://www.wildlife.ca.gov/Conservation/CESA/Endowments. MM BIO 5 calls for approval from regulatory agencies prior to disturbance of jurisdictional waters. That approval *must* (not may) come from CDFW, RWQCB and USACE. The mitigation must come from the applicant, not the agencies. MM BIO 6 makes no sense unless there is also provision for trapping and release of SKR offsite.

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[3] To the extent that the fence represents a preference by the Riverside Parks Dept. based on graffiti concerns those concerns should not hold sway over the very real risk to the SKR and other species from excessive sound.

Cultural Resources

Here you assert that no written comments were received regarding Cultural Resources. This is false. You received an extensive comment letter from the Pechanga Tribe. *See* Appendix A, PDF at 33-39.

Several tribes expressed interest in the site, requesting consultation and monitoring. The Pechanga and the Soboba in particular asserted cogently that the site contained Tribal Cultural Resources, *see* DEIR at 5.5-32 (requesting full avoidance). The City is apparently rejecting these claims on the ground that the integrity of setting has been disturbed by the development of other logistics warehouses in the area. The City should not be able to escape its responsibilities by looking to its past actions inconsistent with these resources. We disagree with your conclusions that there were no significant impacts to identify and that you have reduced these impacts to less than significant.

Greenhouse Gas Emissions

Your GHG analysis is inadequate on several fronts. First of all, you don't use the CEQA Appendix G thresholds. Second, you fail to measure the significant GHGs you identify against a quantitative threshold, when the emissions you identify, a minimum of 25,509.10 $MTCO_2e$ would be significant via any metric you could choose: whether it is the SCAQMD threshold for its own industrial projects of 10,000 $MTCO_2e$ or the far more appropriate 3,000 $MTCO_2e$ for land use projects. You reject the standard adopted in Executive Order B-30-15 even though it was well on its way to becoming the law (in S.B. 32) when you issued the DEIR, and it is the law now. You apply a CEQA Guideline, Section 15083.5, which to our knowledge does not exist. You conduct a BAU scenario in a manner that the California Supreme Court amended its *Newhall Ranch* decision to specifically reject. Finally, you project a reduction in emissions from "vegetation change" based on trees you are adding though we do not think you are accounting for the vegetation you are removing. You say you have reduced emissions based on factors you can't quantify in CalEEMod when the factors you can quantify show substantial emissions. The DEIR is not based on substantial evidence and should be substantially revised and recirculated to address these flaws.

We look forward to your responses. Should you choose to prepare one, please notify us of the availability of a Final Environmental Impact Report when it becomes available at collins@blumcollins.com and bentley@blumcollins.com. Thank you.

Sincerely,

Craig M. Collins

attachments: A-C3

7. BASIC GROUND-BORNE VIBRATION CONCEPTS

Ground-borne vibration can be a serious concern for nearby neighbors of a transit system route or maintenance facility, causing buildings to shake and rumbling sounds to be heard. In contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of ground-borne vibration are trains, buses on rough roads, and construction activities such as blasting, pile-driving and operating heavy earth-moving equipment.

The effects of ground-borne vibration include feelable movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for normal transportation projects, with the occasional exception of blasting and pile-driving during construction. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings.

The basic concepts of ground-borne vibration are illustrated for a rail system in Figure 7-1. The train wheels rolling on the rails create vibration energy that is transmitted through the track support system into the transit structure. The amount of energy that is transmitted into the transit structure is strongly dependent on factors such as how smooth the wheels and rails are and the resonance frequencies of the vehicle suspension system and the track support system. These systems, like all mechanical systems, have resonances which result in increased vibration response at certain frequencies, called natural frequencies.

The vibration of the transit structure excites the adjacent ground, creating vibration waves that propagate through the various soil and rock strata to the foundations of nearby buildings. The vibration propagates from the foundation throughout the remainder of the building structure. The maximum vibration amplitudes of the floors and walls of a building often will be at the resonance frequencies of various components of the building.

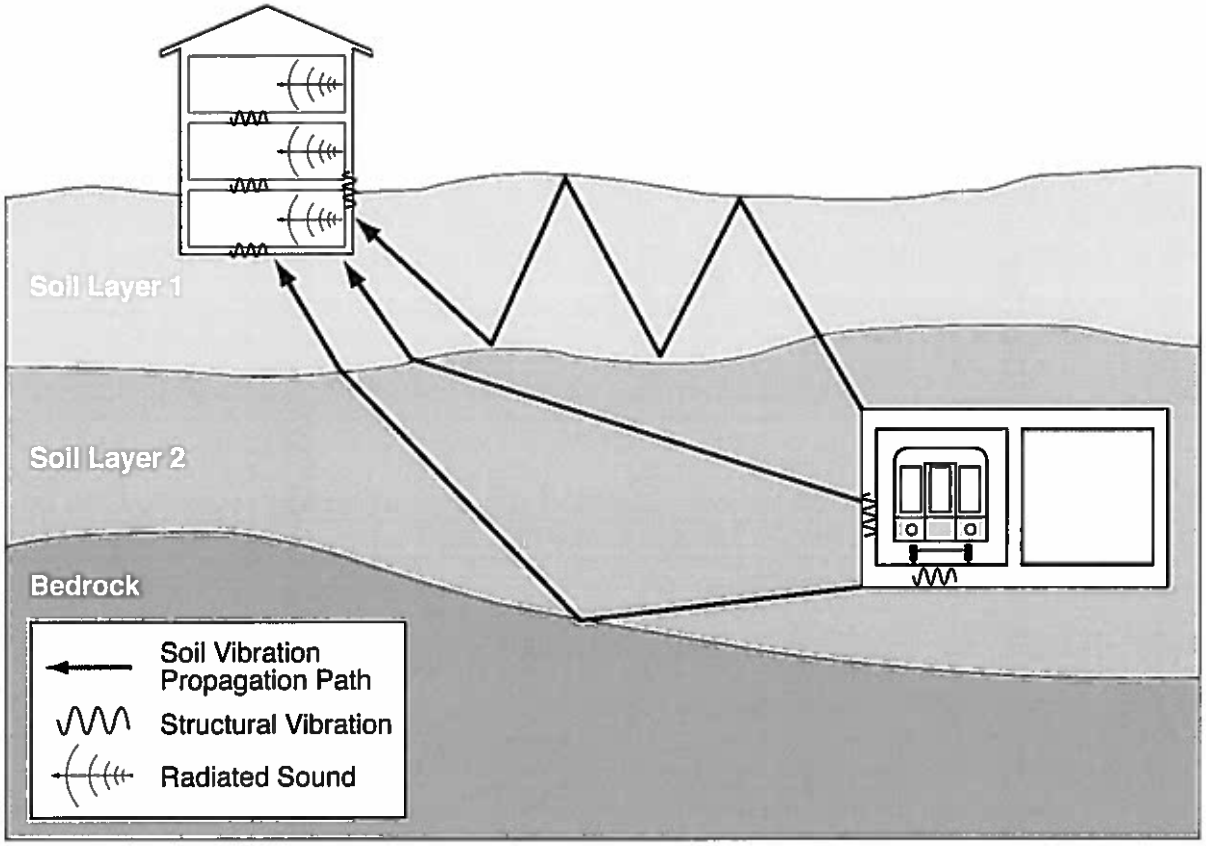


Figure 7-1. Propagation of Ground-Borne Vibration into Buildings

The vibration of floors and walls may cause perceptible vibration, rattling of items such as windows or dishes on shelves, or a rumble noise. The rumble is the noise radiated from the motion of the room surfaces. In essence, the room surfaces act like a giant loudspeaker causing what is called ground-borne noise.

Ground-borne vibration is almost never annoying to people who are outdoors. Although the motion of the ground may be perceived, without the effects associated with the shaking of a building, the motion does not provoke the same adverse human reaction. In addition, the rumble noise that usually accompanies the building vibration is perceptible only inside buildings.

7.1 DESCRIPTORS OF GROUND-BORNE VIBRATION AND NOISE

7.1.1 Vibratory Motion

Vibration is an oscillatory motion which can be described in terms of the displacement, velocity, or acceleration. Because the motion is oscillatory, there is no net movement of the vibration element and the average of any of the motion descriptors is zero. Displacement is the easiest descriptor to understand. For a vibrating floor, the displacement is simply the distance that a point on the floor moves away from its static position. The velocity represents the instantaneous speed of the floor movement and acceleration is the rate of change of the speed.

Although displacement is easier to understand than velocity or acceleration, it is rarely used for describing ground-borne vibration. Most transducers used for measuring ground-borne vibration use either velocity or acceleration. Furthermore, the response of humans, buildings, and equipment to vibration is more accurately described using velocity or acceleration.

7.1.2 Amplitude Descriptors

Vibration consists of rapidly fluctuating motions with an average motion of zero. Several descriptors can be used to quantify vibration amplitude, three of which are shown in Figure 7-2. The raw signal is the lighter-weight curve in the top graph. This curve shows the instantaneous vibration velocity which fluctuates positive and negative about the zero point. The peak particle velocity (PPV) is defined as the maximum instantaneous positive or negative peak of the vibration signal. PPV is often used in monitoring of blasting vibration since it is related to the stresses that are experienced by buildings.

Although peak particle velocity is appropriate for evaluating the potential of building damage, it is not suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to an average vibration amplitude. Because the net average of a vibration signal is zero, the root mean square (rms) amplitude is used to describe the "smoothed" vibration amplitude. The root mean square of a signal is the square root of the average of the squared amplitude of the signal. The average is typically calculated over a one-second period. The rms amplitude is shown superimposed

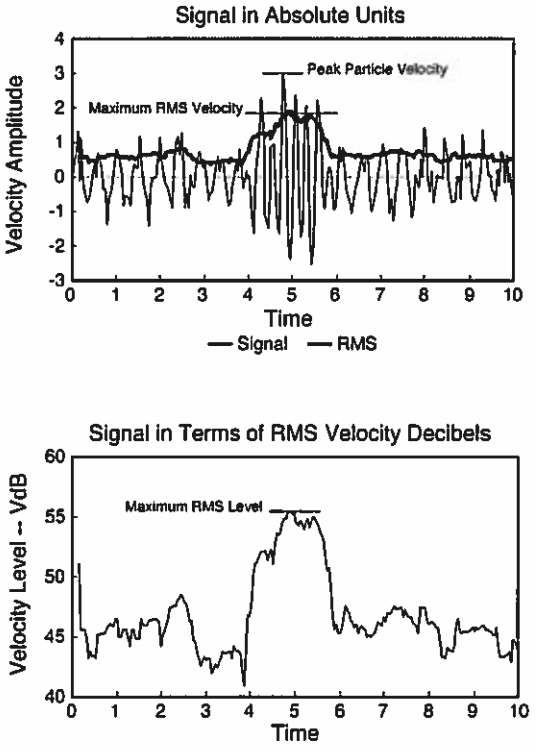


Figure 7-2. Different Methods of Describing a Vibration Signal

on the vibration signal in Figure 7-2. The rms amplitude is always less than the PPV* and is always positive.

The PPV and rms velocity are normally described in inches per second in the USA and meters per second in the rest of the world. Although it is not universally accepted, decibel notation is in common use for vibration.

Decibel notation acts to compress the range of numbers required to describe vibration. The bottom graph in Figure 7-2 shows the rms curve of the top graph expressed in decibels. Vibration velocity level in decibels is defined as:

$$L_v = 20 \times \log_{10}\left(\frac{v}{v_{ref}}\right)$$

where "L_v" is the velocity level in decibels, "v" is the rms velocity amplitude, and "v_{ref}" is the reference velocity amplitude. A reference must always be specified whenever a quantity is expressed in terms of decibels. The accepted reference quantities for vibration velocity are $1x10^{-6}$ inches/second in the USA and either $1x10^{-8}$ meters/second or $5x10^{-8}$ meters/second in the rest of the world. Because of the variations in the reference quantities, it is important to be clear about what reference quantity is being used whenever velocity levels are specified. *All vibration levels in this manual are referenced to $1x10^{-6}$ in./sec.* Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

7.1.3 Ground-Borne Noise

As discussed above, the rumbling sound caused by the vibration of room surfaces is called ground-borne noise. The annoyance potential of ground-borne noise is usually characterized with the A-weighted sound level. Although the A-weighted level is almost the only metric used to characterize community noise, there are potential problems when characterizing low-frequency noise using A-weighting. This is because of the non-linearity of human hearing which causes sounds dominated by low-frequency components to seem louder than broadband sounds that have the same A-weighted level. The result is that ground-borne noise with a level of 40 dBA sounds louder than 40 dBA broadband noise. This is accounted for by setting the limits for ground-borne noise lower than would be the case for broadband noise.

*The ratio of PPV to maximum rms amplitude is defined as the **crest factor** for the signal. The crest factor is always greater than 1.71, although a crest factor of 8 or more is not unusual for impulsive signals. For ground-borne vibration from trains, the crest factor is usually 4 to 5.

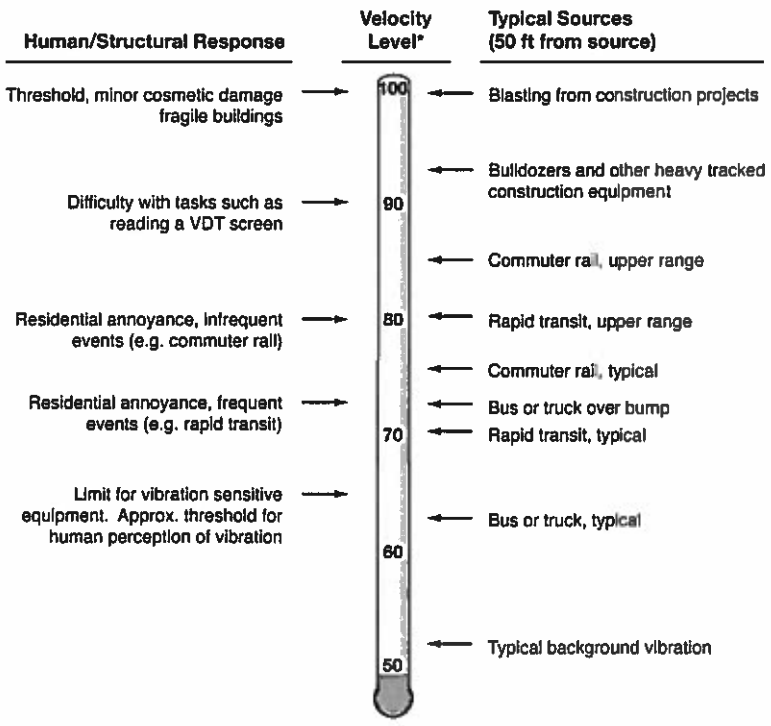
7.2 HUMAN PERCEPTION OF GROUND-BORNE VIBRATION AND NOISE

This section gives some general background on human response to different levels of building vibration, laying the groundwork for the criteria for ground-borne vibration and noise that are presented in Chapter 8.

7.2.1 Typical Levels of Ground-Borne Vibration and Noise

In contrast to airborne noise, ground-borne vibration is not a phenomenon that most people experience every day. The background vibration velocity level in residential areas is usually 50 VdB or lower, well below the threshold of perception for humans which is around 65 VdB. Most perceptible indoor vibration is caused by sources within buildings such as operation of mechanical equipment, movement of people or slamming of doors. Typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is smooth, the vibration from traffic is rarely perceptible.

Figure 7-3 illustrates common vibration sources and the human and structural response to ground-borne vibration. The range of interest is from approximately 50 VdB to 100 VdB. Background vibration is usually well below the threshold of human perception and is of concern only when the vibration affects very sensitive manufacturing or research equipment. Electron microscopes and high-resolution lithography equipment are typical of equipment that is highly sensitive to vibration.



** RMS Vibration Velocity Level in VdB relative to 10^{-6} inches/second*

Figure 7-3. Typical Levels of Ground-Borne Vibration

Although the perceptibility threshold is about 65 VdB, human response to vibration is not usually significant unless the vibration exceeds 70 VdB. Rapid transit or light rail systems typically generate vibration levels of 70 VdB or more near their tracks. On the other hand, buses and trucks rarely create vibration that exceeds 70 VdB unless there are bumps in the road. Because of the heavy locomotives on diesel commuter rail systems, the vibration levels average about 5 to 10 decibels higher than rail transit vehicles. If there is unusually rough road or track, wheel flats, geologic conditions that promote efficient propagation of vibration, or vehicles with very stiff suspension systems, the vibration levels from any source can be 10 decibels higher than typical. Hence, at 50 feet, the upper range for rapid transit vibration is around 80 VdB and the high range for commuter rail vibration is 85 VdB. If the vibration level in a residence reaches 85 VdB, most people will be strongly annoyed by the vibration.

The relationship between ground-borne vibration and ground-borne noise depends on the frequency content of the vibration and the acoustical absorption of the receiving room. The more acoustical absorption in the room, the lower will be the noise level. For a room with average acoustical absorption, the unweighted sound pressure level is approximately equal to the average vibration velocity level of the room surfaces.* Hence, the A-weighted level of ground-borne noise can be estimated by applying A-weighting to the vibration velocity spectrum. Since the A-weighting at 31.5 Hz is -39.4 dB, if the vibration spectrum peaks at 30 Hz, the A-weighted sound level will be approximately 40 decibels lower than the velocity level. Correspondingly, if the vibration spectrum peaks at 60 Hz, the A-weighted sound level will be about 25 decibels lower than the velocity level.

7.2.2 Quantifying Human Response to Ground-Borne Vibration and Noise

One of the major problems in developing suitable criteria for ground-borne vibration is that there has been relatively little research into human response to vibration, in particular, human annoyance with building vibration. The American National Standards Institute (ANSI) developed criteria for evaluation of human exposure to vibration in buildings in 1983[1] and the International Organization for Standardization (ISO) adopted similar criteria in 1989[2] and revised them in 2003 [3]. The 2003 version of ISO 2361-2 acknowledges that "human response to vibration in buildings is very complex." It further indicates that the degree of annoyance can not always be explained by the magnitude of the vibration alone. In some cases the complaints are associated with measured vibration that is lower than the perception threshold. Other phenomena such as ground-borne noise, rattling, visual effects such as movement of hanging objects, and time of day (e.g., late at night) all play some role in the response of individuals. To understand and evaluate human response, which is often measured by complaints, all of these related effects need to be considered. The available data documenting real world experience with these phenomena is still relatively sparse. Experience with U.S. rapid transit projects represents a good foundation for developing suitable limits for residential exposure to ground-borne vibration and noise from transit operations.

*The sound level approximately equals the average vibration velocity level *only* when the velocity level is referenced to 1 micro-inch/second. When velocity level is expressed using the international standard of 1×10^{-8} m/sec, the sound level is approximately 8 decibels lower than the average velocity level.

Figure 7-4 illustrates the relationship between the vibration velocity level measured in 22 homes and the general response of the occupants to the vibration. The data shown were assembled from measurements performed for several transit systems along with subjective ratings by the researchers and residents. These data were previously published in the "State-of-the-Art Review of Ground-borne Noise and Vibration."[4] Both the occupants and the people who performed the measurements agreed that floor vibration in the "Distinctly Perceptible" category was unacceptable for a residence. The data in Figure 7-4 indicate that residential vibration exceeding 75 VdB is unacceptable for a repetitive vibration source such as rapid transit trains that pass every 5 to 15 minutes. Also shown in Figure 7-4 is a curve showing the percent of people annoyed by vibration from high-speed trains in Japan.[5] The scale for the percent annoyed is on the right-hand axis of the graph. The results of the Japanese study confirm the conclusion that at a vibration velocity level of 75 to 80 VdB, many people will find the vibration annoying.

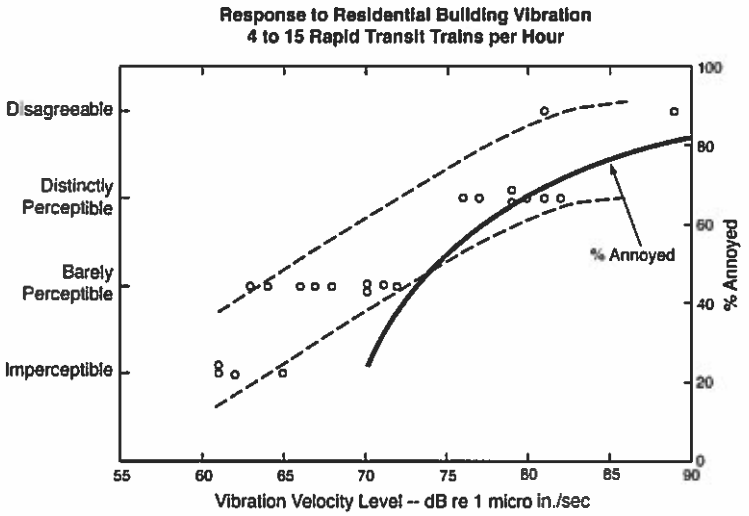


Figure 7-4. Response to Transit-induced Residential Vibration

Table 7-1 describes the human response to different levels of ground-borne noise and vibration. The first column is the vibration velocity level, and the next two columns are for the corresponding noise level assuming that the vibration spectrum peaks at 30 Hz or 60 Hz. As discussed above, the A-weighted noise level will be approximately 40 dB less than the vibration velocity level if the spectrum peak is around 30 Hz, and 25 dB lower if the spectrum peak is around 60 Hz. Table 7-1 illustrates that achieving either the acceptable vibration or acceptable noise levels does not guarantee that the other will be acceptable. For example, the noise caused by vibrating structural components may be very annoying even though the vibration cannot be felt. Alternatively, a low-frequency vibration could be annoying while the ground-borne noise level it generates is acceptable.

Table 7-1. Human Response to Different Levels of Ground-Borne Noise and Vibration			
Vib. Velocity Level	Noise Level		Human Response
	Low Freq1	Mid Freq2	
65 VdB	25 dBA	40 dBA	Approximate threshold of perception for many humans. Low-frequency sound usually inaudible, mid-frequency sound excessive for quiet sleeping areas.
75 VdB	35 dBA	50 dBA	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find transit vibration at this level annoying. Low-frequency noise acceptable for sleeping areas, mid-frequency noise annoying in most quiet occupied areas.
85 VdB	45 dBA	60 dBA	Vibration acceptable only if there are an infrequent number of events per day. Low-frequency noise annoying for sleeping areas, mid-frequency noise annoying even for infrequent events with institutional land uses such as schools and churches.
Notes: 1. Approximate noise level when vibration spectrum peak is near 30 Hz. 2. Approximate noise level when vibration spectrum peak is near 60 Hz.			

7.3 GROUND-BORNE VIBRATION FOR DIFFERENT TRANSIT MODES

This section provides a brief discussion of typical problems with ground-borne vibration and noise for different modes of transit.

- **Steel-Wheel Urban Rail Transit:** This category includes both heavy rail transit and light rail transit. Heavy rail is generally defined as electrified rapid transit trains with dedicated guideway, and light rail as electrified transit trains that do not require dedicated guideway. The ground-borne vibration characteristics of heavy and light rail vehicles are very similar since they have similar suspension systems and axle loads. Most of the studies of ground-borne vibration in this country have focused on urban rail transit. Problems with ground-borne vibration and noise are common when there is less than 50 feet between a subway structure and building foundations. Whether the problem will be perceptible vibration or audible noise is strongly dependent on local geology and the structural details of the building. Complaints about ground-borne vibration from surface track are more common than complaints about ground-borne noise. A significant percentage of complaints about both ground-borne vibration and noise can be attributed to the proximity of special trackwork, rough or corrugated track, or wheel flats.

- **Commuter and Intercity Passenger Trains:** This category includes passenger trains powered by either diesel or electric locomotives. In terms of vibration effects at a single location, the major difference between commuter and intercity passenger trains is that the latter are on a less frequent schedule. Both often share track with freight trains, which have quite different vibration characteristics as discussed below. The locomotives usually create the highest vibration levels. There is the potential of vibration-related problems anytime that new commuter or intercity rail passenger service is introduced in an urban or suburban area.

- **High-Speed Passenger Trains:** High-speed passenger trains have the potential of creating high levels of ground-borne vibration. Ground-borne vibration should be anticipated as one of the major environmental impacts of any high-speed train located in an urban or suburban area. The Amtrak trains on the Northeast Corridor between Boston and Washington, D.C., which attain moderate to high speeds in some sections with improved track, fit into this category.

- **Freight Trains:** Local and long-distance freight trains are similar in that they both are diesel-powered and have the same types of cars. They differ in their overall length, number and size of locomotives, and number of heavily loaded cars. Locomotives and rail cars with wheel flats are the sources of the highest vibration levels. Because locomotive suspensions are similar, the maximum vibration levels of local and long-distance freights are similar. It is not uncommon for freight trains to be the source of intrusive ground-borne vibration. Most railroad tracks used for freight lines were in existence for many years before the affected residential areas were developed. Vibration from freight trains can be a consideration for FTA-assisted projects when a new transit line will share an existing freight train right-of-way. Relocating the freight tracks within the right-of-way to make room for the transit tracks must be considered a direct impact of the transit system which must be evaluated as part of the proposed project. However, vibration mitigation is very difficult to implement on tracks where trains with heavy axle loads will be operating.

- **Automated Guideway Transit Systems (AGT):** This transit mode encompasses a wide range of transportation vehicles providing local circulation in downtown areas, airports and theme parks. In general, ground-borne vibration can be expected to be generated by steel-wheel/steel-rail systems even when limited in size. Because AGT systems normally operate at low speeds, have lightweight vehicles, and rarely operate in vibration-sensitive areas, ground-borne vibration problems are very rare.

- **Bus Projects:** Because the rubber tires and suspension systems of buses provide vibration isolation, it is unusual for buses to cause ground-borne noise or vibration problems. When buses cause effects such as rattling of windows, the source is almost always airborne noise. Most problems with bus-related vibration can be directly related to a pothole, bump, expansion joint, or other discontinuity in the road surface. Smoothing the bump or filling the pothole will usually solve the problem. Problems are likely when buses will be operating inside buildings. Intrusive building vibration can be caused by sudden loading of a building slab by a heavy moving vehicle or by vehicles running over lane divider bumps. A bus transfer station with commercial office space in the same building may have annoying vibration within the office space caused by bus operations.

7.4 FACTORS THAT INFLUENCE GROUND-BORNE VIBRATION AND NOISE

One of the major problems in developing accurate estimates of ground-borne vibration is the large number of factors that can influence the levels at the receiver position. This section gives a general appreciation of which factors have significant effects on the levels of ground-borne vibration. Table 7-2 is a summary of some of the many factors that are known to have, or are suspected of having, a significant influence on the levels of ground-borne vibration and noise. As indicated, the physical parameters of the transit facility, the geology, and the receiving building all influence the vibration levels. The important physical parameters can be divided into the following four categories:

- **Operational and Vehicle Factors:** This category includes all of the parameters that relate to the vehicle and operation of the trains. Factors such as high speed, stiff primary suspensions on the vehicle, and flat or worn wheels will increase the possibility of problems from ground-borne vibration.
- **Guideway:** The type and condition of the rails, the type of guideway, the rail support system, and the mass and stiffness of the guideway structure will all have an influence on the level of ground-borne vibration. Jointed rail, worn rail, and wheel impacts at special trackwork can all cause substantial increases in ground-borne vibration. A rail system guideway will be either subway, at-grade, or elevated. It is rare for ground-borne vibration to be a problem with elevated railways except when guideway supports are located within 50 feet of buildings. For guideways at-grade, directly radiated noise is usually the dominant problem, although vibration can be a problem. For subways, ground-borne vibration is often one of the most important environmental problems. For rubber-tired systems, the smoothness of the roadway/guideway is the critical factor; if the surface is smooth, vibration problems are unlikely.
- **Geology:** Soil and subsurface conditions are known to have a strong influence on the levels of ground-borne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock. Experience with ground-borne vibration is that vibration propagation is more efficient in stiff clay soils, and shallow rock seems to concentrate the vibration energy close to the surface and can result in ground-borne vibration problems at large distances from the track. Factors such as layering of the soil and depth to water table can have significant effects on the propagation of ground-borne vibration.
- **Receiving Building:** The receiving building is a key component in the evaluation of ground-borne vibration since ground-borne vibration problems occur almost exclusively inside buildings. The train vibration may be perceptible to people who are outdoors, but it is very rare for outdoor vibration to cause complaints. The vibration levels inside a building are dependent on the vibration energy that reaches the building foundation, the coupling of the building foundation to the soil, and the propagation of the vibration through the building. The general guideline is that the heavier a building is, the lower the response will be to the incident vibration energy.

Table 7-2. Factors that Influence Levels of Ground-Borne Vibration and Noise	
Factors Related to Vibration Source	
Factors	**Influence**
Vehicle Suspension	If the suspension is stiff in the vertical direction, the effective vibration forces will be higher. On transit cars, only the primary suspension affects the vibration levels, the secondary suspension that supports the car body has no apparent effect.
Wheel Type and Condition	Use of pneumatic tires is one of the best methods of controlling ground-borne vibration. Normal resilient wheels on rail transit systems are usually too stiff to provide significant vibration reduction. Wheel flats and general wheel roughness are the major cause of vibration from steel wheel/steel rail systems.
Track/Roadway Surface	Rough track or rough roads are often the cause of vibration problems. Maintaining a smooth surface will reduce vibration levels.
Track Support System	On rail systems, the track support system is one of the major components in determining the levels of ground-borne vibration. The highest vibration levels are created by track that is rigidly attached to a concrete trackbed (e.g. track on wood half-ties embedded in the concrete). The vibration levels are much lower when special vibration control track systems such as resilient fasteners, ballast mats and floating slabs are used.
Speed	As intuitively expected, higher speeds result in higher vibration levels. Doubling speed usually results in a vibration level increase of 4 to 6 decibels.
Transit Structure	The general rule-of-thumb is that the heavier the transit structure, the lower the vibration levels. The vibration levels from a lightweight bored tunnel will usually be higher than from a poured concrete box subway.
Depth of Vibration Source	There are significant differences in the vibration characteristics when the source is underground compared to surface level.
Factors Related to Vibration Path	
Factor	**Influence**
Soil Type	Vibration levels are generally higher in stiff clay-type soils than in loose sandy soils.
Rock Layers	Vibration levels are usually high near at-grade track when the depth to bedrock is 30 feet or less. Subways founded in rock will result in lower vibration amplitudes close to the subway. Because of efficient propagation, the vibration level does not attenuate as rapidly in rock as it does in soil.
Soil Layering	Soil layering will have a substantial, but unpredictable, effect on the vibration levels since each stratum can have significantly different dynamic characteristics.
Depth to Water Table	The presence of the water table may have a significant effect on ground-borne vibration, but a definite relationship has not been established.
Factors Related to Vibration Receiver	
Factor	**Influence**
Foundation Type	The general rule-of-thumb is that the heavier the building foundation, the greater the coupling loss as the vibration propagates from the ground into the building.
Building Construction	Since ground-borne vibration and noise are almost always evaluated in terms of indoor receivers, the propagation of the vibration through the building must be considered. Each building has different characteristics relative to structureborne vibration, although the general rule-of-thumb is the more massive the building, the lower the levels of ground-borne vibration.
Acoustical Absorption	The amount of acoustical absorption in the receiver room affects the levels of ground-borne noise.

REFERENCES

1. American National Standards Institute, Guide to the Evaluation of Human Exposure to Vibration in Buildings. ANSI S3.29-1983

2. International Organization for Standardization, "Evaluation of Human exposure to whole body vibration: Part 2 – Continuous and shock-induced vibration in buildings (1 – 80 Hz), ISO 2361-2-1989

3. International Organization for Standardization, "Mechanical Vibration and Shock : Evaluation of human exposure to whole body vibration: Part 2 – Vibration in buildings (1 to 80 Hz), ISO 2631-2-2003.

4. J. T. Nelson, H. J. Saurenman, "State-of-the-Art Review: Prediction and Control of Groundborne Noise and Vibration from Rail Transit Trains," U.S. Department of Transportation, Urban Mass Transportation Administration, Report Number UMTA-MA-06-0049-83-4, DOT-TSC-UMTA-83-3, December 1983.

5. Y. Tokita, "Vibration Pollution Problems in Japan," In Inter-Noise 75, Sendai, Japan, pp. 465-472, 1975.

Attachment B

CITY OF RIVERSIDE GOOD NEIGHBOR GUIDELINES FOR SITING NEW AND/OR MODIFIED WAREHOUSE DISTRIBUTION FACILITIES

CITY OF RIVERSIDE
COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION

3900 MAIN STREET
RIVERSIDE, CA 92522

ADOPTED OCTOBER 14, 2008
RESOLUTION No. 21734

In September, 2005, the Western Riverside Council of Governments (WRCOG) and the Regional Air Quality Task Force (RAQTF) approved the *Good Neighbor Guidelines For Siting New and/or Modified Warehouse/Distribution Facilities*. The Good Neighbor Guidelines that follow, adopted by the City Council on October 14, 2008, are a modified version of the WRCOG's RAQTF Guidelines, and include goals and strategies tailored to the unique characteristics and specific needs of the City of Riverside.

These "Good Neighbor Guidelines for Siting New and/or Modified Warehouse/Distribution Facilities," (referred to as "Good Neighbor Guidelines") focus on the relationship between land use, permitting, and air quality, highlighting strategies that can help minimize the impacts of diesel emissions associated with warehouse/distribution centers. These Guidelines are intended to assist developers, property owners, elected officials, community organizations, and the general public address some of the complicated choices associated with siting warehouse/distribution facilities and understanding the options available when addressing environmental issues. The Guidelines will help to minimize the impacts of diesel particulate matter (PM) from on-road trucks associated with warehouses and distribution centers on existing communities and sensitive receptors located in the City. Sensitive receptors include residential neighborhoods, schools, parks, playgrounds, day care centers, nursing homes, hospitals, and other public places where residents are most likely to spend time.

For the purpose of these Guidelines, warehouse/distribution center means a building used for the storage, receiving, shipping, or wholesaling of goods and merchandise, and any incidental or accessory activities that is greater than 400,000 square feet. This shall be cumulative to include multiple warehouse buildings exceeding a total combined building area of 400,000 square feet, including phased projects. For the purpose of these Guidelines, a warehouse and distribution center is not intended to include "big box" discount or warehouse stores that sell retail goods, merchandise or equipment, or storage and mini-storage facilities that are offered for rent or lease to the general public.

PURPOSE

The purpose of the Good Neighbor Guidelines is to provide the City and developers with a variety of strategies that can be used to reduce diesel emissions from heavy-duty trucks that are delivering goods to and from warehouse and distribution centers.

In 1998, the South Coast Air Quality Management District (SCAQMD) conducted its second Multiple Air Toxics Emissions Study (MATES II)[1]. Considered the nation's most comprehensive study of toxic air pollution to date, the study found that:

- Diesel exhaust is responsible for about 70 percent of the total cancer risk from air pollution;
- Emissions from mobile sources -- including cars and trucks as well as ships, trains and planes -- account for about 90 percent of the cancer risk. Emissions from businesses and industry are responsible for the remaining 10 percent; and
- The highest cancer risk occurs in south Los Angeles County -- including the port area--and along major freeways[2].

Implementation of the recommended guidance for proposed facilities is technically more feasible than a retroactive application to existing warehouse/distribution centers. However, there is an educational component of these Guidelines aimed at existing facilities. As well, there are mechanisms in the planning process that will encourage developers to incorporate the recommended guidelines upfront in the design phase of a project.

These Guidelines are intended to be considered when issuing permits such as conditional use permits, or zoning permits. In addition, the recommended Guidelines can be used to mitigate potentially significant adverse environmental impacts that are identified under the California Environmental Quality Act (CEQA). The recommended Guidelines are intended to be used for new warehouses and can be incorporated in the design phase of the proposed warehouse or distribution center.

The recommended Guidelines format identifies the overall goal and the recommended strategies that can be implemented to achieve the goal. The Guidelines include a series of strategies that can be implemented in part or whole, or tailored to

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1 For more information on the MATES II Study visit http://www.aqmd.gov/matesiidf/matestoc.htm.
2 Taken from the MATES II Fact Sheet found at http://www.aqmd.gov/news1/2005/matesiifactsheet.html.

the specific needs of a project. They will provide a general framework for planners and developers regarding how to achieve a specified goal.

It should be noted that the California Air Resources Board (CARB) has adopted two airborne toxic control measures that will reduce diesel particulate materials (PM) emissions associated with warehouse/distribution centers. The first will limit nonessential (or unnecessary) idling of diesel-fueled commercial vehicles, including those entering from other states or countries[3]. This measure prohibits idling of a vehicle for more than five minutes at any one location. The second measure requires that transport refrigeration units (TRUs) operating in California become cleaner over time[4]. The measure establishes in-use performance standards for existing TRU engines that operate in California, including out-of-state TRUs. The requirements are phased-in beginning in 2004, and extend to 2019.

CARB also operates a smoke inspection program for heavy-duty diesel trucks that focuses on reducing truck emissions in California communities. Areas with large numbers of distributions centers are a high priority.

While CARB has these measures in place, local agencies need to acknowledge that the enforcement of these measures is through the California Highway Patrol and do not provide a swift resolve to local air quality issues.

ACRONYMS USED THROUGOUT THIS DOCUMENT

CARB	California Air Resources Board
CEQA	California Environmental Quality Act
EMFAC	EMission FACtors (EMFAC) Model for On-Road Vehicle Emissions
PM	Particulate Matter
RAQTF	Regional Air Quality Task Force
SCAQMD	South Coast Air Quality Management District
TRU	Transportation Refrigeration Unit
URBEMIS	Urban Emissions Software
WRCOG	Western Riverside Council of Governments

3 For more information visit http://www.arb.ca.gov/regact/idling/idling.htm.
4 For more information visit http://www.arb.ca.gov/diesel/tru.htm.

CITY OF RIVERSIDE GOOD NEIGHBOR GUIDELINES

GOAL 1: Minimize exposure to diesel emissions to neighbors that are situated in close proximity to the warehouse/distribution center.

Recommended Strategies:

1a. Design facilities to allow for the queuing of trucks on-site and away from sensitive receptors. Conversely, prevent the queuing of trucks on streets or elsewhere outside of facility in compliance with Title 10 – Vehicles and Traffic – Chapter 10.44 – Stopping, Standing and Parking.

1b. To the extent possible, locate driveways, loading docks and internal circulation routes away from residential uses or any other sensitive receptors.

1c. In compliance with CEQA, conduct SCAQMD URBEMIS and EMFAC computer models, as appropriate, to initially evaluate warehouse and distribution projects on a case by case basis to determine the significance of air quality impacts and whether air quality thresholds would be exceeded as a result of a project. Where thresholds are exceeded, a more detailed air quality analysis/health risk assessment prepared by an air quality specialist is required to be prepared and submitted by the project applicant. As a general rule, the following guidelines can be used to determine whether a proposed project will be required to prepare additional technical analyses:

i. An air quality study for an industrial project is required when the proposed project has the potential to exceed established thresholds as noted by URBEMIS and EMFAC computer models provided by SCAQMD. If these models indicate the project will exceed thresholds due to existing or proposed site conditions, intensity of development, location of nearest sensitive receptor, or any other exceptional circumstance warranting the need for

additional review the preparation of an air quality study will be required.

ii. A health risk assessment is required when the truck traffic areas of an industrial project are located within 1,000 feet of sensitive receptors, in accordance with SCAQMD guidelines and/or practices.

1d. Enforce compliance with Riverside Municipal Code Section 19.880 – "Transportation Demand Management Regulations". This section of the Code requires trip reduction plans to be submitted for all businesses, including warehouses, with over one hundred employees to reduce work-related vehicle trips by six and one half percent from the number of trips related to the project.

GOAL 2: Eliminate diesel trucks from unnecessarily traversing through residential neighborhoods.

Recommended strategies:

2a. Require warehouse/distribution centers to establish a specific truck route between the warehouse/distribution center and the SR-60 and I-215 freeways for City approval as part of the Design Review process. In addition, a haul route plan for construction activities should also be provided as part of the Design Review process.

2b. Require warehouse/distribution centers to clearly specify all entrance and exit points on the site plan submitted for City review and approval.

2c. Require warehouse/distribution centers to provide on-site signage for directional guidance to trucks entering and exiting the facility

2d. Require warehouse/distribution centers to provide signage or flyers that advise truck drivers of the closest restaurants, fueling stations, truck repair facilities, lodging and entertainment.

GOAL 3: Eliminate trucks from using residential areas and repairing vehicles on the streets.

Recommended Strategies:

3a. Enforce compliance with Riverside Municipal Code Section 10.44.155 – "Parking of certain commercial vehicles, trailers and semi-trailers prohibited; exceptions".

3b. Enforce compliance with Riverside Municipal Code Section 10.44.160 – "Parking of certain commercial vehicles prohibited in residential districts".

3c. Enforce compliance with Section 10.44.040 Parking for certain purposes prohibited.

GOAL 4: Reduce and/or eliminate diesel idling within the warehouse/distribution center.

Recommended Strategies:

4a. Promote the installation of on-site electric hook-ups to eliminate the idling of main and auxiliary engines during loading and unloading of cargo and when trucks are not in use – especially where TRUs are proposed to be used.

4b. Implement General Plan 2025 Program Final Program Environmental Impact Report, Mitigation Measure MM Air 12. This Mitigation Measure requires that all new truck terminals, warehouses and other shipping facilities requiring the use of refrigerated trucks and with more than 50 truck trips per day shall provide electrical hookups for the refrigerated units to reduce idling and its associated air quality pollutants. Additionally, future tenant improvements involving conversion of a warehouse for refrigeration storage shall include electrical hookups for refrigerated units.

4c. Require signage (posted inside and outside of the warehouse facility) to inform truck drivers of CARB regulations, idling limits, authorized truck routes, and designated truck parking locations. Post signs requesting truck drivers to turn off engines when not in use and restrict idling within facilities to less than 5 minutes.

DEFINITIONS

Buffer Zone:	An area of land separating one parcel or land from another that acts to soften or mitigate the effects of one land use on the other.
DPM - Diesel Particulate Matter:	Refers to the particles found in the exhaust of diesel-fueled CI engines. DPM may agglomerate and absorb other species to form structures of complex physical and chemical properties (identified in 1998 as a toxic air contaminant).
Idling:	The operation of the engine of a vehicle while the vehicle is not in motion.
Mobil Source:	Sources of air pollution such as automobiles, motorcycles, trucks, off-road vehicles, boats, trains and airplanes.
PM - Particulate Matter:	Refers to the particles found in the exhaust of CI engines, which may agglomerate and absorb other species to form structures of complex physical and chemical properties.
Risk:	For cancer health effects, risk is expressed as an estimate of the increase chances of getting cancer due to facility emissions over 70-year lifetime. The increase in risk expressed as chances in a million (e.g., 1,400 in a million)
TRU:	A Transport Refrigeration Unit refers to refrigeration systems powered by integral internal combustion engines designed to control the environment of temperature sensitive products that are transported in trucks and refrigerated trailers. TRUs may be capable of both cooling and heating.

Warehouse/Distribution Center:	For the purpose of these Guidelines, a warehouse/distribution center means a building used for the storage, receiving, shipping, or wholesaling of goods and merchandise, and any incidental or accessory activities that is greater than 400,000 square feet. This shall be cumulative to include multiple warehouse buildings exceeding a total combined building area of 400,000 square feet including phased projects. For the purpose of these Guidelines, a warehouse and distribution center is not intended to include "big box" discount or warehouse stores that sell retail goods, merchandise or equipment, or storage and mini-storage facilities that are offered for rent or lease to the general public.
WRCOG:	Western Riverside Council of Governments

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science for a changing world

Attachment C1

Prepared in cooperation with the Bureau of Reclamation and the U.S. Fish and Wildlife Service

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

Chapter 10 of
Section A, Biological Science
Book 2, Collection of Environmental Data

Techniques and Methods 2A-10

U.S. Department of the Interior
U.S. Geological Survey

Cover: Southwestern Willow Flycatcher. Photograph taken by Susan Sferra, U.S. Fish and Wildlife Service.

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

By Mark K. Sogge, U.S. Geological Survey; Darrell Ahlers, Bureau of Reclamation; and Susan J. Sferra, U.S. Fish and Wildlife Service

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Techniques and Methods 2A-10

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2010

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Figures

Conversion Factors

Multiply	By	To obtain
centimeter (cm)	0.3937	inch (in.)
gram (g)	0.03527	ounce, avoirdupois (oz)
hectare (ha)	2.471	acre
kilometer (km)	0.6214	mile (mi)
meter (m)	3.281	foot (ft)
millimeter (mm)	0.03937	inch (in.)

Abbreviations and Acronyms

GPS	Global Positioning System
NDVI	Normalized Difference Vegetation Index
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

By Mark K. Sogge, U.S. Geological Survey; Darrell Ahlers, Bureau of Reclamation; and Susan J. Sferra, U.S. Fish and Wildlife Service

Background

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*) has been the subject of substantial research, monitoring, and management activity since it was listed as an endangered species in 1995. When proposed for listing in 1993, relatively little was known about the flycatcher's natural history, and there were only 30 known breeding sites supporting an estimated 111 territories rangewide (Sogge and others, 2003a). Since that time, thousands of presence/absences surveys have been conducted throughout the historical range of the flycatcher, and many studies of its natural history and ecology have been completed. As a result, the ecology of the flycatcher is much better understood than it was just over a decade ago. In addition, we have learned that the current status of the flycatcher is better than originally thought: as of 2007, the population was estimated at approximately 1,300 territories distributed among approximately 280 breeding sites (Durst and others, 2008a).

Concern about the Southwestern Willow Flycatcher on a rangewide scale was brought to focus by Unitt (1987), who described declines in flycatcher abundance and distribution throughout the Southwest. *E. t. extimus* populations declined during the 20th century, primarily because of habitat loss and modification from activities, such as dam construction and operation, groundwater pumping, water diversions, and flood control. In 1991, the U.S. Fish and Wildlife Service (USFWS) designated the Southwestern Willow Flycatcher as a candidate category 1 species (U.S. Fish and Wildlife Service, 1991). In July 1993, the USFWS proposed to list *E. t. extimus* as an endangered species and to designate critical habitat under the Act (U.S. Fish and Wildlife Service, 1993). A final rule listing *E. t. extimus* as endangered was published in February 1995 (U.S. Fish and Wildlife Service, 1995); critical habitat was designated in 1997 (U.S. Fish and Wildlife Service, 1997). The USFWS Service released a Recovery Plan for the Southwestern Willow Flycatcher in 2002 (U.S. Fish and Wildlife Service, 2002), and re-designated critical habitat in 2005 (U.S. Fish and Wildlife Service, 2005).

In addition to its federal status, the Southwestern Willow Flycatcher is listed as an endangered species or species of concern in Arizona (Arizona Game and Fish Department, 2006), New Mexico (New Mexico Department of Game and Fish, 1996), California (California Department of Fish and Game, 1991), and Utah (Utah Division of Wildlife Resources, 1997).

Sound management and conservation of an endangered species like the Southwestern Willow Flycatcher requires current, detailed information on its abundance and distribution. This requires, among other things, identifying where flycatchers are and are not breeding, and annual monitoring of as many breeding areas as possible. Such efforts require effective, standardized survey protocols and consistent reporting, at both local and regional levels. However, the Willow Flycatcher is a difficult species to identify and survey for. Moreover, inconsistent or ineffective surveys are of limited value, can produce misleading information (including "false positives" and "false negatives"), hinder regional and rangewide analyses, and waste limited resources.

We developed this document to provide a standardized survey protocol and a source of basic ecological and status information on the flycatcher. The first section summarizes the current state of knowledge regarding Southwestern Willow Flycatcher natural history, based on a wide array of published and unpublished literature. Emphasis is given to information relevant to flycatcher conservation and management, and to conducting and interpreting surveys. The second section details a standard survey protocol that provides for consistent data collection, reporting, and interpretation. This protocol document builds on and supersedes previous versions, the most recent of which was Sogge and others (1997a). In this update, we incorporate over a decade of new science and survey results, and refine the survey methodology to clarify key points. Further, we update the standard survey data sheets and provide guidelines on how to fill in the requested information. Amidst these revisions, the basic approach of the survey protocol has remained unchanged—multiple surveys at each survey area within the same breeding season, the use of the call-playback technique using flycatcher vocalizations to increase the probability of detection, and verification of species identity through its diagnostic song.

Section 1. Natural History

Breeding Range and Taxonomy

The Willow Flycatcher is a widespread species that breeds across much of the conterminous United States (Sedgwick, 2000). Four subspecies commonly are recognized in North America, with each occupying a distinct breeding range (fig. 1): *E. t. adastus*, ranging across the northern Rocky Mountains and Great Basin; *E. t. brewsteri*, found west of the Sierra Nevada and Cascade Mountains along the Pacific Slope; *E. t. extimus*, the Southwestern Willow Flycatcher, which breeds across the Southwest; and *E. t. traillii*, ranging east of the northern Rocky Mountains. Although the overall subspecies' ranges are distinct, Sedgwick (2001) and Paxton (2008) noted interbreeding/gradation zones in the boundary area between *E. t. extimus* and *E. t. adastus*.

The breeding range of the Southwestern Willow Flycatcher includes southern California, Arizona, New Mexico, southwestern Colorado, and extreme southern portions of Nevada and Utah: specific range boundaries are delineated in the subspecies' recovery plan (U.S. Fish and Wildlife Service, 2002). Unitt (1987) included western Texas in the subspecies' range, but recent breeding records from western Texas are lacking. Records of probable breeding Southwestern Willow Flycatchers in Mexico are few and restricted to extreme northern Baja California and Sonora (Unitt, 1987; Wilbur, 1987). Although recent data are lacking, the USFWS does include parts of northern Mexico in its description of *E. t. extimus* breeding range (U.S. Fish and Wildlife Service, 2002).

Although they appear very similar to most observers, experienced taxonomist or those using specialized equipment (for example, an electronic colorimeter) can differentiate among the subspecies by subtle differences in color and morphology (for example, Unitt, 1987; Paxton, 2008). Despite the subtle level of differences, the taxonomic status of *E. t. extimus* has been critically reviewed and confirmed multiple times based on morphological, genetic, and song data (Hubbard, 1987; Unitt, 1987; Browning, 1993; Paxton, 2000; Sedgwick, 2001).

The Southwestern Willow Flycatcher was described by Phillips (1948) from a specimen collected along the San Pedro River in southeastern Arizona. The Southwestern Willow Flycatcher generally is paler than other Willow Flycatcher subspecies, although this difference is indistinguishable without considerable experience and training, and study skins as comparative reference material. The southwestern subspecies differs in morphology (primarily wing formula) but not overall size. The plumage and color differences between the Willow Flycatcher subspecies are so subtle that they should not be used to characterize birds observed in the field (Unitt, 1987; Hubbard, 1999; U.S. Fish and Wildlife Service, 2002).

Migration and Winter Range, Habitat, and Ecology

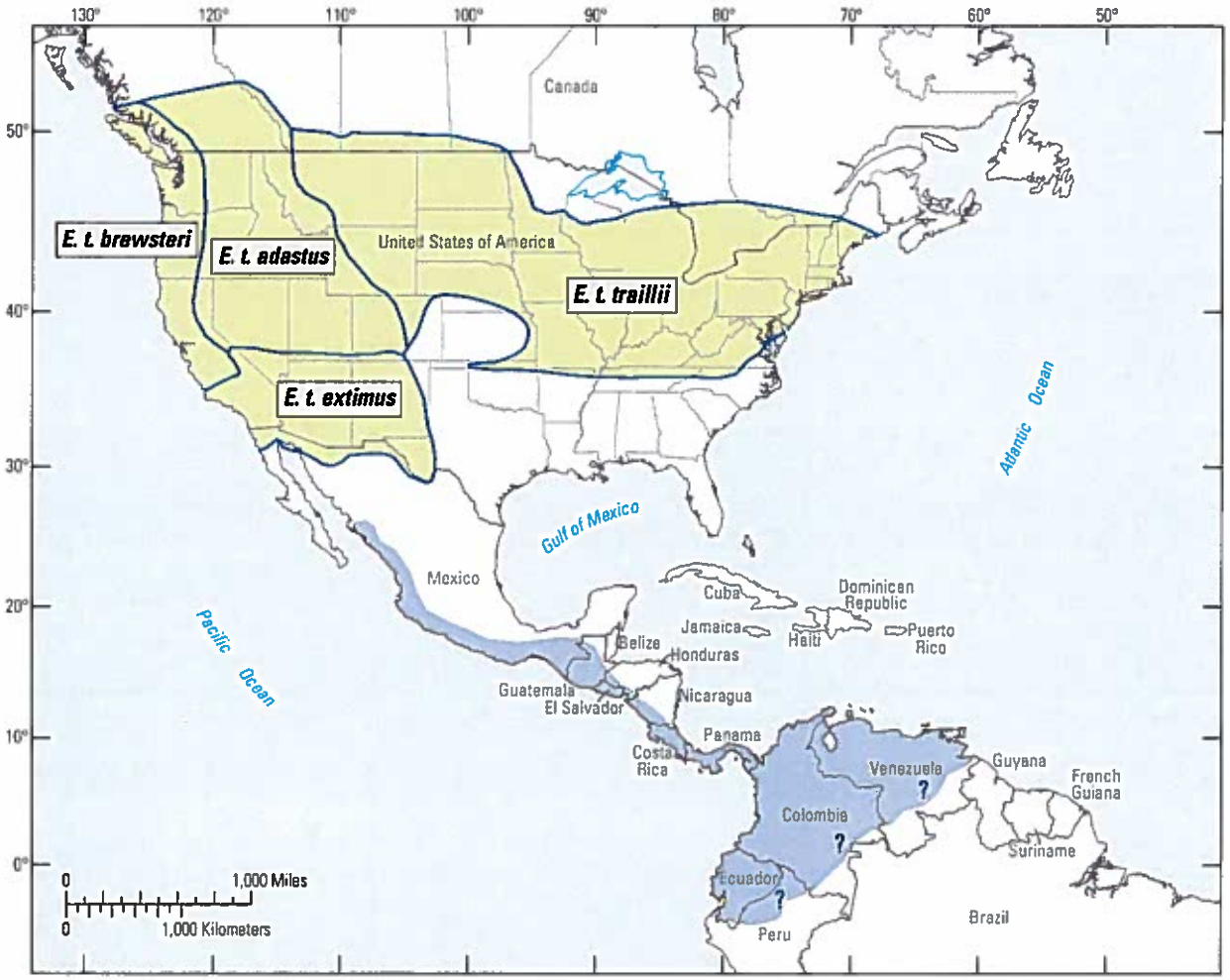
All Willow Flycatcher subspecies breed in North America but winter in the subtropical and tropical regions of southern Mexico, Central America, and northern South America (Sedgwick, 2000; Koronkiewicz, 2002; fig. 1). Most wintering birds are found in the Pacific slope lowlands in Mexico and Central America, and Caribbean slope lowlands in Mexico and Guatemala.

Because all Willow Flycatcher subspecies look very similar, determining specific wintering sites for the southwestern race has been challenging. However, recent genetic analysis of wintering birds (Paxton, 2008) suggests that the four subspecies occupy finite areas of the wintering grounds, but with overlapping ranges. The Southwestern Willow Flycatcher appears to be largely restricted to the center of the winter range (in the vicinity of Costa Rica), although Paxton (2008) suggests more research is needed to address this question.

On the wintering grounds, flycatchers primarily are found in habitats that have four main components: (1) standing or slow moving water and/or saturated soils, (2) patches or stringers of trees, (3) woody shrubs, and (4) open areas (Koronkiewicz and Whitfield, 1999; Koronkiewicz and Sogge, 2000; Lynn and others, 2003; Nishida and Whitfield, 2007; Schuetz and others, 2007). Based on surveys to date, the presence of water or saturated soils is almost universal, although tree heights and configurations, the presence of woody shrubs, and the amount of open space surrounding winter territories can vary considerably (Schuetz and others, 2007).

Male and female flycatchers hold separate, individual non-breeding territories, and defend those territories throughout the winter by using song, calls, and aggression displays. Fidelity to wintering territories and sites is high, as is survivorship over the wintering period (Koronkiewicz and others, 2006b; Sogge and others, 2007).

Willow Flycatchers travel approximately 1,500–8,000 km each way between wintering and breeding areas. During migration, flycatchers use a wider array of forest and shrub habitats than they do for breeding, although riparian vegetation may still be a preferred migration habitat type (Finch and others, 2000). Migration requires high energy expenditures, exposure to predators, and successful foraging in unfamiliar areas. Therefore, migration is the period of highest mortality within the annual cycle of the flycatcher (Paxton and others, 2007). Willow Flycatchers of all subspecies sing during northward migration, perhaps to establish temporary territories for short-term defense of food resources.



Basemap modified from U.S. Geological Survey and other agency digital data, various scales. Projection Mercator, World Geodetic System1984 datum.

EXPLANATION

Approximate range distribution of the Willow Flycatcher (*Empidonax traillii*)—Adapted from Unitt (1987), Browning (1993), and Paxton (2008)

Breeding range, including boundaries of the Willow Flycatcher subspecies

? Wintering range—Question marks reflect uncertainty of the location of the eastern boundary of the winter range

Figure 1. Approximate ranges of the Willow Flycatcher (*Empidonax traillii*) during breeding and non-breeding seasons.

Southwestern Willow Flycatchers typically arrive on breeding grounds between early May and early June (Ellis and others, 2008; Moore and Ahlers, 2009). Because arrival dates vary annually and geographically, northbound migrant Willow Flycatchers of multiple subspecies pass through areas where Southwestern Willow Flycatchers have already begun nesting. Similarly, southbound migrants in late July and August may occur where Southwestern Willow Flycatchers are still breeding (Unitt, 1987). This can make it challenging for an observer to differentiate local breeders from migrants. Other than timing, we still know relatively little about Southwestern Willow Flycatcher migratory behavior, pathways, or habitat use.

Breeding Habitat

Breeding Southwestern Willow Flycatchers are riparian obligates, typically nesting in relatively dense riparian vegetation where surface water is present or soil moisture is high enough to maintain the appropriate vegetation characteristics (Sogge and Marshall, 2000; U.S. Fish and Wildlife Service, 2002; Ahlers and Moore, 2009). However, hydrological conditions in the Southwest can be highly variable within a season and between years, so water availability at a site may range from flooded to dry over the course of a breeding season or from year to year.

The Southwestern Willow Flycatcher breeds in dense riparian habitats across a wide elevational range, from near sea level in California to more than 2,600 m in Arizona and southwestern Colorado (Durst and others, 2008a). Vegetation characteristics of Southwestern Willow Flycatcher breeding habitat generally include dense tree or shrub cover that is ≥ 3 m tall (with or without a higher overstory layer), dense twig structure, and high levels of live green foliage (Allison and others, 2003); many patches with tall canopy vegetation also include dense midstory vegetation in the 2–5 m range. Beyond these generalities, the flycatcher shows adaptability in habitat selection, as demonstrated by variability in dominant plant species (both native and exotic), size and shape of breeding patch, and canopy height and structure (U.S. Fish and Wildlife Service, 2002).

Southwestern Willow Flycatcher breeding habitat can be quantified and characterized in a number of ways, depending on the level of detail needed and habitat traits of interest. For many sites, detailed floristic composition, plant structure, patch size, and even characteristics such as Normalized Difference Vegetation Index (NDVI) have been described in agency reports and scientific journal articles (Allison and others, 2003; Hatten and Paradzick, 2003; Koronkiewicz and others, 2006a; Hatten and Sogge, 2007; Moore, 2007; Schuetz and Whitfield, 2007; Ellis and others, 2008). For purposes of this survey protocol, we take a relatively simple approach and broadly describe and classify breeding sites based on plant species composition and habitat structure. Clearly, these are not the only important components, but they are conspicuous to human perception and easily observed and recorded. Thus, they have proven useful in conceptualizing, selecting and evaluating suitable survey habitat, and in predicting where breeding flycatchers are likely to be found.

Breeding habitat types commonly used by Southwestern Willow Flycatchers are described below. The general categories are based on the composition of the tree/shrub vegetation at the site—native broadleaf, exotic, and mixed native/exotic. In the field, breeding habitats occur along a continuum of plant species composition (from nearly monotypic to mixed species) and vegetation structure (from simple, single stratum patches to complex, multiple strata patches). The images in figures 2–7 illustrate some of the variation in flycatcher breeding habitat, and other examples can be found in numerous publications and agency reports, and on the USGS photo gallery web site (http://sbsc.wr.usgs.gov/SBSCgallery/). The intent of the descriptions and photographs is to provide a general guide for identifying suitable habitat in which to conduct surveys.

Native broadleaf.—Southwestern Willow Flycatchers breed across a great elevational range, and the characteristics of their native broadleaf breeding sites varies between high elevation sites and those at low and mid-elevation sites.

High elevation sites (fig. 2) range from nearly monotypic dense stands of willow to mixed stands of native broadleaf trees and shrubs, 2–7 m in height with no distinct overstory layer; often associated with sedges, rushes, nettles, and other herbaceous wetland plants; usually very dense structure in lower 2 m; live foliage density is high from the ground to the canopy. Vegetation surrounding the patch can range from open meadow, to agricultural lands, to pines or upland shrub.

At low and mid-elevations (fig. 3), flycatcher breeding sites can be composed of single species (often Goodding's willow (*Salix gooddingii*), *S. exigua*, or other willow species) or mixtures of native broadleaf trees and shrubs including (but not limited to) cottonwood, willows, boxelder (*Acer negundo*), ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus* spp.), height from 3 to 15 m; characterized by trees of different size classes; often a distinct overstory of cottonwood, willow or other broadleaf tree, with recognizable subcanopy layers and a dense understory of mixed species; exotic/introduced species may be a rare component, particularly in the understory.

Monotypic exotic.—(fig. 4) Breeding sites also can include nearly monotypic, dense stands of exotics such as saltcedar (*Tamarix* spp.) or Russian olive (*Elaeagnus angustifolia*), 4–10 m in height forming a nearly continuous, closed canopy (with no distinct overstory layer); lower 2 m commonly very difficult to penetrate due to dense branches, however, live foliage density may be relatively low 1–2 m above ground, but increases higher in the canopy; canopy density uniformly high.

Aerial view of Little Colorado River near Greer, Arizona. Photograph by USGS, 1995.

Little Colorado River near Greer, Arizona. Photograph courtesy of Arizona Game and Fish Department, 1996.

Parkview Fish Hatchery, New Mexico. Photograph by USGS, 2000.

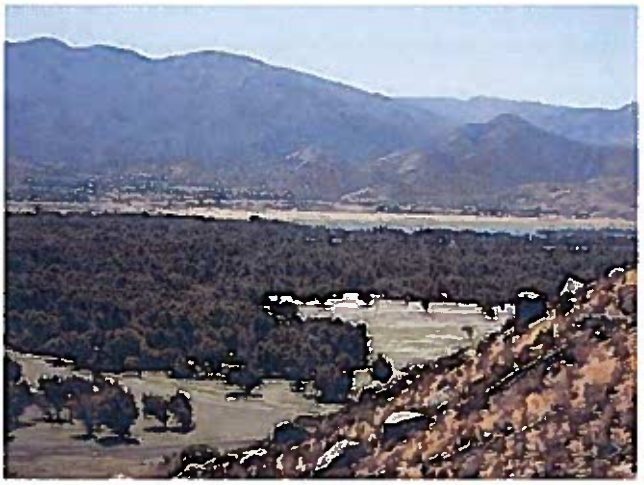
Rio Grande State Wildlife Area, Colorado. Photograph by USGS, 2002.

Tierra Azul, New Mexico. Photograph by USGS, 2005.

McIntyre Springs, Colorado. Photograph by USGS, 2002.

Figure 2. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at high-elevation sites.

Hassayampa River, Arizona. Photograph by USGS, 2003.



Kern River, California. Photograph by USGS, 1995.

Santa Ynez River, California. Photograph by USGS, 1996.

Bosque del Apache, Rio Grande, New Mexico. Photograph courtesy of Bureau of Reclamation, 2008.

San Luis Rey River, California. Photograph by USGS, 2005.

Kern River, California. Photograph by USGS, 1995.

Figure 3. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at low and mid-elevation sites.

Aerial view of Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Salt River, Arizona. Photograph courtesy of Bureau of Reclamation, 1996.

Orrilla Verde, Rio Grande, New Mexico. Photograph by USGS, 2006.

Aerial view of Salt River, Arizona. Photograph by USGS, 1996.

Figure 4. Examples of Southwestern Willow Flycatcher breeding habitat in exotic vegetation.

Mixed native/exotic—(fig. 5) These sites include dense mixtures of native broadleaf trees and shrubs (such as those listed above) mixed with exotic/introduced species, such as saltcedar or Russian olive; exotics are often primarily in the understory, but may be a component of overstory; the native and exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat; overall, a particular site may be dominated primarily by natives or exotics, or be a more-or-less equal mixture.

Regardless of the plant species composition or height, occupied sites almost always have dense vegetation in the patch interior (fig. 6). These dense patches are often interspersed with small openings, open water, or shorter/sparser vegetation, creating a mosaic that is not uniformly dense.

Gila River, Arizona. Photograph by USGS, 2002.

Roosevelt Lake, Arizona. Photograph by USGS, 1999.

Verde River River, Arizona. Photograph by USGS, 2002.

Virgin River, Utah. Photograph by USGS, 1997.

Figure 5. Examples of Southwestern Willow Flycatcher breeding habitat in mixed native/exotic vegetation.

Gila River, Arizona. Photograph by USGS, 2002.

Kern River, California. Photograph by USGS, 1999.

Rio Grande, New Mexico. Photograph by USGS, 2007.

Salt River, Arizona. Photograph by USGS, 1999.

Rio Grande, New Mexico. Photograph by USGS, 2007.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Figure 6. Examples of dense vegetation structure within breeding habitats of Southwestern Willow Flycatcher.

Riparian patches used by breeding flycatchers vary in size and shape, ranging from a relatively contiguous stand of uniform vegetation to an irregularly shaped mosaic of dense vegetation with open areas. Southwestern Willow Flycatchers have nested in patches as small as 0.8 ha (for example, in the Grand Canyon) and as large as several hundred hectares (for example, at Roosevelt Lake, Ariz., or Elephant Butte Reservoir, New Mex.). They have only rarely been found nesting in isolated, narrow, linear riparian habitats that are less than 10 m wide, although they will use such linear habitats during migration.

Flycatcher territories and nests typically are adjacent to open water, cienegas, marshy seeps, or saturated soil, and within riparian areas rooted in standing water. However, in the Southwest, hydrological conditions at a site can vary remarkably within a season, between years, and among nearby sites (fig. 7). Surface water or saturated soil may only be present early in the breeding season (that is, May and part of June), especially in dry years. Similarly, vegetation at a patch may be immersed in standing water during a wet year, but be hundreds of meters from surface water in dry years (Ahlers and Moore, 2009). This is particularly true of reservoir sites, such as the Kern River at Lake Isabella, Calif., Tonto Creek and Salt River at Roosevelt Lake, and the Rio Grande near Elephant Butte Reservoir. Natural or human-caused river channel modifications and altered subsurface flows (for example, from agricultural runoff), can lead to a total absence of water or visibly saturated soil at a site for several years.

Other potentially important aspects of Southwestern Willow Flycatcher habitat include distribution and isolation of vegetation patches, hydrology, food base (arthropods), parasites, predators, environmental factors (for example temperature, humidity), and interspecific competition (U.S. Fish and Wildlife Service, 2002). Population dynamics

Rio Grande at San Marcial, New Mexico, with dry substrate. Photograph by USGS, 2007.

Rio Grande at San Marcial, New Mexico, with flowing water beneath the territories. Photograph by USGS, 2007.

Tonto Creek inflow to Roosevelt Lake, Arizona, during a dry year. Photograph by USGS, 2004.

Tonto Creek inflow to Roosevelt Lake, Arizona, during high-water year. Photograph by USGS, 2005.

Figure 7. Examples of the variable hydrologic conditions at breeding habitats of Southwestern Willow Flycatcher.

factors, such as demography (for example, survivorship rates, fecundity), distribution of breeding groups across the landscape, flycatcher dispersal patterns, migration routes, the tendency for adults and surviving young to return to their previous year breeding site, and conspecific sociality also influence where flycatchers are found and what habitats they use (U.S. Fish and Wildlife Service, 2002).

It is critically important to recognize that the ultimate measure of habitat suitability is not simply whether or not a site is occupied. Habitat suitability occurs along a gradient from high to poor to unsuitable; the best habitats are those in which flycatcher reproductive success and survivorship result in a stable or growing population. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam, 1988). Therefore, it can take extensive research to determine the quality of any given habitat patch. Furthermore, productivity and survival rates can vary widely among years (Paxton and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009), so conclusions based on short-term datasets or data extrapolated from one area to another may be erroneous. It also is important to note that not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding flycatchers. There also may simply not be enough flycatchers in a given area to fill all available habitat in particular locations (U.S. Fish and Wildlife Service, 2002). A better understanding of which habitats or sites are sinks or sources can be especially helpful in site conservation and restoration planning.

As described earlier, migrant Willow Flycatchers may occur in riparian habitats that are structurally unsuitable for breeding (for example, too sparse, smaller patch size, etc.), and in non-riparian habitats. Such migration stopover areas, even though not used for breeding, may be critically important resources affecting local and regional flycatcher productivity and survival (U.S. Fish and Wildlife Service, 2002, 2005).

Breeding Chronology and Biology

Unless otherwise noted, the information that follows and upon which the generalized breeding season chronology (fig. 8) is based comes from Unitt (1987), Whitfield (1990), Maynard (1995), Sogge and others (2003b), Paxton and others (2007), Schuetz and Whitfield (2007), and Ellis and others (2008). Extreme or record dates for any stage of the breeding cycle may vary by 1–2 weeks from the dates presented, depending on the geographic area, extreme weather events, yearly variation and other factors. Higher elevation areas, in particular, have delayed chronology (Ahlers and White, 2000).

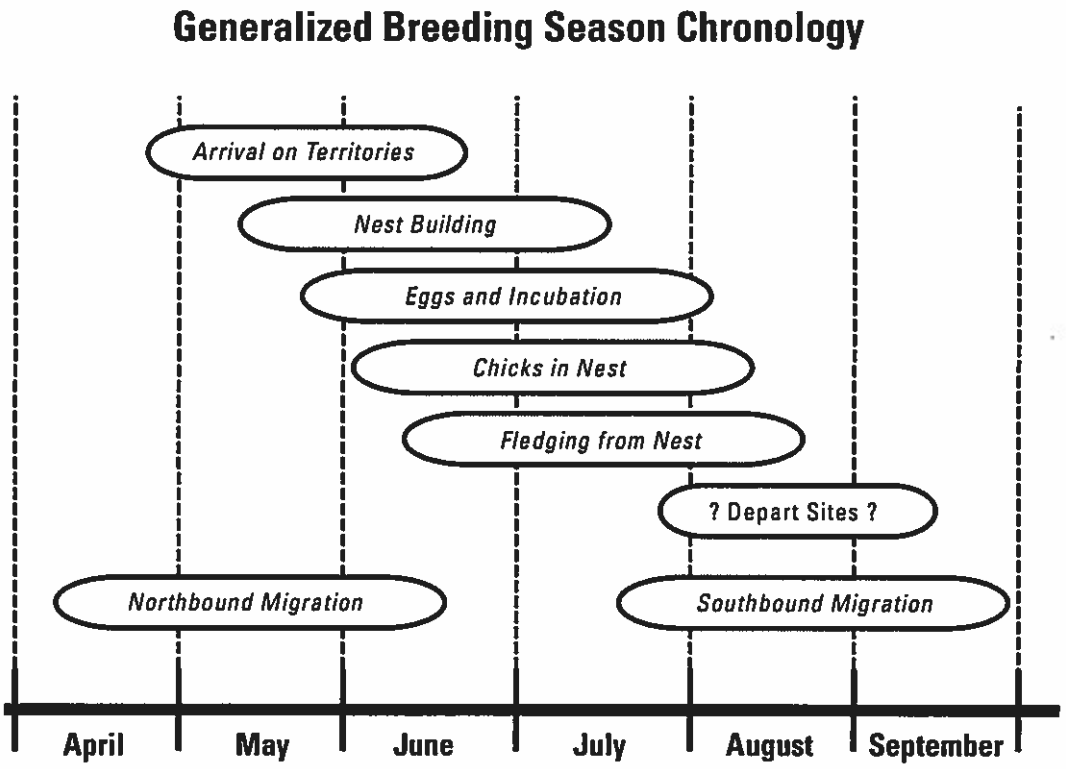


Figure 8. Generalized migration and breeding chronology for the Willow Flycatcher in the Southwest. Extreme or record dates may occur slightly earlier or later than indicated.

Both sexes can breed beginning in their second year. Male Southwestern Willow Flycatchers generally arrive at breeding areas first; older males typically arrive before younger ones. Although females usually arrive a few weeks after males, some older females are present at sites before late-arriving males. Adult flycatchers will sometimes wander extensively through large riparian sites before and after breeding, possibly as a way to evaluate potential breeding habitat (Cardinal and others, 2006).

Males establish and defend their territories through singing and aggressive interactions. Females settle on established territories, and may choose a territory more for its habitat characteristics than for the traits of its territorial male. Territory size tends to be larger when a male first arrives, then gets smaller after a female pairs with the male (Cardinal and others, 2006). Similarly, male song rate is very high early in the season, then declines after pairing (Yard and Brown, 2003). Not all males are successful in attracting mates in a given year, and as a result unpaired territorial males occur at many breeding sites. Unpaired males are usually a small percentage of any local population, but can comprise as much as 15–25 percent of the territories in some populations (Munzer and others, 2005; Ahlers and Moore, 2009).

Although the Willow Flycatcher as a species is considered predominantly monogamous during the breeding season (Sedgwick, 2000), some Southwestern Willow Flycatcher populations have a relatively high degree of polygyny whereby one male can have more than one breeding female in its territory. Polygynous males generally have two females in their territory, but up to four have been recorded (Davidson and Allison, 2003; Pearson and others, 2006). Polygyny rates can vary between sites, and among years at a given site. At some sites, polygynous males have much higher productivity than monogamous males (Paxton and others, 2007).

Nest building within the territory usually begins within a week or two after pair formation. Egg laying begins as early as mid-May, but more often starts in late May to mid-June. Chicks can be present in nests from late May through early August. Young typically fledge from nests from mid-June through mid-August; later fledglings are often products of re-nesting attempts. Breeding adults generally depart from their territories in early to mid-August, but may stay later if they fledged young late in the season. Males that fail to attract or retain mates, and males or pairs that are subject to significant disturbance, such as repeated nest parasitism or predation may leave territories by early July. Fledglings probably leave the breeding areas a week or two after adults, but few details are known.

Southwestern Willow Flycatcher territory size varies widely, probably due to differences in population density, habitat quality (including vegetation density and food availability), and nesting stage. Studies have reported estimated territory sizes ranging from 0.06 to 2.3 ha (Sogge and others, 1995; Whitfield and Enos, 1996; Bureau of Reclamation, 2009). At Roosevelt Lake, Ariz., measurements of home ranges, which include the defended territory and sometimes adjacent use areas, averaged 0.4 ha for actively breeding males; home range can be much larger for pre- and post-breeding males (Paxton and others, 2007). During incubation and nestling phases territory size, or at least the activity centers of pairs, can be very small. Flycatchers may increase their activity area after young are fledged, and use non-riparian habitats adjacent to the breeding area (Cardinal and others, 2006). This variability among sites, individual territories, and over time illustrates the challenge of defining a minimum habitat patch size for breeding flycatchers, or estimating the number of territories based simply on the size of a given breeding site.

At some breeding sites, non-territorial adult "floaters" will be present among the territorial population. Floaters are quieter and less aggressive than territorial adults, and therefore are harder to detect and frequently overlooked. Most floaters are young males, and float for only a single year. At Roosevelt Lake, floaters typically accounted for 3–8 percent of the known adult population, although the rate was much higher in drought years when habitat quality was lower (Paxton and others, 2007). The presence of floaters in a population may indicate that there is not enough high quality habitat to support all potentially territorial individuals present in a given breeding season.

Nests and Eggs

Historically, 75–80 percent of reported Southwestern Willow Flycatcher nests were placed in willows (Phillips, 1948; Phillips and others, 1964; Hubbard, 1987; Unitt, 1987). Southwestern Willow Flycatchers still commonly place their nests in native plants, but will often build nests in exotics, such as saltcedar and Russian olive (Sogge and Marshall, 2000; Stoleson and Finch, 2003; Durst and others, 2008a). In Arizona, most nests are in saltcedar or willows (Paradzick and Woodward, 2003; McLeod and others, 2007). In a unique situation in San Diego County, Calif., the flycatcher nests in coast live oak (*Quercus agrifolia*) along the San Luis Rey River (Haas, 2003), where oak became the dominant plant species adjacent to the river following willow removal in the 1950s. In another unusual situation, flycatchers in the Cliff-Gila Valley in New Mex. nest in tall boxelder (Stoleson and Finch, 2003). Southwestern Willow Flycatcher nests also have been found in buttonbush, black twinberry (*Lonicera involucrata*), Fremont cottonwood (*Populus fremontii*), alder (*Alnus* spp.), blackberry (*Rubus ursinus*), baccharis (*Baccharis* spp.), and stinging nettle (*Urtica* spp.). Overall, flycatcher nest site selection appears to be driven more by plant structure than by species composition.

Southwestern Willow Flycatchers build open cup nests approximately 8 cm high and 8 cm wide (outside dimensions), exclusive of any dangling material at the bottom. Females build the nest with little or no assistance from the males. Nests typically are placed in the fork of a branch with the nest cup supported by several small-diameter vertical stems. Nest height is highly variable and depends on the available plant structure within the territory; nests have been found from 0.6 m to approximately 20 m above ground. In any given habitat type or nest substrate, nests can be placed wherever suitable twig structure and vegetative cover are present.

Egg laying generally begins from mid-May through mid-June, depending on the geographic area and elevation. Willow Flycatcher eggs are buffy or light tan, approximately 18 mm long and 14 mm wide, with brown markings in a wreath at the blunt end. Clutch size is usually three or four eggs for first nests. Only the female develops a brood patch and incubates the eggs. Incubation lasts 12–13 days from the date the last egg is laid, and all eggs typically hatch within 24–48 hours of each other.

Flycatcher chicks are altricial and weigh only about 1–2 g at hatching, but grow rapidly and are ready to leave the nest at 12–15 days of age (Sedgwick, 2000; Paxton and Owen, 2002). The female provides most or all initial care of the young, although the role of the male increases with the age and size of nestlings. After Willow Flycatchers fledge at 12–15 days of age, they stay close to the nest and each other for 3–5 days, and adults continue feeding the fledged young for approximately 2 weeks. Recently fledged birds may repeatedly return to and leave the nest during this period (Spencer and others, 1996). Both male and female adults feed the fledged young, which give frequent, loud "*peep*" calls.

Southwestern Willow Flycatchers readily re-nest following an unsuccessful nesting attempt, although rarely more than once (Ellis and others, 2008). They also will sometimes nest again (double brood) following a successful nesting attempt, although this is more uncommon than re-nesting and varies between sites and years. From 2002 to 2008 at Elephant Butte Reservoir, approximately 13 percent of the pairs produced two successful nests per year (Ahlers and Moore, 2009). The productivity gains from pairs having successful second nests are important drivers of positive population growth (Paxton and others, 2007; Moore and Ahlers, 2009).

Replacement nests are built in the same territory, either in the same plant or at a distance of as much as 20 m from the previous nest. Reuse of old nests is uncommon, but does occur (Yard and Brown, 1999; Darrell Ahlers, Bureau of Reclamation, unpub. data, 2009). Replacement nest building and egg laying can occur (uncommonly) as late as the end of July or early August. Pairs may attempt a third nest if the second fails. However, clutch size, and therefore potential productivity, decreases with each nest attempt (Whitfield and Strong, 1995; Ellis and others, 2008).

Food and Foraging

The breeding season diet of Southwestern Willow Flycatchers is relatively well documented (DeLay and others, 2002; Drost and others, 2003; Durst, 2004; Wiesenborn and Heydon, 2007; Durst and others, 2008b). Breeding flycatchers are exclusively insectivorous, and consume a wide range of prey taxa ranging in size from small leafhoppers (Homoptera) to large dragonflies (Odonata). Major prey taxa include bugs (Hemiptera), bees and wasps (Hymenoptera), flies (Diptera), and leafhoppers; however, diet can vary widely between years and among different habitat types. There is no known differences in diet by sex, but there are differences between adult and nestling diet in the proportions of some arthropod groups. Differences in the composition of arthropods in flycatcher diet have been documented between native and exotic habitats, and between years within particular breeding sites; however, flycatchers appear able to tolerate substantial variation in relative prey abundance, except in extreme situations such as severe droughts (Durst and others, 2008b).

Willow Flycatchers of all subspecies forage primarily by sallying from a perch to perform aerial hawking and gleaning (Sedgwick, 2000; Durst, 2004). Males and females forage with similar maneuvers, although males may forage higher in the tree canopy than females. Foraging frequently takes place at external edges or internal openings within a habitat patch, or at the top of the upper canopy.

Site Fidelity and Survivorship

Based on studies of banded birds, most adult Southwestern Willow Flycatchers that survive from one year to the next will return to the same river drainage, often in proximity to the same breeding site (U.S. Fish and Wildlife Service, 2002; McLeod and others, 2007; Paxton and others, 2007). However, it is common for individual flycatchers to return to different sites within a breeding area, and even to move between breeding areas, from one year to the next. Some of this movement may be related to breeding success and habitat quality. At Roosevelt Lake, those birds that moved to different sites within a breeding area had on average higher productivity in the year following the move than in the year before the move (Paxton and others, 2007). At Roosevelt Lake and on the San Pedro and Gila Rivers, movement out of breeding patches also increased with the relative age of a patch, which may indicate a preference for younger riparian vegetation structure.

In addition to movements within a breeding site, long-distance movements within and between drainages have been observed (Paxton and others, 2007), at distances up to approximately 450 km. Dispersal of first-year flycatchers is more extensive than adult birds, as typical for most bird species.

Survivorship within the breeding season can be very high, averaging 97 percent at Roosevelt Lake (Paxton and others, 2007). Between-year survivorship of adults can be highly variable, but appears to be similar to that of most small passerine birds studied, with estimates generally ranging from approximately 55 to 65 percent (Stoleson and others, 2000; McLeod and others, 2007; Paxton and others, 2007; Schuetz and Whitfield, 2007). Males and females have similar survivorship rates.

Estimated survivorship of young birds (from hatching to the next breeding season) is highly variable, depending in part on how the estimates are generated (Stoleson and others, 2000). Generally reported as between 15 and 40 percent, juvenile survivorship typically is lower than adult survivorship (Whitfield and Strong, 1995; Stoleson and others, 2000; McLeod and others, 2007). Early fledging young have higher survivorship than those that leave the nest later in the season (Whitfield and Strong, 1995; Paxton and others, 2007). Most flycatchers survive for only 1–2 adult years, and mean life expectancy in Arizona was estimated to be 1.9 years following fledging. However, some individuals live much longer. The maximum reported ages of banded Southwestern Willow Flycatchers are 9–11 years (Sedgwick, 2000; Paxton and others, 2007).

Overall, the Southwestern Willow Flycatcher population appears to persist as one or more widely dispersed metapopulations (Busch and others, 2000; U.S. Fish and Wildlife Service, 2002), with movement of individuals, and thus genetic exchange, occurring across the landscape. However, the amount of movement and interchange is lower among sites that are farther apart or more isolated. Some sites serve as population sources while others may be sinks; some sites will be ephemeral over periods of years or decades. Flycatcher movement and dispersal among sites is important for initial site colonization and subsequent recolonization.

There are few general predictors for the persistence of breeding sites. Relatively large populations, such as the Kern River Preserve, San Pedro River, Elephant Butte Reservoir, and the Gila River have persisted for 10 or more years. However, such large sites can be subject to major changes in population numbers, and even potential extirpation, due to changes in local hydrology, site inundation, drought, etc. (Moore, 2005; Paxton and others, 2007). Although some small populations may be ephemeral and last only a few years (Durst and others, 2008a), others have remained occupied for much longer periods (Kus and others, 2003). Breeding populations also may reappear at unoccupied sites following 1–5 year absences. Suitable flycatcher habitat also can develop—and poor quality habitat can improve—relatively quickly in some sites, under favorable hydrological conditions. For example, at Roosevelt Lake and the San Pedro River (AZ), the age of riparian vegetation when first colonized was as young as 3 years (Paxton and others, 2007). In the same study, flycatchers moved back into older habitat patches when nearby younger, occupied habitat was inundated or scoured away.

Overall, the vegetation and flycatcher occupancy of a habitat patch or river drainage are often dynamic; few if any sites remain static over time. The amount of suitable flycatcher habitat can substantially increase or decrease in just a few years, at local and regional scales. Flycatchers can respond quickly to habitat changes, colonizing new sites if available and abandoning others. Therefore, one cannot assume that local, regional, or rangewide flycatcher population numbers will remain stable over time.

Threats to the Flycatcher and Habitat

The greatest historical factor in the decline of the Southwestern Willow Flycatcher is the extensive loss, fragmentation, and modification of riparian breeding habitat (U.S. Fish and Wildlife Service, 2002). Large-scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats historically used by the Southwestern Willow Flycatcher (Unitt, 1987; General Accounting Office, 1988; Dahl, 1990; State of Arizona, 1990). Changes in the riparian plant community have frequently reduced, degraded, and eliminated nesting habitat for the flycatcher, curtailing its distribution and abundance.

Habitat losses and changes have occurred and continue to occur because of urban, recreational, and agricultural development, water diversion and impoundment, channelization, livestock grazing, and replacement of native habitats by introduced plant species (Marshall and Stoleson, 2000; U.S. Fish and Wildlife Service, 2002). Hydrological changes, natural or man-made, can greatly reduce the quality and extent of flycatcher habitat. Although riparian areas are often not considered as fire-prone, several Southwestern Willow Flycatcher breeding sites were destroyed by fire over the past decade (U.S. Fish and Wildlife Service, 2002), and others are at risk to similar catastrophic loss. Fire danger in these riparian systems may be exacerbated by increases in exotic vegetation, such as saltcedar, diversions or reductions of surface water, increased recreational activity, and drawdown of local water tables.

Although the degradation of many river systems and associated riparian habitat is a key cause of their absence, Southwestern Willow Flycatchers do not require free-running rivers or "pristine" riparian habitats. Most of the largest

Southwestern Willow Flycatcher populations in the last decade were found in reservoir drawdown zones, such as at Roosevelt Lake and Elephant Butte Reservoir. Many breeding populations are found on regulated rivers (Graf and others, 2002). In addition, the vegetation at many smaller flycatcher breeding sites is supported by artificial water sources such as irrigation canals, sewage outflow, or agricultural drainages (U.S. Fish and Wildlife Service, 2002). Although rising water levels could be detrimental to breeding flycatchers within a reservoir drawdown zone, reservoir fluctuations can simulate river dynamics with cycles of destruction and establishment of riparian vegetation, depositing rich sediments and flushing salt accumulations in the soil (Paxton and others, 2007). Therefore, managed and manipulated rivers and reservoirs have the potential to play a positive role by providing flycatcher breeding habitat. However, because rivers and reservoirs are not managed solely to create and maintain flycatcher habitat, the persistence of riparian vegetation in these systems—and any flycatchers breeding therein—is not assured.

Although the historic degradation and loss of native riparian negatively affected the Southwestern Willow Flycatcher, this species does not show an inherent preference for native vegetation. Instead, breeding habitat selection is based primarily on vegetation structure, density, size, and other stand characteristics, and presence of water or saturated soils (U.S. Fish and Wildlife Service, 2002). In fact, approximately 25 percent of known territories are found in habitat composed of 50 percent or greater exotic vegetative component—primarily saltcedar (Durst and others, 2008a). Saltcedar also can be an important habitat component in sites dominated by native vegetation (U.S. Fish and Wildlife Service, 2002, 2005). Despite suggestions that flycatchers breeding in saltcedar are suffering negative consequences and that removal of saltcedar is therefore a benefit (DeLoach and others, 2000; Dudley and DeLoach, 2004), there is increasing and substantial evidence that this is not the case. For example, Paxton and others (2007) found that flycatchers did not suffer any detectable negative consequences from breeding in saltcedar. This is consistent with the findings of Owen and others (2005) and Sogge and others (2006). Therefore, the rapid or large-scale loss of saltcedar in occupied flycatcher habitats, without rapid replacement of suitable native vegetation, could result in reduction or degradation of flycatcher habitat (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2008).

In evaluating Southwestern Willow Flycatcher use of either native or exotic habitat, it is important to recognize that throughout the Southwest, there are many saltcedar-dominated and native-dominated habitats in which flycatchers do not breed (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2006). Therefore, the use of any riparian patch—native or exotic—as breeding habitat will be site specific and will depend on the spatial, structural, and ecological characteristics of that particular patch and the potential for flycatchers to colonize and maintain populations within it.

Drought can have substantial negative effects on breeding flycatchers and their breeding habitat by reducing riparian vegetation vigor and density, and reducing prey availability (Durst, 2004; Paxton and others, 2007; Bureau of Reclamation, 2009). For example, the extreme drought of 2002 caused near complete reproductive failure of the large flycatcher population at Roosevelt Lake; among approximately 150 breeding territories, only two nests successfully fledged young in that year (Ellis and others, 2008). If future climate change produces more frequent or more sustained droughts, as predicted by many climate change models (for example, Seager and others, 2007), southwestern riparian habitats could be reduced in extent or quality. This scenario would present a challenge to the long-term sustainability of Southwestern Willow Flycatcher populations.

Brood parasitism by the Brown-headed Cowbird (*Molothrus ater*) was initially considered another significant threat to the Southwestern Willow Flycatcher (Whitfield, 1990; Harris, 1991; U.S. Fish and Wildlife Service, 1993, 1995; Whitfield and Strong, 1995; Sferra and others, 1997). Cowbirds lay their eggs in the nest of other species (the "hosts"), which raise the young cowbirds—often at the expense of reduced survivorship of their own young. Southwestern Willow Flycatchers seldom fledge any flycatcher young from nests that are parasitized by cowbirds (Whitfield and Sogge, 1999). Although parasitism negatively impacts some Southwestern Willow Flycatcher populations, especially at small and isolated breeding sites, it is highly variable and no longer considered among the primary rangewide threats to flycatcher conservation (U.S. Fish and Wildlife Service, 2002). Cowbird abundance, and therefore parasitism, tends to be a function of habitat type and quality, and the availability of suitable hosts, not specific to the flycatcher. Therefore, large-scale cowbirds control may not always be warranted unless certain impact thresholds are met (U.S. Fish and Wildlife Service, 2002; Rothstein and others, 2003; Siegle and Ahlers, 2004).

Section 2. Survey Protocol

The fundamental principles of the methodology described in this version have remained the same since the original Tibbitts and others (1994) and subsequent Sogge and others (1997a) protocols: the use of vocalization play-back, repeated site visits, and confirmation of flycatcher identity via the species-characteristic song. This newest protocol incorporates guidelines of the 2000 USFWS addendum, and includes changes based on our improved understanding of Willow Flycatcher biology and the significance of potential threats, and the availability of new survey technologies.

Several factors work together to make Southwestern Willow Flycatcher surveys challenging. Difficulties include the flycatcher's physical similarities with other species and subspecies; accessing the dense habitat they occupy; time constraints based on their breeding period; and vocalization patterns. Given these challenges, no methodology can assure 100-percent detection rates. However, the survey protocol described herein has proven to be an effective tool for locating flycatchers, and flycatchers generally are detectable when the protocol is carefully followed. Since 1995, hundreds of sites have been surveyed and thousands of flycatchers detected using the two previous versions of the survey protocol.

The Willow Flycatcher is 1 of 10 regularly occurring *Empidonax* flycatchers found in North America, all of which look very much alike. Like all *Empidonax*, Willow Flycatchers are nondescript in appearance, making them difficult to see in dense breeding habitat. Although the Willow Flycatcher has a characteristic *fitz-bew* song that distinguishes it from other birds (including other *Empidonax*), Willow Flycatchers are not equally vocal at all times of the day or during all parts of the breeding season. Because Southwestern Willow Flycatchers are rare and require relatively dense riparian habitat, they may occur only in a small area within a larger riparian system, thus decreasing detectability during general bird surveys. Migrating Willow Flycatchers (of all subspecies) often sing during their migration through the Southwest, and could therefore be confused with local breeders. In addition, Southwestern Willow Flycatchers are in breeding areas for only 3–4 months of the year. Surveys conducted too early or late in the year would fail to find flycatchers even at sites where they breed.

These life history characteristics and demographic factors influence how Southwestern Willow Flycatcher surveys should be conducted and form the basis upon which this protocol was developed. This protocol is based on the use of repeated call-playback surveys during pre-determined periods of the breeding season, to confirm presence or to derive a high degree of confidence regarding their absence at a site. Such species-specific survey techniques are necessary to collect reliable presence/absence information for rare species (Bibby and others, 1992).

The primary objective of this protocol is to provide a standardized survey technique to detect Southwestern Willow Flycatchers, determine breeding status, and facilitate consistent and standardized data reporting. The survey technique will, at a minimum, help determine presence or absence of the species in the surveyed habitat for that breeding season. Ultimately, the quality of the survey that is conducted will depend on the preparation, training, and in-the-field diligence of the individual surveyor.

This protocol is designed for use by persons who are non-specialists with *Empidonax* flycatchers or who are not expert birders. However, surveyors must have sufficient knowledge, training, and experience with bird identification and surveys to distinguish the Willow Flycatcher from other non-*Empidonax* species, and be able to recognize the Willow Flycatcher's primary song. A surveyor's dedication and attitude, willingness to work early hours in dense, rugged and wet habitats, and their ability to remain alert and aware of important cues also are important. Surveys conducted improperly or by unqualified, inexperienced, or complacent personnel may lead to inaccurate results and unwarranted conclusions.

Surveys conducted by qualified personnel in a consistent and standardized manner will enable continued monitoring of general population trends at and between sites, and between years. Annual or periodic surveys in cooperation with State and Federal agencies should aid resource managers in gathering basic information on flycatcher status and distribution at various spatial scales. Identifying occupied and unoccupied sites will assist resource managers in assessing potential impacts of proposed projects, avoiding impacts to occupied habitat, identifying suitable habitat characteristics, developing effective restoration management plans, and assessing species recovery.

The earlier versions of this protocol (Tibbitts and others, 1994; Sogge and others, 1997a) were used extensively and successfully for many years. Hundreds of flycatcher surveys conducted throughout the Southwest since 1994 revealed much about the usefulness and application of this survey technique. Three important lessons were: (1) the call-playback technique works and detects flycatchers that would have otherwise been overlooked; (2) multiple surveys at each site are important; and (3) with appropriate effort, general biologists without extensive experience with *Empidonax* can find and verify Willow Flycatcher breeding sites.

This revised protocol is still based on call-playback techniques and detection of singing individuals. However, it includes changes in the timing and number of surveys to increase the probability of detecting flycatchers and to help determine if they are breeders or migrants. It also incorporates the basic premise of the USFWS 2000 addendum to the 1997 protocol by requiring a minimum of five surveys in all "project-related" sites. A detailed description of surveys and

timing is discussed in section, "Timing and Number of Visits." Changes in the survey data sheets make them easier to use and submit, and allow reporting all site visits within a single year on one form. The new survey forms also are formatted such that the data on the respective forms can be easily incorporated into the flycatcher range-wide database.

This protocol is intended to determine if a habitat patch contains territorial Southwestern Willow Flycatchers, and is not designed establish the exact distribution and abundance of flycatchers at a site. Determining precise flycatcher numbers and locations requires many more visits and additional time observing the behavior of individual birds. This survey protocol also does not address issues and techniques associated with nest monitoring or other flycatcher research activities. Those efforts are beyond the scope usually needed for most survey purposes, and require advanced levels of experience and skills to gather useful data and avoid potential negative effects to the flycatcher. If nest monitoring is a required component of your study, refer to Rourke and others (1999) for appropriate nest monitoring techniques (available for download at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/reports.asp).

Biologists who are not expert birders or specialists with regard to *Empidonax* flycatchers can effectively use this protocol. However, users should attend a U.S. Fish and Wildlife Service-approved Southwestern Willow Flycatcher survey training workshop, and have knowledge and experience with bird identification, surveys, and ecology sufficient to effectively apply this protocol.

Permits

Federal endangered species recovery permits are required for surveys in all USFWS regions where the Southwestern Willow Flycatcher breeds (application forms can be downloaded at http://www.fws.gov/forms/3-200-55.pdf). State permits also may be required before you can survey within any of the States throughout the Southwestern Willow Flycatcher's range: be certain to check with the appropriate State wildlife agency in your area. It usually takes several months to receive permits, so apply early to avoid delays in starting your surveys. You also must obtain permission from government agencies and private landowners prior to conducting any surveys on their lands.

Pre-Survey Preparation

The degree of effort invested in pre-survey preparation will have a direct effect on the quality and efficiency of the surveys conducted. Pre-survey preparation is often overlooked, but can prove to be one of the more important aspects in achieving high-quality survey results.

Surveyors should study calls, songs, drawings, photographs, and videos of Willow Flycatchers. Several web sites describe life history requirements, and provide photographs and vocalizations. It is especially critical for surveyors to be familiar with Willow Flycatcher vocalizations before going in the field. Although the *fitz-bew* song is the basis of verifying detections using this protocol, Willow Flycatchers use many other vocalizations that are valuable in locating birds and breeding sites. We strongly encourage that all surveyors learn as many vocalizations as possible and refer to the on-line "Willow Flycatcher Vocalizations; a Guide for Surveyors" (available at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/wiflvocl.asp). Several commercial bird song recordings include Willow Flycatcher vocalizations, but these recordings typically have only a few vocalizations and the dialects may differ from those heard in the Southwest.

If possible, visit known Willow Flycatcher breeding sites to become familiar with flycatcher appearance, behavior, vocalizations, and habitat. Such visits are usually part of the standardized flycatcher survey workshops. All visits should be coordinated with USFWS, State wildlife agencies, and the property manager/owner, and must avoid disturbance to territorial flycatchers. While visiting these sites, carefully observe the habitat characteristics to develop a mental image of the key features of suitable habitat.

Surveyors must be able to identify, by sight and vocalizations, other species likely to be found in survey areas that may be confused with Southwestern Willow Flycatchers. These include Bell's Vireo (*Vireo bellii*), Western Wood-pewee (*Contopus sordidulus*), young or female Vermillion Flycatchers (*Pyrocephalus rubinus*), and other *Empidonax* flycatchers. At a distance, partial song or call notes of Bell's Vireo, Ash-throated Flycatchers (*Myiarchus cinerascens*) and some swallows can sound considerably like a *fitz-bew*. Surveyors also should be able to identify Brown-headed Cowbirds by sight and vocalizations. It is worthwhile to make one or more pre-survey trips to the survey sites or other similar areas to become familiar with the local bird fauna. You might consider obtaining a species list relative to your area and become familiar with those species by site and sound.

Prior to conducting any presence/absence surveys in your respective State or USFWS Region, contact the respective flycatcher coordinators to discuss the proposed survey sites and determine if the sites have been surveyed in prior years. If possible, obtain copies of previous survey forms and maintain consistency with naming conventions and site boundaries. Study the forms to determine if flycatchers have been previously detected in the site, record locations of any previous detections, and read the comments provided by prior surveyors. While surveying, be sure to pay special attention to any patches where flycatchers have previously been detected.

Familiarity with the survey site prior to the first surveys is the best way to be prepared for the conditions you will experience. Determine the best access routes to your sites and always have a back-up plan available in the event of unforeseen conditions (for example, locked gates, weather, etc.). Know the local property boundaries and where the potential hazards may be, including deep water, barbed wire fencing, and difficult terrain. Be prepared to work hard and remain focused and diligent in a wide range of physically demanding conditions. At many sites, these include heat, cold, wading through flowing or stagnant water, muddy or swampy conditions, crawling through dense thickets (often on hands and knees), and exposure to snakes, skunks, and biting insects.

It is imperative that all surveyors exercise the adage "safety first." Be aware of safety hazards and how to avoid them, and do not allow the need to conduct surveys to supersede common sense and safety. Inform your coworkers where you will be surveying and when you anticipate returning. Always take plenty of water and know how to effectively use your equipment, especially compass, Global Positioning System (GPS), and maps.

Equipment

The following equipment is necessary to conduct the surveys:

1. **USGS topographic maps of the area**: A marked copy is required to be attached to survey data sheets submitted at the end of the season. Be sure to always delineate the survey area and clearly mark any flycatcher detections. If the survey area differed between visits; delineate each survey individually.
2. **Standardized survey form**: Always bring more copies than you think you need.
3. **Lightweight audio player**: Be sure the player has adequate volume to carry well; use portable speakers if necessary. Several digital devices, such as CD players and MP3 players, are currently available and can be connected to external amplified speakers for broadcasting the flycatcher vocalizations. However, not all are equally functional or effective in field conditions; durability, reliability, and ease of use are particularly important. Talk to experienced surveyors for recommendations on particular models and useful features.
4. **Extra player and batteries**: In the field, dirt, water, dust, and heat often cause equipment failure, and having backup equipment helps avoid aborting a survey due to equipment loss or failure.
5. **Clipboard and permanent (waterproof) ink pen**: We recommend recording survey results directly on the survey data form, to assure that you collect and record all required data and any field notes of interest.
6. **Aerial photographs**: Aerial photographs can significantly improve your surveys by allowing you to accurately target your efforts, thus saving time and energy in the field. Previously, aerial images were often expensive and difficult to obtain. However, it is now easy to get free or low-cost images from sources, such as Google© Earth. Even moderate resolution images generally are better than none. For higher resolution aerial photographs, check with local planning offices and/or State/Federal land-management agencies for availability. Take color photocopies, not the original aerial photographs, with you in the field. Aerial photographs also are very useful when submitting your survey results but cannot be substituted in lieu of the required topographic map.
7. **Binoculars and bird field guide**: Although this protocol relies primarily on song detections to verify flycatcher presence, good quality binoculars are still a crucial field tool to help distinguish between possible Southwestern Willow Flycatchers and other species. Use a pair with 7–10 power magnification that can provide crisp images in poor lighting conditions. A good field guide also is essential for the same reason.
8. **GPS unit**: A GPS unit is needed for determining survey coordinates and verifying the location of survey plots on topographic maps. All flycatcher detections should be stored as waypoints and coordinates recorded on the survey form. A wide variety of fairly inexpensive GPS units are currently available. Most commercially available units will provide accuracy within 10 m, which is sufficient for navigating and marking locations.
9. **Compass**: Surveyors should carry a compass to help them while navigating larger habitat patches. This is an important safety back-up device, because GPS units can fail or lose power. Most GPS units have a feature to provide an accurate bearing to stored waypoints (for example, previous flycatcher detections, your parked vehicle, etc.); however, many units do not accurately display the direction in which the surveyor is traveling slowly through dense vegetation. A compass set to the proper bearing provides a more reliable method to navigate the survey site and relocate previously marked locations.

The following equipment also is recommended:

10. **Camera:** These are very helpful for habitat photographs, especially at sites where flycatchers are found. Small digital cameras are easily portable and relatively inexpensive.
11. **Survey flagging:** Used for marking survey sites or areas where flycatcher are detected. Check with the local land owner or management agency before flagging sites. Use flagging conservatively so as to not attract people or predators.
12. **Field vest:** A multi-pocket field vest can be very useful for carrying field equipment and personal items. We recommend muted earth-tone colors.

13. **Cell phone and/or portable radio**: In addition to providing an increased level of safety, cell phones or portable radios may be used by surveyors to assist each other in identifying territories and pairs in dense habitats, or where birds are difficult to hear.

In addition to the necessary equipment mentioned above, personal items, such as food, extra water or electrolyte drink, sunscreen, insect repellent, mosquito net, first-aid kit, whistle, and a light jacket, also should be considered. Being prepared for unforeseen difficulties, and remaining as comfortable as conditions allow while surveying are important factors to conducting thorough and effective surveys.

All survey results (both negative and positive) should be recorded directly on data forms when possible. These data forms have been designed to prompt surveyors to record key information that is crucial to interpretation of survey results and characterization of study sites. Even if no flycatchers are detected or habitat appears unsuitable, this is valuable information and should be recorded. Knowing where flycatchers are not breeding can be as important as knowing where they are; therefore, negative data are important. Standardized data forms are provided in appendix 1, or can be downloaded online. Always check for updated forms prior to each year's surveys.

Willow Flycatcher surveys are targeted at this species and require a great deal of focused effort. Surveyors must be constantly alert and concentrate on detecting a variety of flycatcher cues and responses. Therefore, field work, such as generalized bird surveys (for example, point counts or walking transects) or other distracting tasks, should not be conducted in conjunction with Willow Flycatcher surveys. Avoid bringing pets or additional people who are not needed for the survey. Dress in muted earth-tone colors, and avoid wearing bright clothing.

Willow Flycatcher Identification

The Southwestern Willow Flycatcher is a small bird, approximately 15 cm long and weighing about 11–12 g. Sexes look alike and cannot be distinguished by plumage. The upper parts are brownish-olive; a white throat contrasts with the pale olive breast, and the belly is pale yellow. Two white wing bars are visible (juveniles have buffy wing bars) and the eye ring is faint or absent. The upper mandible is dark and the lower mandible light. The tail is not strongly forked. When perched, the Willow Flycatcher often flicks its tail upward. As a group, the *Empidonax* flycatchers are very difficult to distinguish from one another by appearance. The Willow Flycatcher also looks very similar to several other passerine species you may encounter in the field.

Given that Willow Flycatchers look similar to other *Empidonax* flycatchers that may be present at survey sites, the most certain way to verify Willow Flycatchers in the field is by their vocalization. For the purpose of this protocol, identification of Willow Flycatchers cannot be made by sight alone; vocalizations are a critical identification criterion, and specifically the primary song *fitz-bew*. Willow Flycatchers have a variety of vocalizations (see Stein, 1963; Sedgwick, 2000), but two are most commonly heard during surveys or in response to call-playback:

1. ***Fitz-bew***. This is the Willow Flycatcher's characteristic primary song. Note that *fitz-bews* are not unique to the southwestern subspecies; all Willow Flycatchers sing this characteristics song. Male Willow Flycatchers may sing almost continuously for hours, with song rates as high as one song every few seconds. Song volume, pitch, and frequency may change as the season progresses. During prolonged singing bouts, *fitz-bews* are often separated by short *britt* notes. *Fitz-bews* are most often given by a male, but studies have shown female Willow Flycatchers also sing, sometimes quite loudly and persistently (although generally less than males). Flycatchers often sing from the top of vegetation, but also will vocalize while perched or moving about in dense vegetation.
2. ***Whitt***. This is a call often used by nesting pairs on their territory, and commonly is heard even during periods when the flycatchers are not singing (*fitz-bewing*). The *whitt* call appears to be a contact call between sexes, as well as an alarm call, particularly when responding to disturbance near the nest. *Whitt* calls can be extremely useful for locating Willow Flycatchers later in the season when *fitz-bewing* may be infrequent, but are easily overlooked by inexperienced surveyors. When flycatcher pairs have active nests and particularly once young have hatched, *whitts* may be the most noticeable vocalization. However, many species of birds *whitt*, and a *whitt* is not a diagnostic characteristic for Willow Flycatchers. For example, the "*whitt*" of the Black-headed Grosbeak (*Pheucticus melanocephalus*) and Yellow-breasted Chat (*Icteria virens*) are often confused with that of the flycatcher.

The *fitz-bew* and *whitt* calls are the primary vocalizations used to locate Willow Flycatchers. However, other less common Willow Flycatcher vocalizations can be very useful in alerting surveyors to the presence of flycatchers. These include twittering vocalizations typically given during interactions between flycatchers and sometimes between flycatchers and other birds, bill snapping, *britt*'s, and *wheeo*'s. Because these sounds can be valuable in locating territories (Shook and others, 2003), they should be studied prior to going in the field. Willow Flycatcher vocalization recordings are available from Federal and State agency contacts and online at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/. Standardized recordings of Southwestern Willow Flycatchers also are available online at http://www.naturesongs.com/tyrrcert.html#tyrr. Specifically, only *fitz-bews* and *britts* should be used for conducting surveys, to provide more robust comparative results among sites and years.

Willow Flycatcher song rates are highest early in the breeding season (late May–early June), and typically decline after eggs hatch. However, in areas with many territorial flycatchers or where an unpaired flycatcher is still trying to attract a mate, or where re-nesting occurs, singing rates may remain high well into July. Isolated pairs can be much quieter and harder to detect than pairs with adjacent territorial flycatchers. At some sites, pre-dawn singing (0330–0500 hours) appears to continue strongly at least through mid-July (Sogge and others, 1995). Singing rates may increase again later in the season, possibly coinciding with re-nesting attempts (Yard and Brown, 2003). The social dynamics of adjacent territories can strongly influence vocalization rates. A single "*fitz-bew*" from one flycatcher may elicit multiple responses from adjacent territories. When these interactions occur, it is a good opportunity to distinguish among territories and provides the surveyor with an estimate of territory numbers in the immediate area.

There are some periods during which Willow Flycatchers do not sing and even the use of call-playback sometimes fails to elicit any response. This can be particularly true late in the breeding season. Early and repeated surveys are the best way to maximize the odds of detecting a singing flycatcher and determining its breeding status.

Timing and Number of Visits

No survey protocol can guarantee that a Southwestern Willow Flycatcher, if present, will be detected on any single visit. However, performing repeated surveys during the early to mid-nesting season increases the likelihood of detecting flycatchers and aids in determining their breeding status. A single survey, or surveys conducted too early or late in the breeding cycle, do not provide definitive data and are of limited value.

For purposes of this survey protocol, we have divided the Southwestern Willow Flycatcher breeding season into three basic survey periods, and specified a minimum number of survey visits for each period (fig. 9). Although the Sogge and others (1997a) protocol recommended a minimum of one survey in each period, we now recommend a differing number of visits for general surveys versus project-related studies.

General surveys are conducted for the sole purpose of determining whether Willow Flycatchers are present or absent from a respective site, when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. In such cases, a minimum of one survey visit is required in each of the three survey periods.

Project-related surveys are conducted to determine the presence or absence of Willow Flycatchers within a site when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management. Additional surveys are required for project-related studies in order to derive a greater degree of confidence regarding the presence or absence of Willow Flycatchers.

All successive surveys must be at least 5 days apart; surveys conducted more closely are not considered to be separate surveys. Although a minimum of three or five surveys are required for general and project-related purposes, respectively, if the habitat patches are large, contiguous and extremely dense, additional surveys are strongly encouraged to ensure full coverage of the site.

If you are uncertain whether three general surveys or five project-related surveys are required for your respective study, contact your USFWS flycatcher coordinator. As noted earlier, this survey protocol will help determine if territorial flycatchers are present and their approximate locations; if your project requires fine-scale estimates of flycatcher numbers or distribution at a site, you may need to conduct more intensive efforts that include additional surveys, nest searches, and nest monitoring.

Survey Period 1: May 15–31.—For both general and project-related surveys: a minimum of one survey is required. The timing of this survey is intended to coincide with the period of high singing rates in newly arrived males, which tends to begin in early to mid-May. This is one of the most reliable times to detect flycatchers that have established their territories, so there is substantial value to conducting period 1 surveys even though not all territorial males may yet have arrived. Migrant Willow Flycatchers of multiple subspecies will likely be present and singing during this period. Because both migrant and resident Willow Flycatchers are present during this period, and relatively more abundant then in subsequent surveys, it is an excellent opportunity to hone your survey and detection skills and gain confidence in your abilities. Detections of flycatchers during period 1 also provide insight on areas to pay particular attention to during the next survey period.

Survey Period 2: June 1–24.—For general surveys: a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Note that this differs from the minimum of one survey that was recommended in this period under the previous protocol (Sogge and others, 1997a). During this period, the earliest arriving males may already be paired and singing less, but later arriving males should still be singing strongly. Period 2 surveys can provide insight about the status of any flycatchers detected during survey period 1. For example, if a flycatcher is detected during survey period 1 but not survey period 2, the first detection may have been a migrant. Conversely, detecting a flycatcher at the same site during periods 1 and 2 increases the likelihood that the bird is not a migrant, although it does not necessarily confirm it. Survey period 2 also is the earliest time during which you are likely to find nesting activity by resident birds at most sites. Special care should be taken during this period to watch for activity that will verify whether the flycatchers that are present are attempting to breed. A little extra time and diligence should be spent at all locations where flycatchers were detected during survey period 1.

Survey Visit Timing, Numbers, and Detection Interpretation

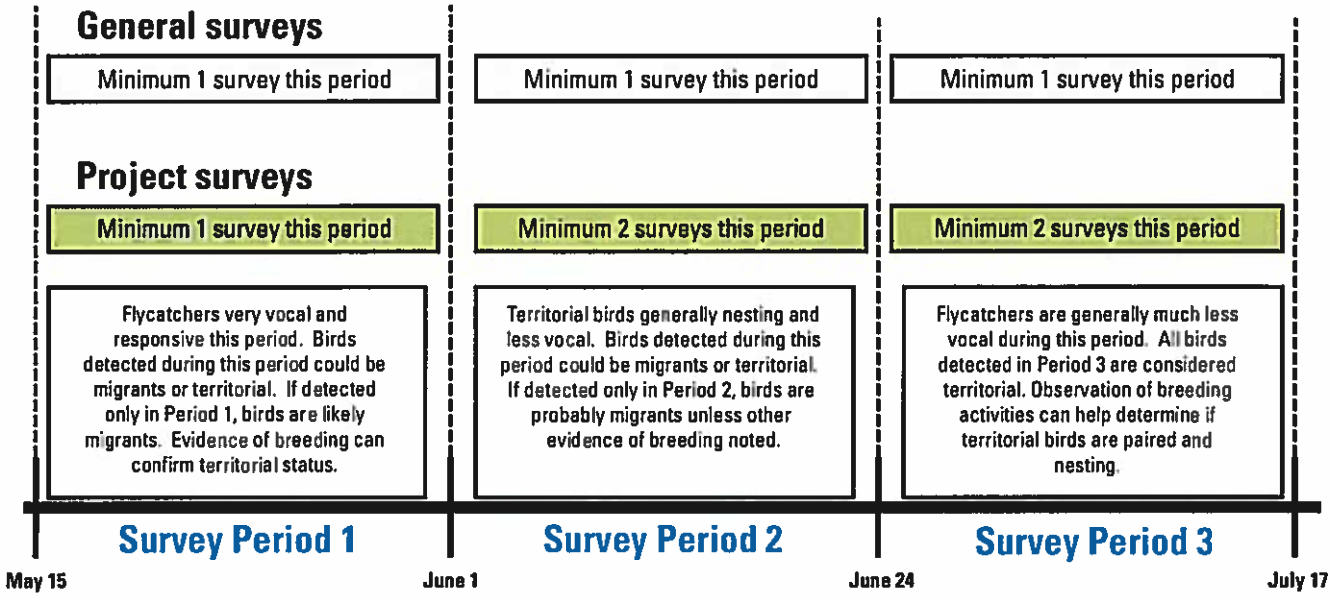


Figure 9. Recommended numbers and timing of visits during each survey period for general surveys and project surveys. General surveys are those conducted when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. Project-related surveys are conducted when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management.

Survey Period 3: June 25–July 17.—For general surveys, a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Virtually all Southwestern Willow Flycatchers should have arrived on their territories by this time. Flycatcher singing rates probably have lessened, and most paired flycatchers will have initiated or even completed their first round of nesting activity. Migrant Willow Flycatchers should no longer be passing through the Southwest; therefore, any flycatchers that you detect are likely to be either territorial or nonbreeding floaters. Surveyors should determine if flycatchers detected during surveys in periods 1 or 2 are still present, and watch closely for nesting activity. Flycatchers that have completed a first nesting attempt may resume vigorous singing during this period. Extra time and diligence should be spent at all locations where flycatchers were detected during survey periods 1 or 2.

At high elevation sites (above 2,000 m), Southwestern Willow Flycatcher arrival and initiation of breeding activities may occur in early June, and possibly later in some years due to weather or migration patterns. Therefore, flycatcher breeding chronology may be delayed by 1 or 2 weeks at such sites, and surveys should be conducted in the latter part of each period.

It may not require multiple surveys to verify Southwestern Willow Flycatcher presence or breeding status. If, for example, Willow Flycatchers are observed carrying nest material during survey periods 1 or 2, this is conclusive verification they are breeders as opposed to migrants, regardless of what is found during period 3. However, it requires a minimum of three surveys for general studies and five surveys for project-related studies to determine with relative confidence that Southwestern Willow Flycatchers probably are not breeding at a site in that year, based on lack of detections.

We strongly encourage additional follow-up surveys to sites where territorial Southwestern Willow Flycatchers are verified or suspected. Extra surveys provide greater confidence about presence or absence of flycatchers at a site, as well as help in estimating the number of breeding territories or pairs, and determining breeding status and the outcome of breeding efforts. Pre-survey visits the evening before the survey or post-survey follow-up later in the morning can help confirm breeding status when surveyors are not under time constraints. However, avoid returning to a site so often as to damage the habitat, establish or enlarge trails, or cause undue disturbance to the flycatchers.

Survey Methods

The survey methods described below fulfill the primary objectives of documenting the presence or absence of Willow Flycatchers, and determining their status as territorial versus migrant. This protocol primarily is a call-playback technique, a proven method for eliciting response from nearby Willow Flycatchers (Seutin, 1987; Craig and others, 1992), both territorial and migrants. The premise of the call-playback technique is to simulate a territorial intrusion by another Willow Flycatcher, which generally will elicit a defensive response by the territorial bird, increasing its detectability. At each site, surveyors should broadcast a series of recorded Willow Flycatcher *fitz-bews* and *britts*, and look and listen for responses. In addition to maximizing the likelihood of detecting nearby flycatchers, this method also allows for positive identification by comparing the responding bird's vocalizations to the known Willow Flycatcher recording.

Documenting Presence/Absence—Begin surveys as soon as there is enough light to safely walk (about 1 hour before sunrise) and end by about 0900–1030 hours, depending on the temperature, wind, rain, background noise, and other environmental factors. Use your best professional judgment whether to conduct surveys that day based on local field conditions. If the detectability of flycatchers is being reduced by environmental factors, surveys planned for that day should be postponed until conditions improve. If observers are camped in or near potential Willow Flycatcher habitat, afternoons and evenings can be spent doing site reconnaissance and planning a survey strategy for the following morning. If camped immediately adjacent to survey sites, surveyors can awaken early and listen for flycatchers singing during the predawn period (0330–0500 hours), when territorial males often sing loudly.

Conduct surveys from within rather than from the perimeter of the sites, while limiting the breaking of vegetation or damaging the habitat. If surveys cannot be conducted from within the habitat, walk along the perimeter and enter the patch at intervals to broadcast the vocalizations and listen for responses. Flycatchers often respond most strongly if the recording is played from within the habitat and territory, rather than from the periphery. In addition, it can be surprisingly difficult to hear singing Willow Flycatchers that are even a short distance away amidst the noise generated by other singing and calling birds, roads, noisy streams, and other extraneous sounds. Therefore, it is preferable to survey from within the habitat, but always move carefully to avoid disturbing habitat or nests. Surveying from the periphery should not be conducted only for the sake of convenience, but is allowable for narrow linear reaches or when absolutely necessary due to safety considerations.

Because flycatchers may be clustered within only a portion of a habitat patch, it is critical to survey all suitable habitat within the patch. Small linear sites may be thoroughly covered by a single transect through the patch. For larger sites, choose a systematic survey path that assures complete patch coverage throughout the length and breadth of the site. This may require multiple straight transects, serpentine, zig-zag, or criss-cross routes. Aerial photographs and previous survey forms are valuable tools to help plan and conduct surveys, and to assure complete coverage. Always move carefully through the habitat to avoid disturbing vegetation or nests.

Initially approach each site and stand quietly for 1–2 minutes or longer, listening for spontaneously singing flycatchers. A period of quiet listening is important because it helps acclimate surveyors to background noises that can be quite loud due to roads, aircraft, machinery, waterways, and other sounds. It also allows surveyors to recognize and shift attention away from the songs and calls of other bird species, letting them focus on listening for flycatchers. Although it happens rarely, some singing Willow Flycatchers will actually stop vocalizing and approach quietly in response to a broadcast song, perhaps in an effort to locate what they perceive as an intruding male. Therefore, playing a recording before listening for singing individuals has at least some potential of reducing detectability.

If you do not hear singing flycatchers during the initial listening period, broadcast the Willow Flycatcher song recording for 10–15 seconds; then listen for approximately 1 minute for a response. Repeat this procedure (including a 10-second quiet pre-broadcast listening period) every 20–30 m throughout each survey site, more often if background noise is loud. The recording should be played at about the volume of natural bird calls, and not so loud as to cause distortion of the broadcast. We recommend that the playback recording include a series of *fitz-bews* interspersed with several *britts*.

Response to the broadcast call could take several forms. Early in the breeding season (approximately May–mid-June), a responding Willow Flycatcher will usually move toward the observer and *fitz-bew* or *whitt* from within or at the top of vegetation. Territorial Willow Flycatchers almost always vocalize strongly when a recording is played in their territory early in the season. If there are several flycatchers present in an area, some or all may start singing after hearing the recording or the first responding individual. Flycatchers can often hear the recording from far away but will not usually move outside of their territory, so listen for distant responses. Also, stay alert and listen for flycatchers vocalizing behind you that may not have responded when you were first in their territory. Another common flycatcher response is alarm calls (*whitts*) or interaction twitters from within nearby vegetation, particularly once nesting has begun. Willow Flycatchers will often sing after a period of *whitting* in response to a recording, so surveyors hearing *whitts* should remain in the area and quietly listen for *fitz-bews* for several minutes. Because some flycatchers may initially respond by approaching quietly, particularly during periods 2 and 3, it is critical to watch carefully for responding birds.

If you detect flycatchers that appear particularly agitated, it is possible that you are in close proximity to their nest. Agitated flycatchers may swoop down at the surveyor, snap their beaks, and otherwise appear distressed. Exercise extreme caution so as to not accidently disturb the nest, and move slowly away from the immediate area.

For the purpose of this protocol, detection of a *fitz-bew* song is essential to identify a bird as a Willow Flycatcher. Similar appearing species (including other *Empidonax* flycatchers) occur as migrants, and even breeders, at potential Willow Flycatcher sites. A few of these other species may even approach a broadcast Willow Flycatcher song and respond with vocalizations. In order to standardize interpretation of survey results and assure a high degree of confidence in surveys conducted by biologists of varying experience and skill, positive identification must be based on detection of the Willow Flycatcher's most unique characteristic—its song. It is important to remember that the *whitt* call is not unique to Willow Flycatchers, and therefore cannot serve as the basis of a positive identification. However, *whitts* are extremely useful for locating flycatchers and identifying areas needing follow-up visits. Loud, strong *whitting* may indicate a nearby nest, dictating that surveyors exercise extra caution moving through the area.

Whenever a verified or suspected Willow Flycatcher is detected, be careful not to overplay the song recording. Excessive playing could divert the bird from normal breeding activities or attract the attention of predators and brood parasites. Wildlife management agencies may consider overplaying the recording as "harassment" of the flycatcher, and this is not needed to verify species identification. Although flycatchers usually sing repeatedly once prompted, even a single *fitz-bew* is sufficient for verification. If you have played a recording several times and a bird has approached but has not *fitz-bewed*, do not continue playing the recording. If a potential Willow Flycatcher responds, approaches or *whitts* but does not sing, it is best to carefully back away and wait quietly. If it is a Willow Flycatcher, it probably will sing within a short time (5–10 minutes). Another option is to return to the same site early the following morning to listen for or attempt to elicit singing again. If you are still uncertain, record the location with your GPS, record comments on the survey form, and follow-up on the detection during subsequent surveys. If possible, request the assistance of an experienced surveyor to determine positive identification.

If more habitat remains to be surveyed, continue onward once a flycatcher is detected and verified. In doing so, move 30–40 m past the current detection before again playing the recording, and try to avoid double-counting flycatchers that have already responded. Willow Flycatchers, particularly unpaired males, may follow the broadcast song for 50 m or more.

Looking For and Recording Color Bands.—Several research projects have involved the capture and banding of Willow Flycatchers at breeding sites across the Southwest. In such projects, flycatchers are banded with one or more small colored leg bands, including a federal numbered band. As a result, surveyors may find color-banded individuals at their survey sites, and identification and reporting of the band combination can provide important data on flycatcher movements, survivorship, and site fidelity.

To look for bands, move to get a good view of the flycatcher's legs. This may be difficult in dense vegetation, but flycatchers commonly perch on more exposed branches at the edges of their territory or habitat patch. If bands are seen, carefully note the band colors. If there is more than one band on a leg, differentiate the top (farthest up the leg) from the bottom (closest to the foot), and those on the bird's left leg versus the right leg. If you are unsure of the color, do not guess. Instead, record the color as unknown. Incorrect color-band data are worse than incomplete data, so only record colors of which you are certain. The fact that a banded bird was seen, even without being certain of its color combination, is very important information. Record the color-band information on the survey form, and report the sighting to the appropriate State or Federal contact as soon as you return from the survey that day.

Determining the Number of Territories and Pairs.—Accurately determining the number of breeding territories and pairs can be more difficult than determining simple presence or absence. Flycatcher habitat is usually so dense that visual detections are difficult, and seeing more than one bird at a time is often impossible. Flycatchers sing from multiple song perches within their territories, and may be mistaken for more than one flycatcher. A flycatcher responding to or following a surveyor playing a recording may move considerable distances in a patch and thus be counted more than once. Territorial male flycatchers often sing strongly, but so do many migrants and some females, particularly in response to call-playback (Seutin, 1987; Unitt, 1987; Sogge and others, 1997b). Rangewide, many territorial male flycatchers are unmated, particularly those in small breeding groups. For these reasons, each singing flycatcher may not represent a territory or a mated pair. Following the established survey protocol and carefully observing flycatcher behavior can help determine if you have detected migrants, territorial birds, breeders, unmated birds, or pairs.

Given sufficient time, effort and observation, it is usually possible to approximate the number of territories and pairs. First, listen carefully for simultaneously singing flycatchers. Note the general location of each bird—especially concurrently singing individuals—on aerial photographs, map, or a site sketch. Spend some time watching each flycatcher to determine approximate boundaries of its territory, and how it interacts with other flycatchers. If one or more singing

birds stay primarily in mutually exclusive areas, they can be considered as separate territories. To determine if a flycatcher is paired, watch for interactions within a territory. Refer to the section, "Determining Breeding Status" for signs of pairing and breeding activity. Do not report a territorial male as a pair unless you observe one or more of the signs listed below. In some cases, it may be possible only to estimate the number of singing individuals. In other cases, it may take multiple site visits to differentiate territories or pairs.

Determining Breeding Status.—One way to determine if the flycatchers found at a particular site are migrants or territorial is to find out if they are still present during the "non-migrant" period, which generally is from about June 15 to July 20 (Unitt, 1987). A Willow Flycatcher found during this time probably is a territorial bird, although there is a small chance it could be a non-territorial floater (Paxton and others, 2007). If the management question is simply whether the site is a potential breeding area, documenting the presence of a territorial flycatcher during the non-migrant period may meet all survey objectives, and the site may not need to be resurveyed during the remainder of that breeding season.

However, in some cases, surveyors will be interested in knowing not only if territorial Southwestern Willow Flycatchers are present at a site, but also whether breeding or nesting efforts are taking place. Some males maintain territories well into July yet never succeed in attracting a mate, so unpaired males are not uncommon (McLeod and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009). Thus, an assumption that each singing male represents a breeding pair may not be well founded, especially in small populations. If it is important to determine whether a pair is present and breeding in that territory, move a short distance away from where the bird was sighted, find a good vantage point, and sit or lie quietly to watch for evidence of breeding. Signs of breeding activity include:

a. observation of another unchallenged Willow Flycatcher in the immediate vicinity (indicates possible pair);
b. *whitt* calls between nearby flycatchers (indicates possible pair);
c. interaction twitter calls between nearby flycatchers (indicates possible pair);
d. countersinging or physical aggression against another flycatcher or bird species (suggests territorial defense);
e. physical aggression against cowbirds (suggests nest defense);
f. observation of Willow Flycatchers copulating (verifies attempted breeding);
g. flycatcher carrying nest material (verifies nesting attempt, but not nest outcome);
h. flycatcher carrying food or fecal sac (verifies nest with young, but not nest outcome);
i. locating an active nest (verifies nesting). Recall that general survey permits do not authorize nest searching or monitoring, and see section, "Special Considerations";
j. observation of adult flycatchers feeding fledged young (verifies successful nesting).

You may be able to detect flycatcher nesting activity, especially once the chicks are being fed. Adults feed chicks at rates of as many as 30 times per hour, and the repeated trips to the nest tree or bush are often quite evident. Be sure to note on the flycatcher survey form any breeding activity that is observed, including detailed descriptions of the number of birds, and specific activities observed. Also note the location of breeding activities on an aerial photograph, map, or sketch of the area.

The number of flycatchers found at a site also can provide a clue as to whether they are migrants or territorial birds. Early season detections of single, isolated Willow Flycatchers often turn out to be migrants. However, discovery of a number of Willow Flycatchers at one site usually leads to verification that at least some of them remain as local breeders. This underscores the importance of completing a thorough survey of each site to be confident of the approximate number of flycatchers present.

In some cases, regardless of the time and diligence of your efforts, it will be difficult to determine the actual breeding status of a territorial male. In these instances, use your best professional judgment, or request the assistance of an experienced surveyor or an agency flycatcher coordinator to interpret your observations regarding breeding status.

Reporting Results.—There is little value in conducting formal surveys if the data are not recorded and submitted. Fill in all appropriate information on the Willow Flycatcher survey form while still in the field, and mark the location of detections on a copy of the USGS topographic map. Make a habit of reviewing the form before you leave any site—trying to remember specific information and recording it later can lead to missing and inaccurate data. Note the location of the sighting on an aerial photograph or sketch of the site. Attaching photographs of the habitat also is useful. Whenever a Willow Flycatcher territory or nest site is confirmed, notify the USFWS or appropriate State wildlife agency as soon as you return from the field. The immediate reporting of flycatcher detections or nests may differ among USFWS regions and States—discuss these reporting procedures with your respective State and USFWS flycatcher coordinators.

Complete a survey form (appendix 1) for each site surveyed, whether or not flycatchers are detected. "Negative data" (that is, a lack of detections) are important to document the absence of Willow Flycatchers and help determine what areas have already been surveyed. Make and retain a copy of each survey form, and submit the original or a legible copy. Electronic copies of the survey forms also are acceptable and are available online (http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/). All survey forms must be submitted to the USFWS and the appropriate State wildlife agency by the specified deadline identified in your permits. Timely submission of survey data is a permit requirement, and will ensure the information is included in annual statewide and regional reports.

Special Considerations

To avoid adverse impacts to Willow Flycatchers, follow these guidelines when performing all surveys:

1. Obtain all necessary Federal, State, and agency permits and permissions prior to conducting any surveys. Failure to do so leaves you liable for violation of the Endangered Species Act, various State laws, and prosecution for trespass.
2. Do not play the recording more than necessary or needlessly elicit vocal responses once Willow Flycatchers have been located and verified. This may distract territorial birds from caring for eggs or young, or defending their territory. If flycatchers are vocalizing upon arrival at the site, and your objective is to determine their presence or absence at a particular site—there is no need to play the recording. Excessive playing of the recording also may attract the attention of predators or brood parasites. Stop playing the survey recording as soon as you have confirmed the presence of a Willow Flycatcher, and do not play the recording again until you have moved 30–40 m to the next survey location.
3. Proceed cautiously while moving through Willow Flycatcher habitat. Continuously check the area around you to avoid disturbance to nests of Willow Flycatchers and other species. Do not break understory vegetation, even dead branches, to create a path through the surveyed habitat.
4. Do not approach known or suspected nests. Nest searches and monitoring require specific State and Federal permits, have their own specialized methodologies (Rourke and others, 1999), and are not intended to be a part of this survey protocol.
5. If you find yourself close to a known or suspected nest, move away slowly to avoid startling the birds or force-fledging the young. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent. Do not leave the nest area by the same route that you approached. This leaves a "dead end" trail that could guide a potential predator to the nest/nest tree. If nest monitoring is a component of the study, but you are not specifically permitted to monitor the nest, store a waypoint with your GPS, affix flagging to a nearby tree at least 10 m away, and record the compass bearing to the nest on the flagging. Report your findings to an agency flycatcher coordinator or a biologist who is permitted to monitor nests.
6. If you use flagging to mark an area where flycatchers are found, use it conservatively and make certain the flagging is not near an active nest. Check with the property owner or land-management agency before flagging to be sure that similar flagging is not being used for other purposes in the area. Unless conducting specific and authorized/permitted nest monitoring, flagging should be placed no closer than 10 m to any nest. Keep flagging inconspicuous from general public view to avoid attracting people or animals to an occupied site, and remove it at the end of the breeding season.
7. Watch for and note the presence of potential nest predators, particularly birds, such as Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), jays, and magpies. If such predators are in the immediate vicinity, wait for them to leave before playing the recording.
8. Although cowbird parasitism is no longer considered among the primary threats to flycatcher conservation it remains useful to note high concentrations of cowbirds in the comment section of the survey form. While conducting surveys, avoid broadcasting the flycatcher vocalizations if cowbirds are nearby, especially if you believe you may be close to an active flycatcher territory. The intent of not broadcasting flycatcher vocalizations is to reduce the potential for attracting cowbirds to a flycatcher territory or making flycatcher nests more detectable to cowbirds.
9. Non-indigenous plants and animals can pose a significant threat to flycatcher habitat and may be unintentionally spread by field personnel, including those conducting flycatcher surveys. Simple avoidance and sanitation measures can help prevent the spread of these organisms to other environments. To avoid being a carrier of non-indigenous plants or animals from one field site to another visually inspect and clean your clothing, gear, and vehicles before moving to a different field site. A detailed description on how to prevent and control the spread of these species is available by visiting the Hazard Analysis and Critical Control Point Planning for Natural Resource Management web site (http://www.haccp-nrm.org). One species of particular interest is the tamarisk leaf-beetle (*Diorhabda* spp.). If you observe defoliation of saltcedar while conducting flycatcher surveys and believe that *Diorhabda* beetles may be responsible, notify your USFWS coordinator immediately. Other non-native species of concern in survey locations are the quagga mussel (*Dreissena rostriformis bugensis*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), giant salvinia (*Salvinia molesta*), water milfoil (*Myriophyllum spicatum*), parrot's feather (*M. aquaticum*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

References Cited

Ahlers, D., and White, L., 2000, 1999 Willow Flycatcher survey results: Fish Creek and Gooseberry Creek drainages, Utah: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Ahlers, D., and Moore, D., 2009, A review of vegetation and hydrologic parameters associated with the Southwestern Willow Flycatcher – 2002-2008, Elephant Butte Reservoir Delta, NM: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Allison, L.J., Paradzick, C.E., Rourke, J.W., and McCarthey, T.C., 2003, A characterization of vegetation in nesting and non-nesting plots for Southwestern Willow Flycatchers in central Arizona: Studies in Avian Biology, v. 26, p. 81–90.

Arizona Game and Fish Department, 2006, DRAFT, Arizona's Comprehensive Wildlife Conservation Strategy–2005-2015: Arizona Game and Fish Department, Phoenix, Arizona. (Also available at http://www.azgfd.gov/pdfs/w_c/cwcs/downloads/CWCS_Final_May2006.pdf.)

Bibby, C.J., Burgess, N.D., and Hill, D.A., 1992, Bird census techniques: Academic Press, London, U.K.

Browning, M.R., 1993, Comments on the taxonomy of *Empidonax traillii* (Willow Flycatcher): Western Birds, v. 24, p. 241–257.

Busch, J.D., Miller, M.P., Paxton, E.H., Sogge, M.K., and Keim, P., 2000, Genetic variation in the endangered Southwestern Willow Flycatcher: Auk, v. 117, p. 586–595.

California Department of Fish and Game, 1991, Endangered and threatened animals of California: State of California, The Resources Agency, Department of Fish and Game, Sacramento, California, 5 p.

Cardinal, S.N., Paxton, E.H., and Durst, S.L., 2006, Home range, movement, and habitat use of the Southwestern Willow Flycatcher, Roosevelt Lake, AZ—2005: U.S. Geological Survey report to the Bureau of Reclamation, Phoenix, AZ, 21 p.

Craig, D., Schlorff, R.W., Valentine, B.E., and Pelles, C., 1992, Survey protocol for Willow Flycatchers (*Empidonax traillii*) on National Forest Service lands in the Pacific Southwest region: U.S. Forest Service Region 5, Vallejo, CA.

Dahl, T.E., 1990, Wetlands losses in the United States, 1780s to 1980s: U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 13 p.

Davidson, R.F., and Allison, L.J., 2003, Effects of monogamy and polygyny on reproductive success in Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in Arizona: Studies in Avian Biology, v. 26, p. 118–124.

DeLay, L.S., Stoleson, S.H., and Farnsworth M., 2002, A quantitative analysis of the diet of Southwestern Willow Flycatchers in the Gila Valley, New Mexico: Final report to T&E Inc., accessed July 28, 2008, at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/Reports/NM_SWWF_Diet_Report_2002.pdf.

DeLoach, C.J., Carruthers, R.I., Lovich, J., Dudley, T.L., and Smith, S.D., 2000, Ecological interactions in the biological control of saltcedar (*Tamarix* spp.) in the U.S.: Toward a new understanding, *in* Spencer, N.R., ed., Proceedings of X International Symposium on Biological Control, July 1999, Montana State University, Bozeman, p. 819–874.

Drost, C.A., Paxton, E.H., Sogge, M.K., and Whitfield, M.J., 2003, Food habits of the Southwestern Willow Flycatcher at the Kern River, California: Studies in Avian Biology, v. 26, p. 96-103.

Dudley, T.L., and DeLoach, C.J., 2004, Saltcedar (*Tamarix* spp.), endangered species, and biological weed control—can they mix?: Weed Technology, v. 18, p. 1542–1551.

Durst, S.L., 2004, Southwestern Willow Flycatcher potential prey base and diet in native and exotic habitats: Flagstaff, Arizona, Northern Arizona University, M.S. Thesis, 86 p.

Durst, S.L., Theimer, T.C., Paxton, E.H., and Sogge, M.K., 2008a, Age, habitat, and yearly variation in the diet of a generalist insectivore, the Southwestern Willow Flycatcher: Condor, v. 110, p. 514-525.

Durst, S.L., Sogge, M.K., Stump, S.D., Walker, H.A., Kus, B.E., and Sferra S.J., 2008b, Southwestern Willow Flycatcher breeding sites and territory summary—2007: U.S. Geological Survey Open-File Report 2008-1303, 31 p. (Also available at http://pubs.usgs.gov/of/2008/1303.)

Ellis, L.A., Weddle, D.M., Stump, S.D., English, H.C., and Graber, A.E., 2008, Southwestern Willow Flycatcher final survey and monitoring report: Arizona Game and Fish Department, Research Technical Guidance Bulletin #10, Phoenix, Arizona, USA.

Finch, D.M., Kelly, J.F., and Cartron, J.E., 2000, Chapter 7: Migration and Winter Ecology, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 71-82.

General Accounting Office, 1988, Public rangelands: Some riparian areas restored but widespread improvement will be slow: General Accounting Office, U.S. Government, Washington, D.C.

Graf, W.L., Stromberg, J., and Valentine, B., 2002, Rivers, dams, and Willow Flycatchers: A summary of their science and policy connections: Geomorphology, v. 47, p. 169–188.

Haas, W.E., 2003, Southwestern Willow Flycatcher field season 2002 data summary: Varanus Biological Services, Inc., San Diego, CA.

Harris, J.H., 1991, Effects of brood parasitism by Brown-headed Cowbirds on Willow Flycatcher nesting success along the Kern River, California: Western Birds, v. 22, no. 1, p. 13-26.

Hatten, J.R., and Paradzick, C.E., 2003, A multiscaled model of Southwestern Willow Flycatcher breeding habitat: Journal of Wildlife Management, v. 67, p. 774–788.

Hatten, J.R., and Sogge, M.K., 2007, Using a remote sensing/GIS model to predict Southwestern Willow Flycatcher breeding habitat along the Rio Grande, New Mexico: U.S. Geological Survey Open-File Report 2007-1207, 27 p. (Also available at http://pubs.usgs.gov/of/2007/1207.)

Hubbard, J.P., 1987, The status of the Willow Flycatcher in New Mexico: Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, New Mexico, 29 p.

Hubbard, J.P., 1999, A critique of Wang Yong and Finch's field-identifications of Willow Flycatcher subspecies in New Mexico: Wilson Bulletin, v. 11, p. 585-588.

Koronkiewicz, T.J., 2002, Intraspecific territoriality and site fidelity of wintering Willow Flycatchers (*Empidonax traillii*) in Costa Rica: Flagstaff, Arizona, Northern Arizona University, M.S. thesis, 73 p.

Koronkiewicz, T.J., and Sogge, M.K., 2000, Willow Flycatcher (*Empidonax traillii*) winter ecology study–Costa Rica 1999/2000: U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center/Colorado Plateau Research Station report.

Koronkiewicz, T.J., McLeod, M.A., Brown, B.T., and Carothers, S.W., 2006a, Southwestern Willow Flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries, 2005: Annual report submitted to Bureau of Reclamation, Boulder City, NV by SWCA Environmental Consultants, Flagstaff, AZ.

Koronkiewicz, T.J., Sogge, M.K., van Riper, C., and Paxton, E.H., 2006b, Territoriality, site fidelity, and survivorship of Willow Flycatchers Wintering in Costa Rica: Condor, v. 108, p. 558-570.

Koronkiewicz, T.J., and Whitfield, M.J., 1999, Winter ecology of the Southwestern Willow Flycatcher: San Diego Natural History Museum and Kern River Research Center report.

Kus, B.E., Beck, P.P., and Wells, J.M., 2003, Southwestern Willow Flycatcher populations in California: distribution, abundance, and potential for conservation: Studies in Avian Biology, v. 26, p. 12-21.

Lynn, J.C., Koronkiewicz, T.J., Whitfield M.J., and Sogge, M.K., 2003, Willow Flycatcher winter habitat in El Salvador, Costa Rica, and Panama—Characteristics and threats: Studies in Avian Biology, v. 26, p. 41-51.

Marshall, R.M., and Stoleson, S.H., 2000—Chapter 3: Threats, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 13–24.

Maynard, W.R., 1995, Summary of 1994 survey efforts in New Mexico for Southwestern Willow Flycatcher (*Empidonax traillii extimus*): New Mexico Department of Game and Fish, Santa Fe, NM, Contract #94-516-69, 48 p.

McLeod, M.A., Koronkiewicz, T.J., Brown, B.T., and Carothers, S.W., 2007, Southwestern Willow Flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries, 2006: Annual report submitted to Bureau of Reclamation, Boulder City, Nevada by SWCA Environmental Consultants, Flagstaff, AZ, 194 p.

Moore, D., 2005, Status and monitoring of Southwestern Willow Flycatchers within Elephant Butte Reservoir, New Mexico: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Moore, D., 2007, Vegetation quantification of Southwestern Willow Flycatcher nest sites: Rio Grande from La Joya to Elephant Butte Reservoir Delta, New Mexico, 2004-2006: Bureau of Reclamation, Technical Service Center, Denver, CO.

Moore, D., and Ahlers, D., 2009, 2008 Southwestern Willow Flycatcher study results: selected sites along the Rio Grande from Velarde to Elephant Butte Reservoir, New Mexico: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Munzer, O.M., English, H.C., Smith, A.B., and Tudor A.A., 2005, Southwestern Willow Flycatcher 2004 survey and nest monitoring report: Nongame and Endangered Wildlife Program Technical Report 244, Arizona Game and Fish Department, Phoenix, Arizona, 73 p.

New Mexico Department of Game and Fish, 1996, List of threatened and endangered: Amendment No. 1, NMAC 33.1; 31 January 1996: New Mexico Department of Game and Fish, Santa Fe, New Mexico.

Nishida, C., and Whitfield, M.J., 2007, Winter distribution of the Willow Flycatcher (*Empidonax traillii*) in Ecuador and Northern Mexico: Report to the Bureau of Reclamation, Boulder City, NV.

Owen, J.C., Sogge, M.K., and Kern, M.D., 2005, Habitat and gender differences in the physiological condition of breeding Southwestern Willow Flycatchers: Auk, v. 122, no. 4, p. 1261-1270.

Paradzick, C.E., and Woodward, A.A., 2003, Distribution, abundance, and habitat characteristics of Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in Arizona, 1993–2000: Studies in Avian Biology, v. 26, p. 22–29.

Paxton, E.H., 2000, Molecular genetic structuring and demographic history of the Willow Flycatcher: Flagstaff, Arizona, Northern Arizona University, MS thesis, 43 p.

Paxton, E.H., 2008, Geographic variation and migratory connectivity of Willow Flycatcher subspecies: Flagstaff, Arizona, Northern Arizona University, Ph.D. dissertation, 100 p.

Paxton, E.H., and Owen, J.C., 2002, An aging guide for Willow Flycatcher nestlings: Flagstaff, Arizona, Colorado Plateau Field Station, Northern Arizona University, 18 p.

Paxton, E.H., Sogge, M.K., Durst, S.L., Theimer, T.C., and Hatten, J.R., 2007, The ecology of the Southwestern Willow Flycatcher in central Arizona—a 10-year synthesis report: U.S. Geological Survey Open-File Report 2007-1381, 143 p.

Pearson, T., Whitfield, M.J., Theimer, T.C., and Keim P., 2006, Polygyny and extra-pair paternity in a population of Southwestern Willow Flycatchers: Condor, v. 108, p. 571–578.

Phillips, A.R., 1948, Geographic variation in *Empidonax traillii*: Auk, v. 65, p. 507-514.

Phillips, A.R., Marshall, J., and Monson, G., 1964, The birds of Arizona: Tucson, Arizona, University of Arizona Press, 212 p.

Pulliam, H.R., 1988, Sources, sinks, and population regulation: American Naturalist, v. 132, p. 652-661.

Bureau of Reclamation, 2009, Elephant Butte Reservoir five-year operational plan—Biological Assessment: Bureau of Reclamation, Albuquerque Area Office, Albuquerque, NM.

Rourke, J.W., McCarthey, T.D., Davidson, R.F., and Santaniello, A.M., 1999, Southwestern Willow Flycatcher nest monitoring protocol: Nongame and Endangered Wildlife Program Technical Report 144, Arizona Game and Fish Department, Phoenix, Arizona.

Rothstein, S.I., Kus, B.E., Whitfield, M.J., and Sferra S.J., 2003, Recommendations for cowbird management in recovery efforts for the Southwestern Willow Flycatcher: Studies in Avian Biology, v. 26, p. 157–167.

Schuetz, J.G., and Whitfield, M.J., 2007, Southwestern Willow Flycatcher monitoring and removal of Brown-headed Cowbirds on the South Fork Kern River in 2006: Report to the U.S. Army Corps of Engineers, Sacramento, CA.

Schuetz, J.G., Whitfield, M.J., and Steen V.A., 2007, Winter distribution of the Willow Flycatcher (*Empidonax traillii*) in Guatemala and Mexico: Report by the Southern Sierra Research Station, Weldon, California.

Seager, R., Ting, M., Held, I., Kushnir, Y., Lu, J., Vecchi, G., Huang, H., Harnik, N., Leetma, A., Lau, N., Li, C., Velez, J., and Naik N., 2007, Model projections of an imminent transition to a more arid climate in southwestern North America: Science Express, April 5, 2007.

Sedgwick, J.A., 2000, Willow Flycatcher (*Empidonax traillii*), *in* Poole, A., and Gill, F., eds., The Birds of North America, No. 533: The Birds of North America, Inc., Philadelphia, Pennsylvania.

Sedgwick, J.A., 2001, Geographic variation in the song of Willow Flycatchers—Differentiation between *Empidonax traillii adastus* and *E.t. extimus*: Auk, v. 118, p. 366-379.

Seutin, G., 1987, Female song in Willow Flycatchers (*Empidonax traillii*): Auk, v. 104, p. 329-330.

Sferra, S.J., Corman, T.E., Paradzick, C.E., Rourke, J.W., Spencer, J.A., and Sumner, M.W., 1997, Arizona Partners in Flight Southwestern Willow Flycatcher survey—1993–1996 summary report: Nongame and Endangered Wildlife Program Technical Report 113, Arizona Game and Fish Department, Phoenix, Arizona, 46 p.

Shook, R.S., Stoleson, S.H., and Boucher, P., 2003, A field evaluation of the Southwestern Willow Flycatcher survey protocol: Studies in Avian Biology, v. 26, p. 177-179.

Siegle, R., and Ahlers, D., 2004, Brown-headed Cowbird management techniques manual: Techniques Manual by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Sogge, M.K., Koronkiewicz, T.J.; van Riper, C., and Durst, S.L., 2007a, Willow Flycatcher nonbreeding territory defense behavior in Costa Rica: Condor, v. 109, p. 475-480.

Sogge, M.K., Kus, B.E., Sferra, S.J., and Whitfield, M.J., 2003b, Ecology and conservation of the Willow Flycatcher—Studies in Avian Biology 26: Cooper Ornithological Society, Camarillo, CA, 210 p.

Sogge, M.K., and Marshall, R.M., 2000, Chapter 5: A survey of current breeding habitats, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 43-56.

Sogge, M.K., Marshall, R.M., Tibbitts, T.J., and Sferra, S.J. 1997a, A Southwestern Willow Flycatcher natural history summary and survey protocol: National Park Service Technical Report NPS/NAUCPRS/NRTR-97/12, 37 p.

Sogge, M.K., Paxton, E.H., and Tudor, A.A., 2006, Saltcedar and Southwestern Willow Flycatchers: lessons from long-term studies in central Arizona, *in* Aguirre-Bravo, C., Pellicane, P.J., Burns, D.P., and Draggan, S., eds., Monitoring science and technology symposium: unifying knowledge for sustainability in the Western hemisphere: September 20-24, 2004, Denver, Colorado: Proceedings RMRS-P-42CD, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado, p. 238–241.

Sogge, M.K., Sferra, S.J., McCarthey, T.D., Williams, S.O., and Kus, B.E., 2003a, Distribution and characteristics of Southwestern Willow Flycatcher breeding sites and territories: Studies in Avian Biology, v. 26, p. 5-11.

Sogge, M.K., Sferra, S.J., and Paxton, E.H., 2008, Saltcedar as habitat for birds—Implications to riparian restoration in the Southwest: Restoration Ecology, v. 16, p. 146-154.

Sogge, M.K., Tibbitts, T.J., and Petterson, J., 1997a, Status and breeding ecology of the Southwestern Willow Flycatcher in the Grand Canyon: Western Birds, v. 28, p. 142-157.

Sogge, M.K., Tibbitts, T.J., van Riper, C., and May, T., 1995, Status of the Southwestern Willow Flycatcher along the Colorado River in Grand Canyon National Park—1995, Summary report: National Biological Service Colorado Plateau Research Station/Northern Arizona University, 26 p.

Spencer, J.A., Sferra, S.J., Corman, T.E., Rourke, J.W., and Sumner, M.W., 1996, Arizona Partners in Flight 1995 Southwestern Willow Flycatcher survey: Nongame and Endangered Wildlife Program Technical Report 79, Arizona Game and Fish Department, Phoenix, Arizona, 46 p.

State of Arizona, 1990, Final report and recommendations of the Governor's riparian habitat task force, Executive Order 89-16: Streams and riparian resources, Phoenix, Arizona, October 1990, 28 p.

Stein, R.C., 1963, Isolating mechanisms between populations of Traill's Flycatchers: Proceedings of the American Philosophical Society, v. 107, no. 1, p. 21-50.

Stoleson, S.H., and Finch, D.M., 2003, Microhabitat use by breeding Southwestern Willow Flycatchers on the Gila River, NM: Studies in Avian Biology, v. 26, p. 91-95.

Stoleson, S.H., Whitfield, M.J., and Sogge, M.K., 2000, Chapter 8: Demographic characteristics and population modeling, *in* Finch D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 84-94.

Tibbitts, T.J., Sogge, M.K., and Sferra, S.J., 1994, A survey protocol for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*): National Park Service Technical Report NPS/NAUCPRS/NRTR-94/04.

Unitt, P., 1987, *Empidonax traillii extimus*: an endangered subspecies: Western Birds, v. 18, no. 3, p. 137-162.

U.S. Fish and Wildlife Service, 1991, Notice of review: animal candidate review for listing as endangered or threatened species, November 21, 1991: Federal Register 56:58804-58836.

U.S. Fish and Wildlife Service, 1993, Proposal to list the Southwestern Willow Flycatcher as an endangered species and to designate critical habitat, July 23, 1993: Federal Register 58:39495-39522.

U.S. Fish and Wildlife Service, 1995, Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher: Federal Register 60:10694 (February 27, 1995).

U.S. Fish and Wildlife Service, 1997, Final determination of critical habitat for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*): Federal Register 62(140):39129-39147.

U.S. Fish and Wildlife Service, 2002, Southwestern Willow Flycatcher (*Empidonax traillii extimus*) final recovery plan: U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service, 2005, Designation of critical habitat for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*), Final Rule: Federal Register 70:60886–61009 (October 19, 2005).

Utah Division of Wildlife Resources, 1997, Utah Sensitive Species List – March 1997: Utah Division of Wildlife Resources, Salt Lake City, Utah, 28 p.

Whitfield, M.J., 1990, Willow Flycatcher reproductive response to brown-headed cowbird parasitism: Chico, California, California State University, Masters theses, 25 p.

Whitfield, M.J., and Enos, K., 1996, A Brown-headed Cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California, 1996: Report to the U.S. Army Corps of Engineers, Sacramento District and the California Department of Fish and Game.

Whitfield, M.J., and Sogge, M.K., 1999, Range-wide impacts of Brown-headed Cowbird parasitism on the Southwestern Willow Flycatcher (*Empidonax traillii extimus*), 1999: Studies in Avian Biology, v. 18, p. 182-190.

Whitfield, M.J., and Strong, C.M., 1995, A Brown-headed Cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California: California Department of Fish and Game, Bird and Mammal Conservation Program Report 95-4, Sacramento, California, 17 p.

Wiesenborn, W.D., and Heydon, S.L., 2007, Diet of Southwestern Willow Flycatcher compared among breeding populations in different habitats: Wilson Journal of Ornithology, v. 119, p. 547–557.

Wilbur, S.R., 1987, Birds of Baja California: Berkeley, California, University of California Press.

Yard, H.K., and Brown, B.T., 1999, Willow Flycatcher nest resuse in Arizona: Journal of Field Ornithology, v. 70, p. 211–213.

Yard, H.K., and Brown, B.T., 2003, Singing behavior of the Southwestern Willow Flycatchers in Arizona: Studies in Avian Biology, v. 26, p. 125–130.

Appendix 1. Willow Flycatcher Survey and Detection Form

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site (http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher (WIFL) Survey and Detection Form (revised April 2010)

Site Name_____ State_____ County _____
USGS Quad Name _____ Elevation _____ (meters)
Creek, River, Wetland, or Lake Name_____
Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? *Yes___* *No___*

Survey Coordinates: Start: E_____ N_____ UTM Datum_____(See instructions)
Stop: E_____ N_____ UTM Zone _____
If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.
***** Fill in additional site information on back of this page *****

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N / If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding; potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
							# Birds	Sex	UTM E	UTM N
Survey # 1 Observer(s)	Date Start Stop Total hrs ___									
Survey # 2 Observer(s)	Date Start Stop Total hrs ___									
Survey # 3 Observer(s)	Date Start Stop Total hrs ___									
Survey # 4 Observer(s)	Date Start Stop Total hrs ___									
Survey # 5 Observer(s)	Date Start Stop Total hrs ___									
Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total Survey Hrs		Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any Willow Flycatchers color-banded? Yes___ No ___ If yes, report color combination(s) in the comments section on back of form and report to USFWS.				

Reporting Individual _____ Date Report Completed_____ _____
US Fish and Wildlife Service Permit #_____State Wildlife Agency Permit #_____
***Submit** form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.*

Fill in the following information completely. Submit form by September 1st. Retain a copy for your records.

Reporting Individual _____ Phone # _____
Affiliation _____ E-mail _____
Site Name _____ Date Report Completed _____

Did you verify that this site name is consistent with that used in previous years? Yes ____ No ____ Not Applicable ___
If site name is different, what name(s) was used in the past? _____
If site was surveyed last year, did you survey the same general area this year? Yes ____ No ____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes ____ No ____ If no, summarize below.

Management Authority for Survey Area : Federal____ Municipal/County ____ State ____ Tribal ____ Private ____
Name of Management Entity or Owner (e.g., Tonto National Forest) _____

Length of area surveyed: _____ (meters)

Vegetation Characteristics: Mark the category that best describes the predominant tree/shrub foliar layer at this site (check one):

_____ Native broadleaf plants (entirely or almost entirely, > 90% native, includes high-elevation willow)

_____ Mixed native and exotic plants (mostly native, 50 - 90% native)

_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.
_____

Average height of canopy (Do not include a range): _____ (meters)

Attach copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections.
Attach sketch or aerial photo showing site location, patch shape, survey route, location of any WIFLs or WIFL nests detected.
Attach photos of the interior of the patch, exterior of the patch, and overall site; describe any unique habitat features.

Comments (attach additional sheets if necessary)
_____
_____
_____
_____
_____
_____

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM N	UTM E	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Attach additional sheets if necessary

Appendix 2. Willow Flycatcher Survey Continuation Sheet / Territory Summary Table

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site (http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher Survey Continuation Sheet

(For reporting additional detections and territories; append to Survey and Detection form)

Reporting Individual _____ Phone # _____
Affiliation _____ E-mail _____
Site Name _____ Date Report Completed _____

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Comments _____

Appendix 3. Instructions for Completing the Willow Flycatcher Survey and Detection Form and the Survey Continuation Sheet

These instructions are provided as guidance for completing the standard survey form. It is particularly important to provide the correct type and format of information for each field. Complete and submit your survey forms to both the appropriate State Willow Flycatcher coordinator and the U.S. Fish and Wildlife Service (USFWS) by September 1 of the survey year. You also may complete forms digitally (Microsoft® Word or Excel) and submit them via email with attached or embedded topographic maps and photographs.

Page 1 of Survey Form

Site Name. Standardized site names are provided by the flycatcher survey coordinators for each State and should be consistent with the naming of other sites that might be in the area. If the site is new, work with your State or USFWS flycatcher coordinator to determine suitable site names before the beginning of the survey season. If the site was previously surveyed, use the site name from previous years (which can be obtained from the State or USFWS flycatcher coordinator). If you are uncertain if the site was previously surveyed, contact your State or USFWS flycatcher coordinator.

USGS Quad Name. Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps.

Creek, River, Wetland, or Lake Name. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Survey Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). California surveyors only: provide latitude/longitude geographic coordinates instead of UTMs in the UTM fields and identify them as such. If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet. Note that we do not need the coordinates for the detailed path taken by the surveyor(s).

Datum. Indicate the datum in which the coordinates are expressed: NAD27, WGS84, or NAD83. The datum can be found in the settings of most GPS units. Note that Arizona prefers NAD27 and New Mexico prefers NAD83.

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units. Zones for California are 10, 11, or 12. The zone for Arizona is 12. Zones for New Mexico are 12 or 13.

Survey #. Survey 1 – 5. See the protocol for an explanation of the number of required visits for each survey period. **Note:** A survey is defined as a complete protocol-based survey that occurs over no more than 1 day. If a site is so large as to require more than a single day to survey, consider splitting the site into multiple subsites and use separate survey forms for each. Casual site visits, pre-season or supplemental visits, or follow-up visits to check on the status of a territory should not be listed in this column, but should be documented in the Comments section on page 2 or in the survey continuation sheet.

Date. Indicate the date that the survey was conducted, using the format mm/dd/yyyy.

Start and **Stop.** Start and stop time of the survey, given in 24-hour format (e.g., 1600 hours rather than 4:00 p.m.).

Total hours. The duration of time (in hours) spent surveying the site, rounded to the nearest tenth (0.1) hour. For single-observer surveys, or when multiple observers stay together throughout the survey, total the number of hours from survey start to end. If two or more observers surveyed sections of the site concurrently and independently, sum the number of hours each observer spent surveying the site.

Number of Adult WIFLs. The total number of individual adult Willow Flycatchers detected during this particular survey. Do not count nestlings or recently fledged birds.

Number of Pairs. The number of breeding pairs. Do not assume that any bird is paired; designation of birds as paired should be based only on direct evidence of breeding behaviors described in the protocol. If there is strong evidence that the detected bird is unpaired, enter "0". If it is unknown whether a territorial bird is paired, enter "–". Note that the estimated number of pairs can change over the course of a season.

Number of Territories. Provide your best estimate of the number of territories, defined as a discrete area defended by a resident single bird or pair. This is usually evidenced by the presence of a singing male, and possibly one or more mates. Note that the estimated number of territories may change over the course of a season.

Nest(s) Found? Yes or No. If yes, indicate the number of nests. Renests are included in this total.

Comments about this survey. Describe bird behavior, evidence of pairs or breeding, evidence of nest building, evidence of nestlings/fledglings, nesting, vocalizations (e.g., interaction twitter calls, *whitts*, *britts*, *wheeos*, *fitz-bews*/countersinging), potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.). If *Diorhabda* beetles are observed, contact your USFWS and State flycatcher coordinator immediately. Please be aware that permits are needed for nest monitoring.

GPS Coordinates for WIFL Detections. Provide the number of birds (e.g., unpaired, paired, or groups of birds) and corresponding UTMs. If known, provide the sex of individuals.

Overall Site Summary. For each of these columns, provide your best estimate of the overall total for the season. Do not simply total the numbers in each column. In some cases where consistent numbers were detected on each survey, the overall summary is easy to determine. In cases where numbers varied substantially among the different surveys, use professional judgment and logic to estimate the most likely number of adults, pairs, and territories that were consistently present. Be careful not to double count individuals. Record only territorial adult Southwestern Willow Flycatchers, do not include migrants, nestlings, or fledglings in the overall summary. In complex cases, consult with your State or USFWS flycatcher coordinator.

Total Survey Hours. The sum of all hours spent surveying the site.

Were any WIFLs color-banded? Circle or highlight "Yes" or "No". If yes, report the sighting and color combination (if known) in the comments section on back of form, and contact your USFWS coordinator within 48 hours after returning from the survey. Note that identifying colors of bands is difficult and might require follow-up visits by experienced surveyors.

Reporting Individual. Indicate the full first and last name of the reporting individual.

Date Report Completed. Provide the date the form was completed in mm/dd/yyyy format.

U.S. Fish and Wildlife Service Permit #. List the full number of the required federal permit under which the survey was completed.

State Wildlife Agency Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State permit. State permits are required for Arizona and California. State permits are recommended for New Mexico.

Page 2 of Survey Form

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone Number. Self-explanatory; include the area code.

E-mail. Self-explanatory.

Was this site surveyed in a previous year? Indicate "Yes", "No", or "Unknown."

Did you verify that this site name is consistent with that used in previous years? Indicate "Yes" or "No". This can be determined by checking survey forms from previous years or consulting with agency flycatcher coordinators.

If site name is different, what name(s) was used in the past? Enter the full site name that was used in previous years.

If site was surveyed last year, did you survey the same general area this year? Indicate "Yes" or "No". If no, indicate the reason and how the survey varied in the Comments section.

Did you survey the same general area during each visit to this site this year? If no, indicate the reason in the Comments section and delineate the differing route of each survey on the topographical map.

Management Authority for Survey Area. Mark the appropriate management authority.

Name of Management Entity or Owner (e.g., Tonto National Forest). Provide the name of the organization or person(s) responsible for management of the survey site.

Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Vegetation Characteristics: Mark only one of the categories that best describes the predominant tree/shrub foliar layer at the site.

Native broadleaf habitat is composed of entirely or almost entirely (i.e., > 90%) native broadleaf plants.

Mostly native habitat is composed of 50–90% native plants with some (i.e., 10–50%) non-native plants.

Mostly exotic habitat is composed of 50–90% non-native plants with some (i.e., 10–50%) native plants.

Exotic/introduced habitat is composed entirely or almost entirely (i.e., > 90%) of non-native plants.

Identify the 2–3 predominant tree/shrub species in order of dominance. Identify by scientific name.

Average height of canopy. Provide the best estimate of the average height of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Attach the following: (1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections; (2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests; (3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments. Include the flycatcher territory number and GPS location. You also may include a compact disc of photographs.

Comments. Include any information that supports estimates of total territory numbers and breeding status. You may provide additional information on bird behavior, banded birds, evidence of pairs or breeding, nesting, potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.), and changes in survey length and route throughout the season. Attach additional pages or use the continuation sheet if needed.

Table. If Willow Flycatchers are detected, complete the table at the bottom of the form. Identify flycatchers by territory number and include the dates detected, UTMs, whether or not pairs were detected, and whether or not nests were located. Also describe the observation. For example, the surveyor might have observed and heard a bird *fitz-bew* from an exposed perch, heard and observed two birds interacting and eliciting a twitter call, heard a bird *fitz-bew* while observing another carrying nesting material, heard birds from territory 1 and 2 countersinging, etc. This information provides supporting information for territory and breeding status. Use the continuation sheet if needed.

Appendix 4. Example of a Completed Willow Flycatcher Survey and Detection Form (with map)

Willow Flycatcher (WIFL) Survey and Detection Form (revised April, 2010)

Site Name: **DL-08** State: **New Mexico** County: **Socorro**

USGS Quad Name: **Paraje Well** Elevation: **1,356** (meters)

Creek, River, or Lake Name: **Rio Grande**

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? *Yes* **X** *No* ____

Survey Coordinates: Start: E **306,009** N **3,715,506** UTM Datum: **NAD 83** (See instructions)

Stop: E **304,339** N **3,711,922** UTM Zone: **13**

If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.

*****Fill in additional site information on back of this page*****

Survey # Observer(s) (Full Name)	Date (m/d/y) Survey Time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding;-potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator.	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	5/24/2009						1	M	305,276	3,714,926
D. Savage	Start:						1	M	305,131	3,714,628
	5:45	5	0	5	N	Suitable breeding habitat dispersed throughout site. WIFLs were very vocal, and covering large areas. No obvious signs of pairing were observed. Approximately 10 head of cattle were found within this site.	1	M	305,191	3,714,778
	Stop:						1	M	305,394	3,715,009
	10:15						1	M	305,084	3,714,732
	Total hrs:									
	4.5									
Survey # 2	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	6/10/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	6:00	11	4	7	Y (3)	Portions of site are flooded, 1-2 ft deep. Two males found during 1st survey appear unpaired. Three pairs confirmed based on nesting, and another pair suspected based on vocal interactions and nonaggressive behavior with another flycatcher. Two additional territories (1 pair and 1 unpaired male) found during this survey.	2	M/F	305,191	714,778
	Stop:						2	M/F	305,394	3,715,009
	10:15						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.3						1	M	305,010	3,714,524
Survey # 3	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	6/21/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	5:30	12	5	7	Y (4)	Portions of site still flooded. All territories found in Survey 2 are still active. The two males found during Surveys #1 and #2, still believed to be unpaired. All other territories are believed to be paired. Several cows observed in vicinity of active territories.	2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.5						2	M/F	305,010	3,714,524
Survey # 4	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	7/1/2009						1	M	305,276	3,714,926
D. Moore	Start:						1	M	305,131	3,714,628
	6:00	12	5	7	Y (4)	Site is no longer flooded, but saturated soils persist throughout most of site. No change in territory numbers or status. All SWFL pairs very quiet - only a few whits and fitz-bews. Light rain over night, vegetation was saturated early in the morning. Lots of mosquitos!	2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.0						2	M/F	305,010	3,714,524
Survey # 5	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	7/10/2009						1	M	305,131	3,714,628
D. Moore	Start:						2	M/F	305,191	3,714,778
	5:30	11	5	6	Y (4)	Site beginning to dry out, some portions still muddy. One of the unpaired males could not be detected. It was hard to hear SWFLs due to breezy conditions early in the morning.	2	M/F	305,394	3,715,009
	Stop:						2	M/F	305,084	3,714,732
	10:00						2	M/F	305,001	3,714,640
	Total hrs:						2	M/F	305,010	3,714,524
	4.5									

Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals.	Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any WIFLs color-banded? Yes ____ No **X**
Total survey hrs: 21.8	12	5	7	4	If yes, report color combination(s) in the comments section on back of form and report to USFWS.

Reporting Individual: **Darrell Ahlers** Date Report Completed: **8/20/2009**

US Fish & Wildlife Service Permit #: **TE819475-2** State Wildlife Agency Permit #: **N/A**

Submit form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.

Fill in the following information completely. Submit form by September 1st. Retain a copy for your records.

Reporting Individual **Darrell Ahlers** Phone # **(303) 445-2233**

Affiliation **Bureau of Reclamation** E-mail **dahlers@usbr.gov**

Site Name **DL-08** Date report Completed **8/20/2009**

Was this site surveyed in a previous year? Yes__x__ No____ Unknown____

Did you verify that this site name is consistent with that used in previous yrs? Yes **x** No_____ Not Applicable_____

If name is different, what name(s) was used in the past? **Not applicable**

If site was surveyed last year, did you survey the same general area this year? Yes **x** No_____ If no, summarize below.

Did you survey the same general area during each visit to this site this year? Yes **x** No_____ If no, summarize below.

Management Authority for Survey Area: Federal **X** Municipal/County_____ State_____ Tribal_____ Private_____

Name of Management Entity or Owner (e.g., Tonto National Forest) **Bureau of Reclamation**

Length of area surveyed: **2.5** (km)

Vegetation Characteristics: Check (only one) category that best describes the predominant tree/shrub foliar layer at this site:

_____ Native broadleaf plants (entirely or almost entirely, > 90% native)

X Mixed native and exotic plants (mostly native, 50 - 90% native)

_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.

Salix Gooddingii, Populus spp., Tamarix spp.

Average height of canopy (Do not include a range): **6** (meters)

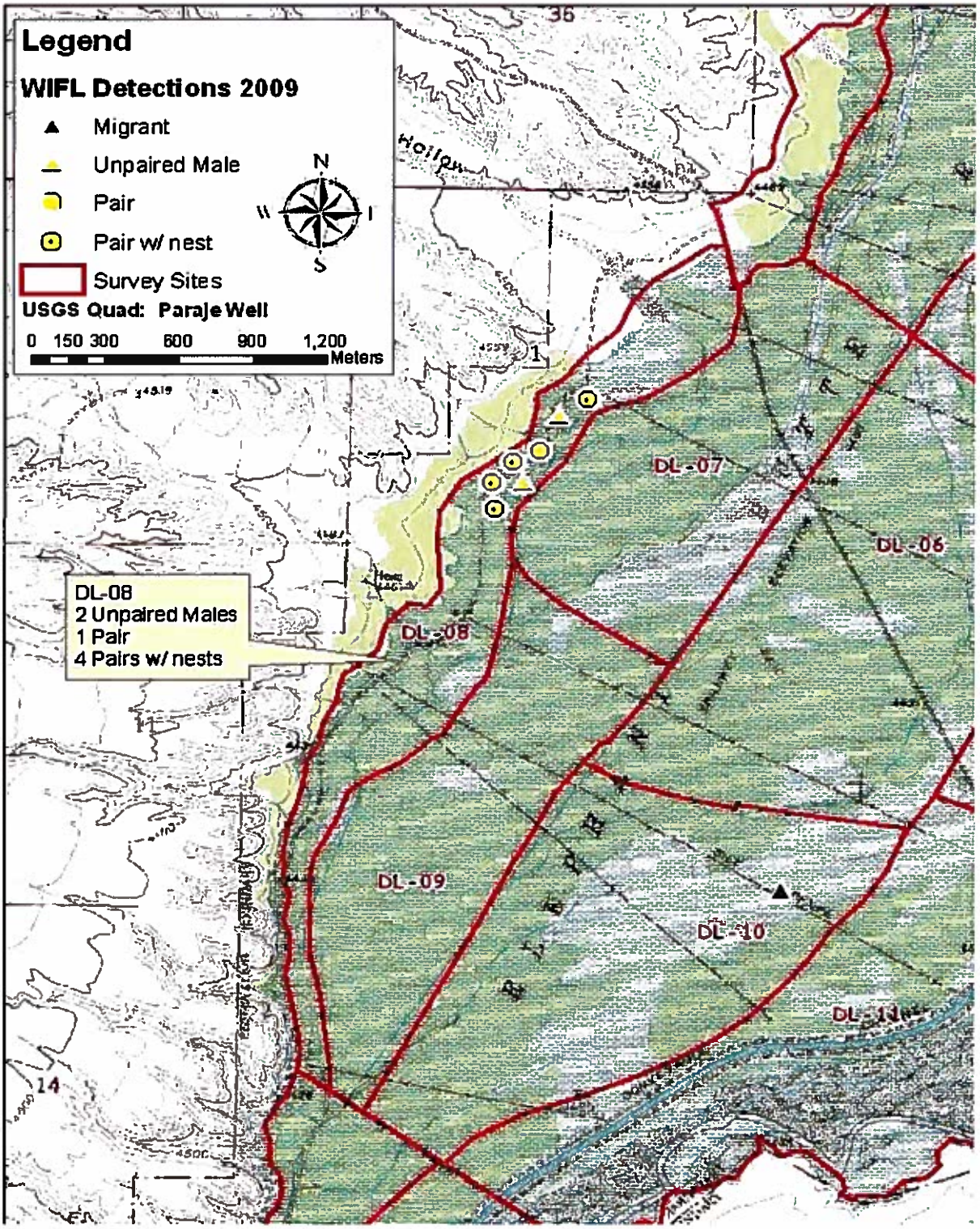
Attach the following: 1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections;
2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests;
3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments.

Comments (such as start and end coordinates of survey area if changed among surveys, supplemental visits to sites, unique habitat features. Attach additional sheets if necessary.
Great habitat with saturated or flooded soils throughout most of the site on 1st survey. Site began to dry by the end of the breeding season. SWFL territories are dominated by Gooddings willow, however Tamarix spp. tends to be increasing in density compared to previous years. Site is supported by flows from the Low Flow Conveyance Channel.

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)
1 (Unpaired male)	5/24, 6/10,6/21,7/1	305,276	3,714,926	N	N	extended presence at site from 5/24 through 7/1, no evidence of pairing
2 (Unpaired male)	5/24, 6/10,6/21,7/1, 7/10	305,131	3,714,628	N	N	extended presence at site from 5/24 through 7/10, no evidence of pairing
3 (Pair)	5/24, 6/10,6/21,7/1, 7/10	305,191	3,714,778	Y	Y	Pair confirmed based on vocalizations and observation of unchallenged WIFL
4 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,394	3,715,009	Y	Y	Confirmed breeding status with nest
5 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,084	3,714,732	Y	Y	Confirmed breeding status with nest
6 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,001	3,714,640	Y	Y	Confirmed breeding status with nest
7 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,010	3,714,524	Y	N	Confirmed breeding status with nest

Attach additional sheets if necessary


Legend
WIFL Detections 2009
Migrant
Unpaired Male
Pair
Pair w/ nest
Survey Sites
USGS Quad: Paraje Well
0 150 300 600 900 1,200
Meters
N
S
DL-08
2 Unpaired Males
1 Pair
4 Pairs w/ nests
DL-07
DL-06
DL-08
DL-09
DL-10
DL-11
36
1
14

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Publishing Network, Tacoma Publishing Service Center

For more information concerning the research in this report, contact
Mark Sogge
U.S. Geological Survey
2255 Gemini Drive,
Flagstaff, AZ 86001

Attachment C2

Final Report - NCCP/MSCP Raptor Monitoring Project (January 1, 2001 – December 31, 2003)

for

California Department Fish and Game
4949 Viewridge Ave.
San Diego, CA 92123

by

Wildlife Research Institute, Inc.
P.O. Box 2209
18030 Highland Valley Road
Ramona, CA 92065

March 31, 2005

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BACKGROUND

The Natural Communities Conservation Planning (NCCP) Raptor Monitoring Project is part of the urgent implementation tasks associated with the Multiple Species Conservation Program (MSCP). The MSCP is the local representation of the State's NCCP Program of which the City of San Diego is a participating member and the lead agency. The County of San Diego is also an active participant (County of San Diego 1997). The city adopted the MSCP on March 18, 1997 and entered into a binding contract on July 16, 1997 with the State of California Department of Fish and Game and the United States Fish and Wildlife Service to implement the MSCP.

Each habitat conservation plan (HCP) requires a monitoring program to determine the efficacy of that plan. The "Biological Monitoring Plan for the Multiple Species Conservation Program" (Ogden 1996) recommended monitoring for certain plant species, coastal sage scrub (Coastal California Gnatcatcher and Cactus Wren), herpetofauna, and grasslands (specifically, using raptors).

THE PROJECT AND ITS OBJECTIVES

Monitoring of raptors is a critical component of the MSCP. This project, specifically, addresses monitoring the raptor species identified as target species for MSCP monitoring with one exception--the Burrowing Owl (BO; *Athene cunicularia hypugaea*). In addition to the Burrowing Owl, the MSCP Biological Monitoring Plan (Ogden, 1996) identified the following raptor species (hereafter referred to as the "target" species) to be monitored: Golden Eagle (GE; *Aquila chrysaetos*), Bald Eagle (BE; *Haliaeetus leucocephalus*), Peregrine Falcon (PF; *Falco peregrinus*), Northern Harrier (NH; *Circus cyaneus*), Ferruginous Hawk (FH; *Buteo regalis*), Swainson's Hawk (SH; *Buteo swainsoni*), and Cooper's Hawk (CH; *Accipiter cooperii*). Prior to the subject work, no comprehensive study had been conducted for any of these species, within the geographical limits of the MSCP.

The Wildlife Research Institute, Inc. (WRI), a non-profit organization, has been working with all MSCP participants to identify appropriate long-term raptor monitoring locations (based on the results of the current WRI raptor surveys), develop a scientifically-based monitoring program (including survey locations and protocols), test the monitoring methods, and identify opportunities for population enhancements.

The original project objectives (taken from the contract's scope of work) are as follows:

- Determine where breeding and wintering individuals (of the target species) are located within the study areas.
- Wherever possible, document the breeding success of active pairs.
- Characterize situations of both successful and less successful or unsuccessful habitat.
- Identify, modify, or create, if necessary, survey raptor monitoring methods, based on scientific principles that would be appropriate to meet the objectives of the MSCP Monitoring Plan.
- Identify management, including research, needs and enhancement opportunities.

THIS REPORT

Constraints. This report covers WRI's raptor surveying activity for the three years of this project (January 1, 2001 through December 31, 2003), focusing on the breeding and wintering seasons. For the record, our work did not, officially, include the BO. Therefore, with few exceptions, surveys were not conducted during what would normally have been the most productive time for this species (i.e., early morning and early evening). Fieldwork was conducted during the daylight hours to maximize chances for seeing the diurnal raptors that were the focus of the contracted scope. Although nocturnal owls can be expected to nest and winter in many of the study sites, they would be expected to often escape observation under this temporal survey regime. However, our methods required documenting any raptor, regardless of whether or not it was a target species and, when a BO or any other owl was observed, it was noted.

A natural phenomenon created a situation that could be considered a constraint. This was the extreme drought that the region experienced for several years (1999-2004). Therefore, 2001 through 2003 may not have been the best of raptor breeding years. Drought clearly plays a significant factor in the density and reproductive success of raptors. This study was conducted during the worst drought for San Diego in over 160 years. This fact should be noted for future researchers and resource managers/planners. This kind of extreme drought has the potential effect of reducing the available prey biomass, which, in turn, can have at least two effects. First, it likely reduces the "attractiveness" of a habitat complex, partly because of low prey densities, and may encourage raptors and other predators to look elsewhere. Second, for those individuals that choose to stay in a less-than-ideal environment, the lack of prey often results in lowered reproductive success or even total nest failure (see Discussion, below). If a nest site is not successful, the birds are more likely to disperse, which leaves the historically active territories apparently, or actually, vacant.

Intent. It is the intent that this, the Final Report, will not only serve to (1) provide data analysis and interpretation but, importantly, it strives to (2) provide an initial baseline of information on many of the breeding and wintering raptors within the MSCP and environs, (3) identify resource management challenges and opportunities, and (4) recommend needed research and management, including what areas should be considered for the MSCP Long-term Raptor Monitoring Program (LRMP).

METHODS

LITERATURE REVIEW, INTERVIEWS, DATA SEARCHES, ETC.

We first contacted other professional biologists, regarding available literature and monitoring programs already in place. We acquired relevant literature, which we did not already have, and met with and/or phone-interviewed members of the outdoor-oriented public as well as key professionals in the San Diego ornithologist community (including Mr. John Oakley, Mr. David Mayer, Mr. Phil Unitt, Dr. Jim Hannan, and others listed in the Acknowledgements section) to inquire about raptor sightings. Using existing published and gray literature, the Natural Communities Data Base, museum collections, raw data from the San Diego County Bird Atlas (then in prep.), MSCP vegetation and sensitive species GIS data, and discussions with knowledgeable experts, a project bibliography, relevant to the MSCP and the target species, was produced (Appendix A).

STUDY SITES

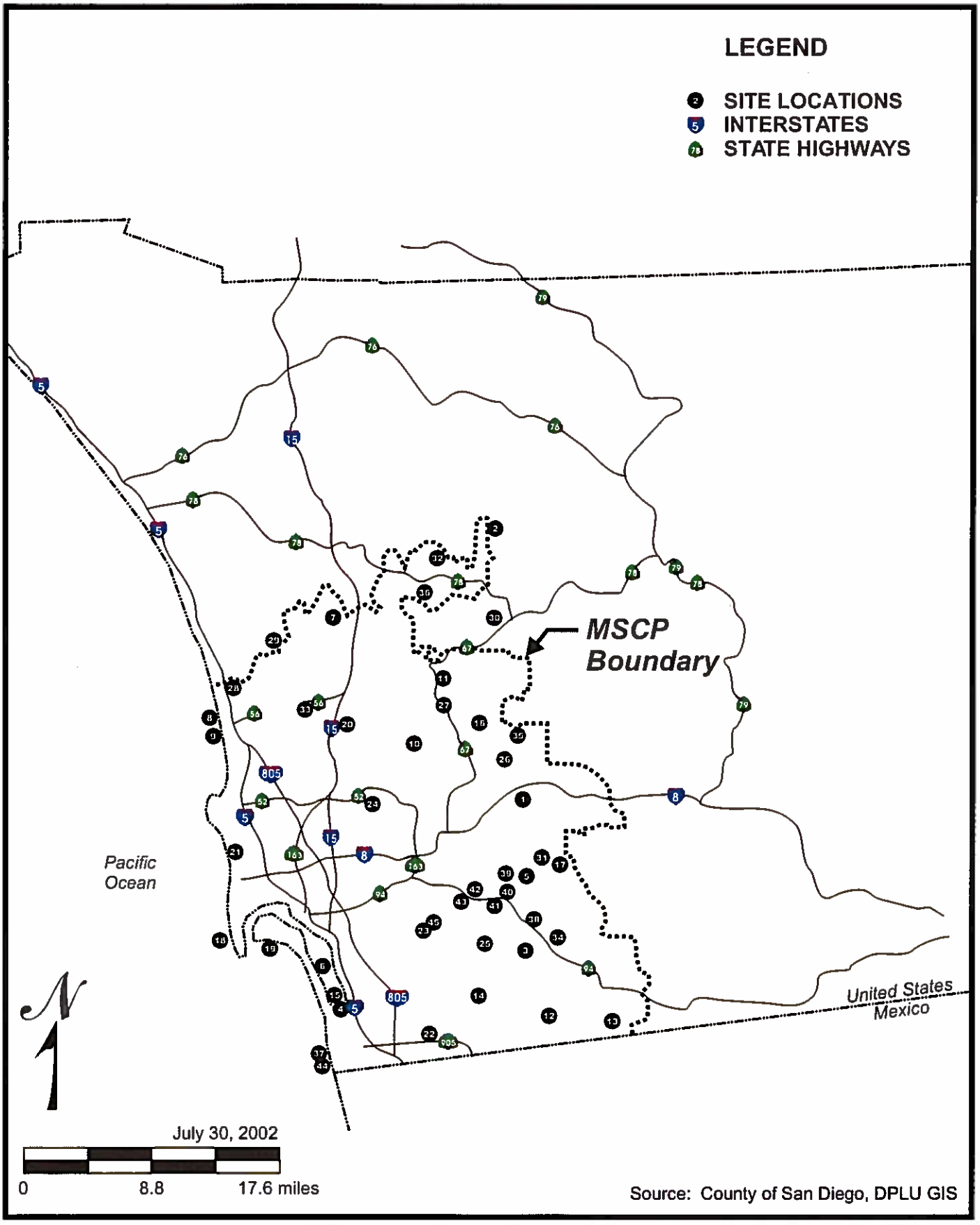
The choice of *study sites* (i.e., those which would be the focus of the 2001-2003 field observations) began with the raptor monitoring locations proposed by the "Biological Monitoring Plan for the Multiple Species Conservation Program" (Ogden 1996). Through consultations with CDFG staff and other knowledgeable biologists, we initially identified 22 sites. After some consolidation and the addition of several sites, including control sites and five sites recently acquired by the state or federal government (numbers 34, and 39 through 43), this number was, ultimately, increased to 45 locations within, and juxtaposed to, the MSCP (hereafter referred to as "study sites"; Figure 1 and Table 1). These became the sites, which were surveyed and considered as *potential* sites, or components of sites, for the Long-term *Monitoring* Plan. The basis for choosing the study sites included that they (1) could be expected to support raptors, (2) were part of an area which was managed by a public or private organization or, alternatively, could serve as a control site over time, (3) were accessible by vehicle and could be safely surveyed with repeatability, (4) contained grassland and/or other relevant habitat which was representative of the MSCP area, and (5) were within or immediately juxtaposed to the MSCP area. We considered all ten sites recommended by the Ogden (1996) report. Of those ten sites, we believe all are covered by one or more of the above 45 locations unless they did not meet the above criteria.

MONITORING SITES

The parameters considered in order to make the recommendations for monitoring sites (i.e., those which would be used in the MSCP Long-term Monitoring Program; LRMP) were discussed at a meeting with representatives of CDFG, USFWS, the City of San Diego and the County of San Diego, on January 27, 2002, at the CDFG San Diego office. It was agreed that the following were important when reviewing each study site as a potential MSCP LRMP site:

- Number of individual raptors documented at a site
- Number of raptor species
- Number of target raptor species
- Diversity of raptors and/or target raptor species
- Number of raptor territories
- Number of crows and/or ravens
- Incidence and/or expectation of management/enforcement problems
- Likely changes in habitat and disturbance over time

In order to identify which sites are the most appropriate for the MSCP LRMP during the breeding season, each site was examined, based on two species diversity parameters (number of total raptors and number of target raptors, both of which were normalized by level of effort) and a third parameter for evenness (Probability of an Interspecific Encounter or PIE; Hurlburt, 1971). The analysis for evenness provided a logical break between the top 19th and 20th sites. All sites were then arranged in descending order for each of these three parameters. If any site came out in the top 19 for any two of the three parameters, it was considered a candidate for the MSCP LRMP. Seventeen sites met this requirement. Each site was reviewed, based on our biological knowledge of that site and how it fit into the geographic distribution of recommended monitoring sites. Finally, juxtaposed sites were combined and sites and site boundaries were adjusted based on historic raptor numbers and improved geographic coverage.



Wildlife Research Institute, Inc.

MSCP RAPTOR STUDY SITE LOCATIONS

Figure 1

Table 1. Raptor Study Sites (2001-2003)

NOTE TO READER: In order to facilitate the reader's access to the following topographic maps, they are listed below alphabetically and by site number.

Number	Name
1	Crestridge
2	Boden Canyon
3	Jamul Ranch
4	SDNWR*/Salt Works/Egger Ghio
5	McGinty Mountain Complex
6	San Diego Bay NWR (winter only)
7	Lake Hodges
8	Penasquitos Lagoon
9	Torrey Pines
10	Sycamore Canyon
11	Iron Mountain
12	Otay Mountain
13	Marron Valley
14	Otay Lakes
15	SDNWR* Sweetwater Marsh
16	San Vicente
17	Sycuan Peak
18	Point Loma
19	North Island
20	Miramar Reservoir
21	Mission Bay
22	Brown Field Complex
23	SDNWR*/San Miguel Mountain
24	Mission Trails
25	Proctor Valley
26	San Diego River
27	Route 67 South
28	San Dieguito Lagoon
29	Route S-6 (deleted/safety issue)
30	Grasslands/Route 67
31	Sloan Canyon
32	Rockwood Canyon
33	Penasquitos Canyon
34	Hollenbeck Canyon
35	Rock Mountain
36	San Pasqual
37	SDNWR*Tijuana Slough
38	Route 94 (North and South)
39	Immenschuh
40	Los Montanas (North)
41	Los Montanas (South)
42	Rancho San Diego (East)
43	Rancho San Diego (West)
44	Border Fields
45	Sweetwater Reservoir

*San Diego National Wildlife Refuge

Name	Number
Boden Canyon	2
Border Fields	44
Brown Field Complex	22
Crestridge	1
Grasslands/Route 67	30
Hollenbeck Canyon	34
Immenschuh	39
Iron Mountain	11
Jamul Ranch	3
Lake Hodges	7
Los Montanas (North)	40
Los Montanas (South)	41
Marron Valley	13
McGinty Mountain Complex	5
Miramar Reservoir	20
Mission Bay	21
Mission Trails	24
North Island	19
Otay Lakes	14
Otay Mountain	12
Penasquitos Canyon	33
Penasquitos Lagoon	8
Point Loma	18
Proctor Valley	25
Rancho San Diego (East)	42
Rancho San Diego (West)	43
Rock Mountain	35
Rockwood Canyon	32
Route 67 South	27
Route 94 (North and South)	38
Route S-6	29
San Diego Bay NWR (winter only)	6
San Diego River	26
San Dieguito Lagoon	28
San Pasqual	36
San Vicente	16
SDNWR* Sweetwater Marsh	15
SDNWR*/Salt Works/Egger Ghio	4
SDNWR*/San Miguel Mountain	23
SDNWR*Tijuana Slough	37
Sloan Canyon	31
Sweetwater Reservoir	45
Sycamore Canyon	10
Sycuan Peak	17
Torrey Pines	9

After completing the above analysis, it became clear that the coastal portions of the MSCP were excluded from the proposed breeding season monitoring because the vast majority and greatest diversity of raptor species breed somewhat inland of the coast. In addition, our data showed that the MSCP area supported a sizable wintering PF population, most of which would be excluded without a coastal component to the MSCP LRMP. Therefore, a winter monitoring route was established that included a good sampling of the coastal wintering raptor habitat that could be driven safely and consistently.

FIELD SURVEYS

By way of clarification, we will be discussing two kinds of raptor searching and documentation. The first is the *survey*—the approach we took to investigate each of the 45 study sites, some of which we are recommending for the MSCP LRMP. This approach utilized several techniques in order to capture a maximum amount of raptor data on sites of considerable environmental variation. The second kind of raptor searching and documentation is the *monitoring protocol*, which will be recommended for MSCP LRMP. This was based on which *survey* techniques were most useful, what has become standardized for raptors, and what will meet the objectives of a monitoring program (discussed below).

Based on a review of the MSCP Biological Monitoring Plan, discussions with the Contract Manager, and our knowledge of survey techniques that are widely accepted, we established guidelines for WRI biologists to follow for the breeding and wintering surveys (WRI 2004, Appendices A and B). As discussed in the Year 1 and 2 reports (WRI 2002, 2004), because of latitude, and the resulting mild climate of the MSCP area, raptor nesting activities can start as early as December and run into August. However, wintering raptors are commonly observed in this region December through February, with some remaining (or migrating through) into mid-March. Therefore, we have, somewhat arbitrarily, called field observations made December through February "winter " survey data. However, "breeding" season data are not limited to a specific timeframe, often overlap with the "winter" observation, and are based on observed behavior (e.g., copulation, nest building, incubation, bringing food to the nest, presence of young).

Table 1 provides a reminder of all the sites that were in the original list of those to be examined. One of the objectives of the 2003 fieldwork was to fill in some data gaps. We had difficulty gaining access to one site (San Diego National Wildlife Refuge/San Miguel Mountain, Site 23) because it involved the use of an access across private property. Table 1 does not reflect surveys that were conducted for the GE or numerous surveys conducted by WRI volunteers and cooperators. During this last year of study, we also continued our coordination with individuals responsible for managing the study sites to keep them appraised of project progress, maintain a point of contact, enlist their input, coordinate access, etc.

Although most of the fieldwork was conducted by vehicle and on foot, as described in WRI (2004, Appendices A and B), some observations, which were focused on the GE, were conducted by helicopter (WRI 2005).

RESULTS

LITERATURE REVIEW

The Project Bibliography has been completed (Appendix A); although, we would welcome any additions from those who review it. This bibliography is not intended to be comprehensive but is intended to provide the reader and local resource manager with important references that relate to: (1) relevant natural history of the target raptors; (2) the presence or distribution of the target raptors within the MSCP, and/or (3) survey or monitoring techniques that could be applied to the target raptor resources by land and wildlife managers within the MSCP. It is arranged by sections for each raptor target species, followed by a section on general raptor literature, with a focus on raptor management.

FIELD SURVEYS

The GE and the PF are addressed separately below because they are unique in both their biological status and their potential for being disturbed. The PF was only recently removed from the listing category and the GE has shown a marked (approximately 50 percent), and well-documented, decline in San Diego County.

Golden Eagle

The GE has been reported on separately (WRI 2005) for a number of reasons relating to resource protection. The detailed site-specific maps are provided in that document so that CDFG has the option of distributing those data separate from the other, less sensitive, raptor data depending on the recipient's need to know.

As an overview, however, after 16 years of consistent monitoring, we estimate that thirty one (31) pairs formerly occupied the San Diego MSCP. Today, fifteen (15) pairs are still active and sixteen (16) pairs have been extirpated. Most of these extirpations occurred in the last 35 years. The fifteen (15) breeding pairs of Golden Eagles remaining in the SD MSCP represent 30 percent of all the breeding Golden Eagles in San Diego County. Seven (7) of the fifteen (15) remaining active pairs within the SD MSCP are in serious jeopardy of being extirpated in the next 5-10 years. Three (3) of the seven (7) pairs predicted to become extirpated may, in fact, already be lost.

The first changes of significance that affected the SD MSCP Golden Eagle population were from intensive agriculture such as avocado and citrus groves. This agriculture replaced cattle grazing and grasslands. Some extirpations were documented to occur in San Diego County in the 1950s and 1960s, after the build-up of military personnel post-WWII, but most disappeared after the 1970s, when major freeways opened land for development that was formerly cattle ranches. Interstate and local freeways made access easy and allowed development to proceed.

Extirpated Golden Eagle territories were primarily located on private land (56 percent). Currently only three (20 percent) of the remaining pairs of Golden Eagles core nesting areas remain on private lands. Twelve (80 percent) of the currently active Golden Eagles within the SD MSCP nest on public land. *This is a significant and valuable opportunity for the future management and survival of Golden Eagles within the SD MSCP.*

In order to properly manage this far-ranging species, specific information about their ecological needs is required, including the limits of the core area around the nest, the primary foraging areas, and the limits of the defendable territory. These are provided in the Golden Eagle report (WRI 2005).

Peregrine Falcon

Breeding Season Results

Of the 12 current and/or historic PF territories known for the county, nine were (and, in five cases, are) located within the MSCP boundaries. Of the five territories located within the MSCP, only one territory is located at one of the study sites (Point Loma, Site 18; see Table 2). The status of that territory and others that we are aware of, within the MSCP, is as follows: Point Loma—active (likely produced young, 2002; was active, 2003); downtown San Diego—active (nest success not known, 2001-2003); La Jolla Cove—active (thought to have produced young, 2002); La Jolla Cliffs—active (nest success not known, 2001-2003); Downtown El Cajon—active (2002) but nest success not known.

Winter Results

A total of 14 PFs were documented during the winter months of 2002 and we believe this was typical for the study period (2001-2003). These were observed at ten study sites (Table 3). One individual was observed at each of nine sites, 2 at one site, and 3 were noted at, or near, another site (Point Loma; site 18). Most birds were observed along the coast or associated with large bodies of water, where shorebirds and other water-associated birds were abundant. Based on other observations, and input from knowledgeable raptor biologists, it is likely that there were roughly 20 PFs wintering in San Diego County during each of the period 2001-2003.

Other Raptors

Breeding Raptors

The raptor breeding season data, by study site, presented in Table 2 and Appendix B provides a picture of what each of the study sites can be expected to support under conditions of average-to-poor precipitation. Maps of all 45 study sites are provided. In cases where no data were collected, or data were combined between two sites, a note on the map provides that explanation. During the period 2001-2003, we examined 44 out of 45 sites (land access was not possible at SDNWR/San Miguel Mountain, Site 23 although we were able to survey a nearby GE nest by helicopter). We documented a total of 15 raptor species and 539 raptor breeding territories (excluding the CR but including 78 stick nests, which we could not positively identify as to raptor species). Of the 539 raptor breeding territories, 96 were target species (all but the BE, SH, and FH, which do not, currently, breed in the MSCP area). Sites varied greatly in their ability to support breeding raptors. Some sites didn't support more than one or two territories, while, others, like the Ramona Grasslands, supported almost 90 territories. Four sites supported no breeding raptors (see those with note "NBR"), while one site (Ramona Grasslands) supported 9 raptor species, including three target species.

The RT was the most commonly documented nesting raptor species, with a total of 177 nests and/or territories located on 34 sites. The next most commonly documented raptor

TABLE 2. Number of Raptor Nests and/or Territories by Site (2001-2003)

		SPECIES**																		Stick	Target	Total	Notes	Site
	SITE	AK	BE	BR	BO	CH	CR	FH	GE	GO	LO	NH	OS	PF	RS	RT	SO	SH	TV	WK	Nest	Spp.	Spp.		No.
1	Crestridge	1				1	2								3	2						1	9		1
2	Boden Canyon					2									2	2						2	6		2
3	Jamul Ranch					2	2			1					1	13				2	15	2	36		3
4	SDNWR*/Salt Works/Egger Ghio																					0	0	NBR	4
5	McGinty Mountain Complex					1									1	5						1	7		5
6	San Diego Bay NWR			1			1									1					2	0	5	Note 1	6
7	Lake Hodges	1		2		2	1		1	2					5	8				1		3	23		7
8	Penasquitos Lagoon																					0	0	Note 5	8
9	Torrey Pines						6									1						0	7	Note 5	9
10	Sycamore Canyon			1							3				1	1	1					0	7		10
11	Iron Mountain			2		4	1		1	1			1		11	13			1	2		5	37	Note 2	11
12	Otay Mountain						2		2						1	5					1	2	11		12
13	Marron Valley						2		1							6					10	1	19		13
14	Otay Lakes	1				2	2			1		2				4				1	4	4	17		14
15	SDNWR* Sweetwater Marsh											2				1						2	3	NBR	15
16	San Vicente								1				3			2			2			1	8		16
17	Sycuan Peak																					0	0	NBR	17
18	Point Loma													1		1						1	2		18
19	North Island				6								1			1					1	6	9		19
20	Miramar Reservoir					1							1			1						1	3		20
21	Mission Bay																					0	0	NBR	21
22	Brown Field Complex	1			4		1					1				5					1	5	13		22
23	SDNWR*/San Miguel Mountain								1													1	1	NSC	23
24	Mission Trails					1									1	2				1	1	1	6		24
25	Proctor Valley	3				1										3					1	1	8		25
26	San Diego River	1				3	1		1	1					3	9						4	19		26
27	Route 67 South/Iron Mtn #11																					0	0	Note 2	27
28	San Dieguito Lagoon											1				4				1		1	6		28
29	Route S-6																					0	0	Note 4	29
30	Grasslands/Route 67	10			1	1	1		1	6					25	41			1	3		3	90		30
31	Sloan Canyon						7		1						2	4				1	2	1	17		31
32	Rockwood Canyon					1	1		1						1	4						2	8		32
33	Penasquitos Canyon	3		2		7	1			2		2			9	4			1	6		9	37		33
34	Hollenbeck Canyon	4				1	4					2			2	4				1	4	3	22		34
35	Rock Mountain						1		1						1	2						1	5		35
36	San Pasqual	1		4		2	2			3					9	16			1	2	7	2	47		36
37	SDNWR*Tijuana Slough	1										2										2	3		37
38	Route 94 (North and South)																					0	0	Note 3	38
39	Immenschuh					1															1	1	2		39
40	Los Montanas (North)														1	1					1	0	3		40

TABLE 2. Number of Raptor Nests and/or Territories by Site (2001-2003)

		SPECIES**																			Stick	Target	Total	Notes	Site
	SITE	AK	BE	BR	BO	CH	CR	FH	GE	GO	LO	NH	OS	PF	RS	RT	SO	SH	TV	WK	Nest	Spp.	Spp.		No.
41	Los Montanas (South)															2						0	2		41
42	Rancho San Diego (East)	1				1										3				1	5	1	11		42
43	Rancho San Diego (West)					2									1						8	2	11		43
44	Border Fields	1		2		6				1		13			2	1				2	12	19	40		44
45	Sweetwater Reservoir					5	3			2					1	5				1	2	5	19		45
Total		29	0	14	11	47	41	0	12	20	3	25	6	1	83	177	1	0	6	25	78	96	579		

* San Diego National Wildlife Refuge.

NBR No breeding raptors observed.

NSC No formal raptor surveys conducted (see notes on topo report maps).

(1) Breeding raptors and ravens observed in residential areas to east of study area.

(2) Data for Route 67 South (# 27) and Iron Mountain (#11) were combined. See Iron Mountain (#11)).

(3) The Route 94 transect overlaps other study sites. Data from this transect were assigned to other appropriate sites.

(4) No data collected due to safety and access issues.

(5) Data for Penasquitos Canyon (#8) combined with Torrey Pines (#9). See Torrey Pines (#9).

**Specie:

AC American Crow
AK American Kestrel
BE Bald Eagle
BH Black Hawk
BR Barn Owl
BO Burrowing Owl
CH Cooper's Hawk
CR Common Raven
FH Ferruginous Hawk
GE Golden Eagle
GO Great-horned Owl
HH Harris' Hawk
LO Long-eared Owl
MR Merlin
NH Northern Harrier
OS Osprey
PF Peregrine Falcon
PR Prairie Falcon
RS Red-shouldered Hawk
RT Red-tailed Hawk
SO Screech Owl
SS Sharp-shinned Hawk
SH Swainson's Hawk
TV Turkey Vulture
WK White-tailed Kite

Table 3. Number* of raptors observed during the winter (primarily January, February, and December) surveys--2001-2003.

SITE		SPECIES***																					Total Target Spp.	Total Raptors	Notes	Site No.
		AK	BE	BR	BO	CH	CR	FH	GE	GO	LO	MR	NH	OS	PF	PR	RS	RT	SO	SS	SH	TV	WK				
1	Crestridge					1	19										3	4				1		1	28		1
2	Boden Canyon					2			2								2	6				3		4	15		2
3	Jamul Ranch	5					6						1					7						1	19		3
4	SDNWR*/Salt Works/Egger Ghio	2				1	2	1				1	4	3	1			4					1	7	20		4
5	McGinty Mountain Complex						2										2	5						0	9		5
6	San Diego Bay NWR	3					1	1					1	1	1									3	8		6
7	Lake Hodges	5		4		3	2		2	2			1	2	1		8	36				2	3	7	71		7
8	Penasquitos Lagoon																							0	0	Note 1	8
9	Torrey Pines						12								2			2						2	16	Note 1	9
10	Sycamore Canyon			2							6						2	2	2					0	14		10
11	Iron Mountain			4		8	2		1	2				2			22	18				2	4	9	65	Note 2	11
12	Otay Mountain	2					18		1				1					5						2	27		12
13	Marron Valley	1				1	14										1	6				1		1	24		13
14	Otay Lakes	5				3	10						2	2	1		1	5				1		6	30		14
15	SDNWR* Sweetwater Marsh	2				1	1					1	3	1				5					1	4	15		15
16	San Vicente																	4					2	0	6		16
17	Sycuan Peak																							0	0	Note 3	17
18	Point Loma	1				1	3								3			3						4	11	Note 4	18
19	North Island	2			3		6							2				3						3	16	Notes 3 & 5	19
20	Miramar Reservoir					2								2				2				2		2	8		20
21	Mission Bay	2					2											2						0	6		21
22	Brown Field Complex	4			3	1	8						4					7					2	8	29		22
23	SDNWR*/San Miguel Mountain																							0	0	NWC	23
24	Mission Trails	1				2	6										3	3				1	2	2	18		24
25	Proctor Valley	3				1	132								1			8						2	145		25
26	San Diego River	5				6	2			2			1	1			7	22					2	7	48		26
27	Route 67 South/Iron Mtn #11																							0	0	Note 2	27
28	San Dieguito Lagoon												2					8					2	2	12		28
29	Route S-6	2																2						0	4	Note 4	29
30	Grasslands/Route 67	7			2	1	3	9	3	6		1		1	1		4	12		1		40		16	91		30
31	Sloan Canyon						5		1								2	1						1	9	Note 3	31
32	Rockwood Canyon					2	2		2									6						4	12		32
33	Penasquitos Canyon	6		4		14	2		4				4	2			18	8				2	12	22	76		33
34	Hollenbeck Canyon	7				1	13		2				3			1	3	5						6	35		34
35	Rock Mountain								3															3	3		35
36	San Pasqual	11		7		2	6		2	6			1		1		16	57		1		3	8	6	121		36
37	SDNWR*Tijuana Slough	3				1	4		1			1	2	1	1			4						5	18		37
38	Route 94 (North and South)																							0	0	Note 6	38
39	Immenschuh					1																		1	1		39
40	Los Montanas (North)																	3						0	3		40
41	Los Montanas (South)						4											3						0	7		41
42	Rancho San Diego (East)	2				3	6											4					1	3	16		42
43	Rancho San Diego (West)						3											1						0	4		43
44	Border Fields	8											6				1	13					3	6	31		44

Table 3. Number* of raptors observed during the winter (primarily January, February, and December) surveys--2001-2003.

45	Sweetwater Reservoir	9	2			3	38			2		1		1	1			5				1	1	6	64		45
Total		98	2	21	8	61	334	11	24	20	6	5	36	21	14	1	95	291	2	2	0	59	44	156	1155		

* Numbers refer to maximum number of birds observed.

** San Diego National Wildlife Refuge.

(1) Data for Penasquitos Lagoon (#8) and Torrey Pines (#9) combined. See Torrey Pines (#9).

(2) Data for Route 67 South (# 27) and Iron Mountain (#11) were combined. See Iron Mountain (#11)).

(3) Includes March survey.

(4) Two PFs were observed to the north of this site, near the S.D. Airport.

(5) Seven widely-spaced active burrows suggested that there were at least seven BOs on this study site.

(6) The Route 94 transect overlaps other study sites. Data from this transect were assigned to other appropriate sites.

***Species

AK American Kestrel	CR Common Raven	MR Merlin	RS Red-shouldered Hawk	TV Turkey Vulture
BE Bald Eagle	**FH Ferruginous Hawk**	**NH Northern Harrier**	RT Red-tailed Hawk	WK White-tailed Kite
BR Barn Owl	**GE Golden Eagle**	OS Osprey	SO Screech Owl	
BO Burrowing Owl	GO Great-horned Owl	**PF Peregrine Falcon**	SS Sharp-shinned Hawk	
CH Cooper's Hawk	LO Long-eared Owl	PR Prairie Falcon	**SH Swainson's Hawk**	

nests/territories were those of the RS with 83 and the CH with 47. The CR (a non-raptor, but a species that can have an impact on raptors) was fourth in frequency with 41 nests/territories. The next level of frequency was shared by AK (29), NH (25), WK (25), and GO (20). To a great extent, this frequency distribution is a function of site size, amount of appropriate habitat, and sometimes local conditions on the respective sites.

Of the eight project target species, nesting was documented for five—CH, NH, GE, BO, and, PF. CH nesting was observed at the highest number of study sites, with nests and/or territories documented at 21 sites (48 percent of the 44 sites surveyed). GE was observed nesting at 11 sites (25 percent); while NH was documented at only 8 sites (18 percent) with 13 of the 25 territories found at Border Fields. BO were found nesting at only 3 (7 percent) of the sites and PF at only 1 (0.23 percent) of the sites.

The CH nested, primarily, at those sites that contain healthy riparian habitat; however, this species has become somewhat of a generalist and also nests elsewhere (see Discussion). GEs limited their nesting to sites with sheer cliffs away from human activity and close to nearby grasslands for hunting (see below). The NH and the PF were concentrated primarily along the coast. However, one PF pair attempted nesting in downtown El Cajon and a few scattered NHs were observed nesting at more inland sites. NHs nested in mostly coastal marsh and open field habitat; although we have observed NHs nesting in ruderal areas (J. Oakley, pers. comm.). PFs utilized mostly man-made structures, along the coast, with nearby sources of shorebirds and other prey. Most of BOs, located on the study sites, were found in sandy soil with low grass and open areas (see also WRI 2003, Lincer and Bloom 2003, in prep.). BE and FH winter within the MSCP but are not known to breed there. SHs only pass through during migration, are infrequently documented, and when they are, they are usually not within the MSCP. Some of the SH migrants seen are in the Ramona area and large numbers (over 5,200) have been recently documented migrating along the desert front to the east of the MSCP during the spring (Unitt 2004).

Based on the number of *all* nesting raptor species (plus the CR) and all the sites surveyed during the 2001-2003 breeding seasons, Site 30 (Ramona Grasslands/Route 67) contained the most nests/territories of all sites surveyed. Eighty-nine nests/territories were documented, representing nine raptor species (and 1 CR). The site to show the next highest number of territories was San Pasqual (Site 36) with 47 territories (including two CR and 7 unidentified stick nests that were not duplications of known territories). Border Fields State Park (Site 44) showed the next highest number of territories with 40 territories (including 12 non-duplicative unidentified stick nests).

Site 44 (Border Fields) contained the highest number of *target* species nests/territories of all sites surveyed (19). Penasquitos Canyon (Site 33) supported 9 target species territories while North Island (Site 19) supported 6 and Brown Field Complex (Site 22) and Iron Mountain (Site 11) tied, with both supporting 5 nests of the target raptor species.

Wintering Raptors

A total of 20 raptor species were documented on our study sites during the winter months (January, February, and December) of 2001-2003 (Table 3). Of course, at San Diego's latitude, a number of the resident breeders are actively nesting while many of the wintering birds are still on site. All target raptors, but the SH, were documented during the winter observation period (December-February). Numbers ranged from 0 to 22 individual target raptors per site for a total of 154 individuals for all study sites. Comparable numbers for all raptors (plus the Common Raven) were 0 to 145 as a range. A total of 1,153 wintering individuals were documented (or 819, without the ravens).

The CR was, clearly, the most common wintering bird of those surveyed for. The three most commonly documented wintering raptors were the RT, AK, and RS, with totals of 291, 98, and 95, respectively. Of those sites surveyed in this study, the following held the highest number of wintering individuals (raptors and ravens): Site 25 (Proctor Valley) – 145, Site 36 (San Pasqual) – 121, Site 30 (Ramona Grasslands) – 91 (which included 9-16 FHs; with 20 documented in 2005), Site 33 (Penasquitos Canyon) – 76, and Site 7 (Lake Hodges) – 71.

DISCUSSION

Weather as a Factor

In reviewing any body of data, it is important to consider how typical the sampling period was. So just how "typical" were 2001 through 2003? Drought plays a significant factor in the density and reproductive success of raptors and other predators. During the El Nino of 1998/99, NHs were breeding in areas where they have not bred since and in lower numbers in other locations. The demonstrable impacts of drought on GEs and Prairie Falcons, throughout southern California, were presented by Bittner et al. (2003). This study was conducted during the worst drought for San Diego in 160 years. This should be noted for future researchers.

Management and Enforcement Issues

Table 4 is a summary of management and enforcement issues by site. Clearly, some study sites are substantially impacted, either directly or indirectly, by human activities. Some sites are currently without major impacts. Unfortunately, many of the more diverse and potentially productive sites are the same ones that are experiencing multiple management and enforcement challenges. Of those that are obviously impacted, the following activities are the most common: humans walking or hiking (36 out of 45 sites or 80%) and pets, primarily dogs being allowed to run free, (26 out of 45 sites or 57 %).

Table 4. Management Enforcement Issues Identified by Raptor Study Site

Site No.	Name	Humans Walking/Hiking	Rock Climbing	Off-road Vehicle Use	Pets	Disking, etc. Agricultural Activities	Rodent/Ground Squirrel Poisoning	Construction/Development	Newly-developed Access Road(s)	Other
1	Crestridge	X								
2	Boden Canyon	X		X	X				X	6
3	Jamul Ranch									6?
4	SDNWR*/Salt Works	X								
5	McGinty Mountain Complex			X	X					
6	San Diego Bay NWR	X			X					
7	Lake Hodges	X	X	X	X			X	X	6
8	Penasquitos Lagoon	X			X					
9	Torrey Pines	X			X					7
10	Sycamore Canyon	X		X	X				X	
11	Iron Mountain	X	X	X	X				X	
12	Otay Mountain	?	X	X						1
13	Marron Valley	X	X	X	X					1
14	Otay Lakes	X			?				X	8
15	SDNWR* Sweetwater Marsh	X		X	X					
16	San Vicente	X	X		X				X	
17	Sycuan Peak									
18	Point Loma	X								
19	North Island	X								2
20	Miramar Reservoir	X						X		
21	Mission Bay	X		X	X			X		
22	Brown Field Complex	X		X	X			X		1,3,4
23	SDNWR*/San Miguel Mountain	X		X	X				X	
24	Mission Trails	X	X		X					
25	Proctor Valley	X		X	X		X	X		
26	San Diego River	X	X		X		X			7
27	Route 67 South	X		X				X	X	
28	San Dieguito Lagoon	X				X		X		
29	Route S-6	X						X		
30	Grasslands/Route 67	X	X		X	X	X	X	X	
31	Sloan Canyon	X			X					
32	Rockwood Canyon	X	X					X		
33	Penasquitos Canyon	X		X	X				X	
34	Hollenbeck Canyon									6
35	Rock Mountain	X	X							5
36	San Pasqual	X		X	X	X	X	X		5
37	SDNWR*Tijuana Slough	X		X	X	X	?			

Table 4. Management Enforcement Issues Identified by Raptor Study Site

38	Route 94 (North and South)									
39	Immenschuh									
40	Los Montanas (North)									
41	Los Montanas (South)									
42	Rancho San Diego (East)	X			X					
43	Rancho San Diego (West)	X			X					
44	Border Fields	X			X					1
45	Sweetwater Reservoir									

*San Diego National Wildlife Refuge

(1) Border Patrol and illegal alien activities.
(2) Conflicts with Navy goals and endangered species recovery program.
(3) Potential conflict with future Navy goals at Satellite Surveillance Station.
(4) Heavy predation by Coyotes and Barn owls.
(5) Future threats from proposed trail construction and associated access to rock climbers, ORVs, etc. activities.
(6) Shooting (legal and illegal).
(7) Paragliding.
(8) Cattle grazing.

Management Conflicts

The following are observed management conflicts, which lead to our recommended management and research (see Recommendations):

- As indicated above, human uses [rock-climbing, hiking, jogging, walking dogs (often without leashes), vehicular use, etc.] impact the normal behavior of raptors (and other wildlife).
- In many cases, the size of protected parcels is substantially smaller than that required by a raptor's functional territory, including foraging areas.
- The public/political pressure to create new trails into MSCP preserve lands provides a path for, and encourages, increased disturbance to raptors (and other wildlife).
- The public/political perception that MSCP preserve lands have been created primarily for active, and in some cases, consumptive, recreation, sets up an obvious conflict for managing raptors (and other wildlife).
- The constraint of using fire as a management tool in proximity to human habitation limits habitat management tools.
- Inadequate funding to both acquire important lands and properly manage MSCP lands which are acquired.

Raptor Monitoring

The following is a reiteration of considerations, regarding the MSCP Long-term Raptor Monitoring Program, that were presented previously (WRI 2004) and discussed elsewhere (Lincer and Bittner 2002; Lincer et al. 2003). For further reading, relevant issues are proposed and discussed by Oakley, Thomas, and Fancy (2003).

Sample Design

The ideal sample design should be:

1. Representative of the study area and the issues at hand. (e.g., habitat loss, disturbance, etc.) ;
2. Representative of the habitats of interest and the seasons during which those habitat support the monitored species (e.g., the MSCP not only provides important breeding habitat for numerous raptor but it is also a significant habitat for several wintering raptors, including some that are considered target raptors, like the PF, BE, FH, and BO);
3. Inclusive of all focus species or represent them in some functional way;
4. Sensitive to the objectives of the MSCP monitoring requirements;
5. Sensitive to logistics;
6. Statistically appropriate (which may be compromised by above logistics);
7. Able to predict, and take into consideration, *detectability* (i.e., how counts relate to the actual number of raptors in the sampled area; one approach is to use a "double count" approach). This objective may also be compromised by above logistics.

Questions to be Answered and Objectives to be Met

How will the data be used by the various management entities? When do they need what? An example of a clear monitoring objective would be, "Be able to detect a 25% change in population (individual species or overall raptor group?), in each chosen habitat, in 10 years." This is the approach that is being attempted by NARMS (North American Monitoring Strategy) but some of the best raptor monitoring minds are having a serious challenge addressing these objectives. It is entirely possible that we won't have enough observations for some species to detect a significant change in a timely manner.

Possible Monitoring Approaches

Levels of effort and agency *commitment* are, integrally tied. For instance, the MSCP program could adopt a:

1. Highly rigorous, scientific approach that would be costly but could withstand the most challenging statistical/legal tests, or
2. More practical, less expensive approach that would be more likely to be funded, and therefore carried out, but would stand the chance of being successfully, challenged at some time in the future.

As to *which, and how many, species* should be involved, the program could use a:

1. Multiple species approach, using selective target species only,
2. Multiple species approach, using selective target species, but recording all raptors (and ravens) observed,
3. Single species approach, using a keystone species, like the Golden Eagle or
4. Combination of the above.

Target Species and Other Multiple Species Approaches

A monitoring approach that focuses on one or more so-called "target" species has the appeal of apparent simplicity and the implication that these target species will, somehow, reflect a broader suite of species and be sensitive to whatever perturbations are experienced. Having surveyed raptors for many years, it is apparent that each species often responds to similar impacts differently. Although GOs and RTs might show similar population changes in response to small mammal population changes, and most raptors will show some response to a record-breaking drought, such as we have just experienced, there are likely more differences than similarities between species. Those differences are not only in *degree* but also in *direction*. For instance, GEs and PRs responded to the recent drought to different degrees (Bittner et al. 2003), with the PR being less impacted by presumed small mammal population decreases because it takes a wider range of prey species than the GE, which is heavily dependent on jackrabbit and ground squirrel populations. In addition, some raptors (e.g., GE) are far more negatively responsive to human activity than others (e.g., AKs, RTs, RSs, and some CHs). There are also differences in response, both within and between species, depending on the time of year (e.g., during the

breeding season vs. the wintering season) and where a disturbance occurs (e.g., on the hunting grounds or within the nest territory).

Regarding raptors responding in a different direction, one only needs to recognize that many different raptors require different habitats and, although not many species will persist if usable habitat is replaced with a development (although some CHs and RSs may defy this simplification), a conversion from one habitat/land use to another will often affect different species in different ways. For instance, if an extensive riparian habitat were to be replaced by an agricultural land use, and some hedge rows were to be left/created, we could expect that there would be a decrease in RSs, CHs, and several owl species. But, at the same time, there would likely be an increase in AKs, RTs, and perhaps WKs.

The point to the above exercise is that, if an arbitrary few species are chosen as "target" species, and the other raptors are not monitored, there will be a good chance that only some kinds of impacts will be reflected in the population trends of those raptors monitored. In our opinion, the MSCP Long-term Monitoring Program should include a broad-based approach, which documents all raptors observed and uses observed changes/trends to identify appropriate adaptive management strategies.

Single Species Monitoring Approach

Having sung the praises of a multiple raptor species approach (above), there is at least one raptor species in the western United States that has the ability to reflect regional trends in environmental health. This is the Golden Eagle. The attraction of using the GE, as a regional "miner's canary," is that (1) it requires a reasonably large and intact territory, and (2) there exists, in San Diego County, a unique and relevant historical regional database for this species. The Wildlife Research Institute has a long history of investigating the historical presence of GE in southern California, which includes the MSCP and environs (Bittner and Oakley 1999; WRI 2005). This collection of records has been compiled to reflect past documentation of GE pairs, their nesting success, hunting territories, and numbers of egg and /or young. The WRI database includes both active and extirpated territories beginning with records as early as 1864. WRI became involved in 1987 with the start of the San Diego GE Project (see Discussion in WRI 2005). *This project, in total, represents the longest such study of any eagle population in the Western Hemisphere, and is the second to longest in the world, next to one study in Switzerland.*

Providing this historical information, in conjunction with current trend data, is critical to managing the GE into the future. Only if we understand the extant population (within the context of the historical variation) can we properly evaluate the population and meet the needs of the species under current and future changing environmental and land-use conditions. If this is accomplished, it will reflect the success of the MSCP program.

RECOMMENDATIONS

Long-term MSCP Raptor Monitoring

Long-term monitoring is recommended under three categories: (1) Breeding Season, (2) Winter Season, and (3) Single Species Monitoring Program.

Breeding Season Monitoring Program

Twelve areas are recommended for breeding season portion of a Long-term Raptor Monitoring Program (Figure 2 and Table 5). Each Raptor Monitoring Area (RMA) consists of one to four of the individual raptor study sites that were surveyed during the period 2001-2003, the analysis of which led up to these recommendations. The choices of RMAs were based on a number of biological parameters (e.g., raptor diversity and population parameters, known history of raptor use), logistical considerations (how a monitor would move efficiently through a monitoring area), and a reasonable geographic coverage of the MSCP study area (see Methods). The Breeding Season Monitoring Program should, initially, be conducted every two years and encompass all 12 RMAs each time (i.e., don't conduct different portions of the total every other year). After a maximum of 5 monitoring events (i.e., 10 years), a statistical trend analysis should be conducted to determine if the frequency of every two years is adequate or, perhaps, unnecessarily frequent. Depending on the data, it may make sense to conduct this analysis earlier.

Raptor monitoring for the Breeding Season Monitoring Program should follow the protocol provided in Appendix C. This monitoring should be conducted by qualified raptor biologists with several years of relevant regional experience with the raptors found in the MSCP and proper training in the specific techniques necessary to conduct this monitoring.

Thanks to a grant from the San Diego Foundation, for post- (2003) fire studies, WRI was able to test this monitoring program on seven RMAs, representing varying degrees of being burned:

B. Ramona Grasslands (Control Area)
D. Iron Mountain (Burned)
E. San Diego River (Burned)
F Sloan Canyon (Burned)
H. Proctor Valley (Partially Burned)
I. Rancho Jamul (Partially Burned)
L. Otay Mountain (Burned)

The results of this monitoring effort were reported to the San Diego Natural History Museum (Lincer 2005).

Winter Season Monitoring Program

Because (1) the MSCP provides important wintering grounds for many raptors (some of which are *only* here during the winter), (2) coastal portions of the MSCP are not captured by the above breeding season monitoring approach, and (3) it is important to track at least three raptor species, that are primarily coastal in the MSCP, which have proven to be ideal bioindicators (PF, NH, and Osprey), we recommend conducting a winter monitoring program that focuses on the coastal portions of the MSCP (Figure 3). This, like the Breeding Season Monitoring program, should be conducted every two years (alternating years with the breeding season monitoring would be acceptable). After a maximum of 5 monitoring events (i.e., 10 years), a statistical trend analysis

should be conducted to determine if the frequency of every two years is adequate or, perhaps, unnecessarily frequent. Depending on the data, it may make sense to conduct this analysis earlier.

TABLE 5. Proposed MSCP Areas for Long-term Raptor Monitoring (Breeding Season)

Area	Name	Study Sites* (original number(s))
A	San Pasqual	San Pasqual (36), Lk. Hodges (7), Boden Cyn. (2), Rockwood (32)
B	Ramona Grasslands	Ramona Grasslands (30)
C	Penasquitos Canyon	Penasquitos Canyon (33)
D	Iron Mountain Complex	Iron Mountain**(11), San Vicente (16), Route 67 (27)
E	San Diego River	San Diego River (26)
F	Sloan Canyon	Sloan Canyon (31), McGinty Mtn. North (5), Sycuan Mtn. North (17)
G	Sweetwater River	Sweetwater Reservoir (45), Rcho. S.D. East (42), Rcho. S.D. West (43), San Miguel Mtn. North (23)
H	Proctor Valley	Proctor Valley (25), San Miguel Mtn. South (23), Upper Otay Lk.(14)
I	Rancho Jamul	Jamul Ranch (3), Hollenbeck Canyon (34)
J	Border Fields	Border Fields (44), Tijuana River (part)
K	Brown Field Complex	Brown Field (22), Otay River, Spring Cyn. (part), Dennery Cyn. (part)
L	Otay Mountain	Otay Mountain (12), Marron Valley (13), Lower Otay Lake (14)

* In some cases, only a portion of a study site is included because of access, visibility, or some other reason (see detailed maps, Appendix C, for details).
** Including Monte Vista Ranch.

Raptor monitoring for the Winter Season Monitoring Program should follow the protocol provided in Appendix C. This monitoring should be conducted from a vehicle, following the route depicted by Figure 3, and be conducted by qualified raptor biologists with several years of relevant regional experience with the raptors found in the MSCP.

Single Species Program

For the reasons covered in the Discussion section, we recommend that the GE (breeding season only) be used for the Single Species Program. Because of the dynamic nature of the GE pairs and the use of their territory, including their primary foraging area, these surveys should be conducted *every year* as they have been by WRI's biologists for the last 16 years. GE monitoring should follow the protocol that has been used for the San Diego GE Study for the last 16 years (Bittner and Oakley 1999, WRI 2005). WRI (2005) provides the details of both the breeding history of the GEs in the MSCP and recommendations on monitoring and future research. WRI (2005) is provided as a separate report for the protection and proper management of the GE. As an overview, observations must begin in December and go through June of each year. GEs begin courtship and nest building in December and January. They lay eggs in February and early March, hatch young in late March and April and fledge young in May and June. Therefore, it is essential that monitoring biologists be in the field for critical portions of the entire season (six months) to obtain all the data needed to monitor the GE population properly.

Aerial surveys have been a crucial part of the current study providing new insight into once-difficult areas to investigate potential territories. Patagial tags (and soon radio transmitters) placed on the GE's wings are now also an integral part of the eagle tracking process. Territory

Fig. 2. Prop'd RMAs (breeding)

Contact WRI for maps

integrity is fairly well documented in the San Diego MSCP and is being refined. See MSCP (2005) for more details.

Consistency in Monitoring

If data to be collected for this, or *any* monitoring program, are to have any utility in showing trends, they must be collected in a consistent fashion. As discussed above, the areas and routes to be monitored should be monitored frequently enough to reveal a complete picture of what is breeding and wintering on those respective areas and routes but these data are only a *sampling* of the entire MSCP. Therefore, it is extremely important that monitoring protocol is consistent both between sites/areas and over time (i.e., between years). To do this, a significant effort will have to go into selecting qualified raptor biologists, making sure that they are familiar with the required protocol, geography and species, and ensuring consistency between sites and years.

Other Recommendations

Management Needs and Enhancement Opportunities

- Restriction of inappropriate human activities where they are in conflict with, especially nesting, raptors.
- Apply the lessons learned in the development of the MSCP to the North and East County MSCPs and other HCPs.
- Develop a comprehensive management plan for the dwindling Burrowing Owl population within the MSCP.
- Selectively install artificial burrows, for BOs, and nest boxes for AKs, BRs, and Screech Owls (SOs). Keep in mind that BRs are an effective predator on not only small mammals but also medium size raptors, like the BO.
- Consider the use of grazing and/or fire as appropriate management tools to maintain grasslands, maintain/improve biological diversity, and manage fire fuel loading.

Recommended Research

- Transmitter study to better define the use of MSCP lands by GEs (initial studies in progress).
- Investigate the feasibility of reintroducing SHs into historical sites within the MSCP.
- Investigate the most efficient approaches to captive rearing and hacking BOs into appropriate habitat (either as is or as it can be modified and managed) within the MSCP.
- In order to prioritize the management of raptors that winter within the MSCP, but breed elsewhere (e.g., FH, MR, OS, BE, and some of the WK), determine the natal areas for these birds. If the natal areas have substantial threats, then no amount of MSCP management will have substantial positive impact.
- Document the growing OS population and determine emigration and immigration.
- Document the presence of, and habitat use by, crepuscular (BO) and nocturnal raptors (e.g., BR, SO, GO, Long-eared Owl).
- Document the recovery of raptors after the November 2003 fires and apply findings to future management strategies.

Fig. 3. Prop'd Winter Monit. Areas.

Contact WRI for Maps

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LITERATURE CITED

Bittner, J.D. and J. Oakley. 1999. Status of Golden Eagles in Southern California. Raptor Research Foundation Conference. Golden Eagle Symposium. November 2. La Paz, Baja California.

Bittner, J.D., J.L. Lincer, J. Oakley, Nick Muscolino, and J. Hannan. 2003. Golden Eagle reproduction in a drought period. Raptor Research Foundation's Annual Scientific Conference. September 2-7. Anchorage, AK.

County of San Diego. 1997. Multiple Species Conservation Program; County of San Diego, Subarea Plan. Adopted by the Board of Supervisors on October 22, 1997.

Hurlburt, T. 1971. [Probability of Interspecific Encounter]. In Gotelli, N.J. and G.L. Entsminger. 2001. EcoSim:no model software for ecology. Version 7.0. Acquired Intelligence, Inc. and Kesey-Bear. HTTP: \\Homepage.together.net\ gentsmin\ecosim\ecosim.htm.

Lincer, J. 2005. Post-Fire Raptor Monitoring Report. Letter report to Dr. Mick Hager, Executive Director, San Diego Natural History Museum. 20 January. Prepared for the San Diego Foundation.

Lincer, J.L. and P.H. Bloom. 2003. The status of the burrowing owl (*Athene cunicularia*) in San Diego County, CA. California Burrowing Owl Symposium. 11-12 November. Sacramento, CA.

Lincer, J.L. and P.H. Bloom. In prep. The status of the burrowing owl (*Athene cunicularia*) in San Diego County, CA. Proceedings of the California Burrowing Owl Symposium. 11-12 November. Sacramento, CA.

Lincer, J.L. and J.D. Bittner. 2002. Use of Raptors to monitor Habitat Conservation Plans. Poster presented at the Raptor Research Foundation's Annual Scientific Conference. September 24-28. New Orleans, Louisiana.

Lincer, J.L., J.D. Bittner, N. Muscolino, and, L. Swartz. 2003. A Raptor Protocol for Monitoring HCPs. Paper to be presented at the Raptor Research Foundation's Annual Scientific Conference. September 2-7. Anchorage, AK.

Ogden. 1996. Biological Monitoring for the Multiple Species Conservation Program. Prepared for the City of San Diego, California Department of Fish and Game, and U.S. Fish and Wildlife Service. Revised April 25.

Oakley, K.L., L.P. Thomas, and S.G. Fancy. 2003. Guidelines for long-term monitoring protocols. Wildlife Society Bull., 31 (4): 1000-1003.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2003. Burrowing Owl Surveys on City of San Diego Properties (for the period January 1, 2001 – March 24, 2003). Prepared for the City of San Diego, Planning Department. 24 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report for NCCP/MSCP Raptor Monitoring Project-Golden Eagles of the San Diego Multiple Species Conservation Plan Area 2001-2003. Prepared for California Department of Fish and Game. 31 March.

APPENDIX A

PROJECT BIBLIOGRAPHY

Bald Eagle

Anderson, D.W. and J.J. Hickey. 1972. Eggshell changes in certain North American birds. Proc. Int. Ornithol. Congr. 15:514-540.

Buehler, D.A. 2000. Bald Eagle *Haliaeetus leucocephalus*. *In* The Birds of North America, No. 506. (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C. 40 pp.

Buehler, D.A., T.J. Mersmann, J.D. Fraser, and J.K.D. Seegar. 1991. Effects of human activity on Bald Eagle distribution on the northern Chesapeake Bay. J. Wildl. Manage. 55(2):282-290.

California. Department of Fish and Game. 1980. Bald Eagle *Haliaeetus leucocephalus* At the Crossroads. 89-90 pp.

California. Department of Fish and Game. 1982. Bald Eagle. *Haliaeetus leucocephalus* California's Wildlife. 2:122 p.

Dawson, W.L. 1923. The Southern Bald Eagle. *In* The Birds of California, Vol. 3. South Moulton Company, San Diego, Calif. Student's ed. 1712-1717 pp.

Detrich, P.J., D.K. Garcelon. 1986. Criteria and habitat evaluation for Bald Eagle reintroduction in coastal California. The Resources Agency Department of Fish and Game. 1-32 pp.

Detrich, P. J. 1981. Historic range of breeding Bald Eagles in California. Unpubl. Report., Redding, California. California State University, Chico 17 pp.

Detrich, P.J. 1986. Status and distribution of the Bald Eagle in California. MS Thesis, California State University, Chico 112 pp.

Forbis, L.A., B. Johnston, A. M. Camarena, and D. McKinney. 1977. Bald Eagle-habitat management guidelines. U.S.D.A. Forest Service, California Region. 60 pp.

Gerrard, J.M. and G.R. Bortolotti. 1998. The Bald Eagle: haunts and habits of a wilderness monarch. Smithsonian Inst. Press, Washington, D.C.

Green, N. 1985. The Bald Eagle. Audubon Wildlife Report. 508-529 pp.

Grinnell, J., and A. H. Miller. 1944. The distribution of the birds of California. *Pacific Coast Avifauna* 27:17, 106.

Harmata, A.R. 1993. Heavy metal and pesticide contamination of Bald and Golden Eagles in the western United States. Unpubl. USEPA, December 1993. 43 pp.

Hastings, B. and C. Comp. 1988. Midwinter Bald Eagle survey report. National Wildlife Federation, Washington, D.C., 1986-1988.

Henny, C.J. and R.G. Anthony. 1989. Bald Eagle And Osprey. Western Raptor Mgmt. Symposium and Workshop. 12:317.

Howell, A.H. and F.L. Jaques. 1932. Florida bird life. Florida Department of Game and Fresh Water Fish. 182-183 pp.

Institute for Wildlife Research. 1989. Midwinter Bald Eagle survey report. National Wildlife Federation, Washington, D.C.

Jacobson, S.L. 1987. Bald Eagle habitat capability model. [Second draft.]. Unpubl. Report. U.S. Forest Service, Shasta-Trinity National Forest, Redding, California. 35 pp.

Jones and Stokes Associates, 1982. Investigation of wintering Bald Eagles at Lake Mathews, Riverside County, California. Jones & Stokes, Inc., Sacramento, CA. (Prepared for the Metropolitan Water District of Southern California)

Jurek, R.M. 1979. Southern Bald Eagle. Job Progress Report. State of California The Resource Agency, Department of Fish and Game.

Jurek, R.M. 1982. Endangered, threatened and rare wildlife. Job Progress Report. State of California The Resource Agency, Department of Fish and Game.

Jurek, R.M. 1982. Endangered, threatened and rare wildlife. Job Final Report. State of California, The Resource Agency, Department of Fish and Game.

Jurek, R.M. 1988. Five year status report Bald Eagle. State of California The Resource Agency Department of Fish and Game. 1-15 pp.

Jurek, R.M. 1990. California Bald Eagle breeding population survey and trend, 1970-90. State of California, Dept. of Fish and Game. 16 pp.

Jurek, R.M., D.M. Horn, and C. Roberts 1986. California mid winter Bald Eagle survey. State of California, The Resource Agency, Department of Fish and Game. 4pp.

Knight, R.L. 1984. Responses of wintering Bald Eagles to boating activity. *J. Wildl. Manage.* 48(3): 999-1004 pp..

Lehman, R.N. 1979. A survey of selected habitat features of 95 Bald Eagle nest sites in California. Wildl. Management Branch Administrative Report 79-1:1-23

Lehman, R.N. 1981. Breeding status and management of Bald Eagles in California. State of California The Resources Agency, Department. of Fish and Game. 83-1:1-24

Lincer. J.L. 1981. "Bald Eagle Management at the Local Government Level." Paper presented at the 45th Annual Meeting of the Florida Academy of Sciences, April 30-May 2, Orlando, FL. *Florida Scientist*, 44 (1): 36-37.

Lincer, J.L. 1982. "Bald Eagle: Symbol of Symbols." Invited editorial for ENFO Newsletter (a publication of the Florida Conservation Foundation), Vol. 82, No. 3. Winter Park, FL.

Lincer, J.L. 1982. "Protecting Endangered Species at the Local Governmental Level." Paper presented at the 46th Annual Meeting of the Florida Academy of Sciences, April 22-24, DeLand, FL. *Florida Scientist*, 45(1): 40.

Lincer, J.L. (Consulting Editor). 1989. Raptor Habitat Management Under the U.S. Bureau of Land Management Multiple-Use Mandate by R.R. Olendorff *et al.* Raptor Research Report No. 8, Raptor Research Foundation, Inc. Allen Press. 80 pp.

Lincer, J.L., R.G. Brooks and B.L. Valla. 1991. "Managing Bald Eagles at the Local Level: A Prototypical Ordinance." Presented by J.L. Lincer at the Raptor Research Foundation Conference, November 6-9, Tulsa, OK.

Lincer, J.L., W.S. Clark and M. Le Franc. 1979. Working Bibliography of the Bald Eagle. A comprehensive guide to the literature on the bald eagle. 2,000 refs. 268 pages with permuted keyword sort for index. National Wildlife Federation, Washington, D.C.

Lincer, J.L., B. Millsap and G. Holder. 1988. "Bald Eagle Buffer Zones: Do They Work in Florida?" Presented at Raptor Research Foundation Annual Meeting, October 26-29, Minneapolis, MN.

McWilliams, S.R., J.P. Dunn, and D.G. Raveling. 1994. Predator-prey interactions between eagles and cackling Canada and Ross' Geese during winter in California. *Wilson Bull.* 106:272-288.

National Wildlife Federation. 1989. Proceedings of the Western Raptor Management Symposium and Workshop. National Wildlife Federation, Washington, D.C., Series No. 12. October 26-28, 1987, Boise, Idaho.

Simmons, T., S. K. Sherrod, M.W. Collopy and M. A. Jenkins. 1988. Restoring the Bald Eagle. *American Scientist* 76(3): 252-260.

Smith, B. 1989. Plan for Bald Eagles sought at Cachuma. Santa Barbara News Press (Santa Barbara, CA) (March 6):A1-A5.

Solomon, S. and T. Newlon. 1991. Living with eagles. Status report and recommendations. Northwest Renewable Resources Center. 9-47 pp.

Stalmaster, M.V. 1987. The Bald Eagle. Universe Books, New York.

Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering Bald Eagles to human activity. *J. Wildl. Manage.* 42(3): 506-513.

Steenhof, K. 1988. Identifying potential Bald Eagle nesting habitat; a review of the state of the art. pp. 31-59. *In* D. K. Garcelon and G. W. Roemer [eds.], Proceedings of the International Symposium on Raptor Reintroduction 1985. Institute for Wildlife Studies, Arcata, CA.

Steinhart, P. 1990. Bald Eagle. *Haliaeetus leucocephalus* California. Wildlife. heritage: threatened and endangered animals in the golden state California Department of Fish and Game. 15-17 pp.

Thompson, R.A. 1973. Bald Eagle nesting surveys in California. United States Fish and Wildlife Service. 48 pp.

U.S Fish and Wildlife. 1994. Federal Register. Reclassify the Bald Eagle from endangered to threatened in most of the lower 48 states. 59: 132.

Wood, P.B., D.A. Buehler, and M.A. Byrd. 1990. Raptor status report-Bald Eagle. *In* Proceedings of the southeast raptor management symposium and workshop (B. Giron Pendleton, ed.). National Wildlife Federation. Washington, D.C. Pp. 13-21.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report – NCCP/MSCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

Burrowing Owl

Allaback, M., J. Barclay. 1994. Burrowing Owl *Speotyto (Athene) cunicularia* Reference Manual. Proceedings of Burrowing Owl consortium of August 1993.

Anderson, S.H., L.W. Ayers, J.A. Dechant, M.T. Green, W.H. Howe, S.L. Jones, D.S. Klute, D.K. Rosenberg, S.R. Sheffield, and T.S. Zimmerman. 2001. Status assessment and conservation plan for the western Burrowing Owl in the United States. Adminstrative Report. U.S. Department of Interior, Fish and Wildlife Service, Denver, CO.

Banuelos, G. 1997. The one-way door trap: an alternative trapping technique for Burrowing Owls. *J. Raptor Res.* 9:122-124.

Barclay, J., D. Plumpton and B. Walton 1998. (The California Burrowing Owl consortium) Burrowing Owl conservation in California: issues and challenges. Poster presented at Second International Burrowing Owl Symposium. The Raptor Research Foundation, Inc. Ogden, UT.

Benson, P.C. 1981. Large raptor electrocution and power pole utilization: a study in six western states. Ph.D. thesis, Brigham Young University, Provo, UT.

Bent, A.C. 1938. Life histories of North American birds of prey. U.S. Natl. Mus. Bull. No. 170.

Best, T.R. 1969. Habitat, annual cycle, and food of burrowing owls in southwestern New Mexico. M.S. Thesis, New Mexico State Univ., Las Cruces. 34pp.

Bloom, P.H. 1994. Ramona Airport Spring Raptor Census Report (*in* BFMA. 1997).

BFMA (Brian F. Mooney Associates). 1997. Ramona Airport, Airport Master Plan Improvements, Ramona, CA. Vol. 1. Prepared for the County of San Diego and the U.S. Department of Transportation. March.

Boggs, D.F. 1980. Respiratory adaptations of a burrow-dwelling bird to hypoxia and hypercarbia. Ph.D. thesis, University of Montana.

Buchanan, J.T. 1997. A spatial analysis of the Burrowing Owl (*Speotyto cunicularia*) population in Santa Clara County, California, using a geographic information system. pp. 90-96. In Biology and conservation of owls of the northern hemisphere; second international symposium. February 5-9, 1997. Winnipeg, Manitoba, Canada, (J.R. Duncan, D.H. Johnson, and T.H. Nicholls, eds.). U.S. Department of Agriculture. Forest Service. North Central Forest Experiment Station, St. Paul, MN.

Burrows, C.W. 1989. Diets of five species of desert owls. *Western Birds.* 20:1-10.

Butts, K.O. 1973. Life History and Habitat Requirements of Burrowing Owls in Western Oklahoma Master's Thesis. Oklahoma State University, Stillwater. 188 Pp.

CBOC (California Burrowing Owl Consortium). 1997. Burrowing Owl Survey Protocol and Mitigation Guidelines. *In* Lincer and Steenhof. 1997. The Burrowing Owl, its Biology and Management. *Raptor Res. Report* 9: Appendix B.

CDFG (California Department of Fish and Game). 1995. Staff Report on Burrowing Owl Mitigation. Memorandum to Division Chiefs and Regional Managers from C.F. Raysbrook, Interim Director, California Department of Fish and Game. October 17.

Clark, Greg. 2001. Burrowing Owl artificial next box project an Arizona partners in flight habitat substitution project. Website citation: www.mirror-pole.com/burr_owl/bur_owl1.html.

Clark, R.J., J.L. Lincer, and J.S. Clark. 1997. A Bibliography on the Burrowing Owl (*Speotyto cunicularia*). *In* The Burrowing Owl, Its Biology and Management. Proceedings of the First International Burrowing Owl Symposium. Raptor Research Reports No. 9:145-170.

Climpson, J.T. 1977. Feeding ecology and selected other aspects of the behavior and ecology of the Burrowing Owl (*Speotyto cunicularia*). M.S. thesis, Washington State University, Pullman, WA.

Colvée, Salvador. 1996. Ecologia alimentaria del Mochuelo de Hoyos (*Athene cunicularia*) en la Peninsula de Paraguana. MS. Dissertation. Universidad Simon Bolivar. 34 pp.

Coulombe, H.N. 1968. Energy exchange in the biology of the Western Burrowing Owl, *Speotyto cunicularia*. Ph.D. thesis. University of California at Los Angeles, CA.

Coulombe, H.N. 1971. Behavior and population ecology of the Burrowing Owl, *Speotyto cunicularia*, in the Imperial Valley of California. *Condor*. 73:162-176.

Delevoryas, P. 1997. Relocation of Burrowing Owls during courtship period. *In* Lincer and Steenhof (Eds.). 1997. The Burrowing Owl, its Biology and Management *Raptor Res. Reports*, 9:138-144.

DeSante, D.F., E.D. Ruhlen, S. L. Adamany, K.M. Burton, and S. Amin. 1997. A census of burrowing owls in Central California in 1991. *In* Lincer, J. L. and K. Steenhof. 1997. The Burrowing Owl, Its Biology and Management. *Raptor Research Report* Number 9:38-48.

DeSante, D.F., E.D. Ruhlen, and D.K. Rosenberg. 2002. Density and Abundance of Burrowing Owls in the agricultural matrix of the Imperial Valley, California. *Press, Studies in Avian Biology*. 9 pp.

Drost, C. A and R. C. McCluskey. 1992. Extirpation of alternative prey during a small rodent crash. *Oecologia* (Berlin) 92(2):301-304

Duxbury J.M. and G.L. Holroyd. 1995. A standardized, roadside Burrowing Owl survey technique. Canadian Wildlife Service, Environment Canada. Department of Renewable Resources. 7 pp.

Duxbury, J.M. and G.L. Holroyd. 1998. A Standardized, Roadside Burrowing Owl Survey Technique. Paper presented at The Second International Burrowing Owl Symposium held in conjunction with the 1998 Annual Raptor Research Foundation Meeting. 29-30 September. Ogden, UT.

Holroyd, G.L. and T.I. Wellicome. 1998. Report on the Burrowing Owl Conservation Workshop. Pages 612-615 *in* Duncan, J.R., D.H. Johnson and T.H. Nicholls (eds.). Biology and Conservation of Owls of the Northern Hemisphere, Second International Symposium, February 5-9, 1997, Winnipeg, Manitoba, Canada

EDAW. 2001. Wildlife Biological Technical Report for the East Otay Mesa Specific Plan Amendment Area, San Diego, California. Prepared for County of San Diego Department of Planning and Land Use. October.

Feeney, L.R. 1997. Burrowing Owl site tenacity associated with relocation efforts. *J. Raptor Res.* 9:132-137.

Gervais, J.A., D.K. Rosenberg, and R.G. Anthony. 2001. Burrowing Owl space use and pesticide exposure risk in an agricultural landscape. *J. Wildl. Manage.* 31 pp.

Green, G. A., R. E., Fitzner, R. G Anthony, L E Rogers. 1993. Comparative diets of burrowing owls in Oregon and Washington. *Northwest Science* 67(2): 88-93.

Grinnell, J. and A.H. Miller. 1944. The distribution of the birds of California. Contribution from the Museum of Vertebrate Zoology of the University of California. Reprinted by Artemisia Press. Lee Vining, CA. 617 pp.

Haley, K.L. 2002. The role of food limitation and predation on reproductive success of Burrowing Owls in Southern California. (Thesis) submitted to Oregon State University. 47 pp.

Halverson, W.S. and A.C. Crabb. (Eds). 1994. Natural history and protection of Burrowing Owls. Proceedings of the Sixteenth Vertebrate Pest Conference. March 1-3, 1994. Santa Clara, California. Published at University of California, Davis. 83-86.

Haug, E.A. and A.B. Didiuk. 1981. Use of recorded calls to detect Burrowing Owls. *J. Field Ornithol*, 64(2):188-194.

Haug, E.A., B.A. Millsap, and M.S. Martell. 1993. Burrowing Owl (*Speotyto cunicularia*). *In* The Birds of North America, No. 61:2-20. (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C.

HELIX Environmental Planning, Inc. 1999. San Diego Air Commerce Center at Brown Field Airport Master Plan Biological Assessment. United States Department of Transportation Federal Aviation Administration. 20 pp.

HELIX Environmental Planning, Inc. 2001. Draft EIR/EIS of Route 905. Prepared for Federal Highway Administration and Caltrans.

Hennings, L.T. 1970. Life history of the Burrowing Owl at the Oakland Airport, Alameda County, California. MS. Dissertation, University of California, Berkeley.

Henny, C.J. and L.J. Blus. 1981. Artificial burrows provide new insight into Burrowing Owl nesting biology. *Raptor Res.* 15:82-85.

Holroyd, G.L. and H. Trefry. 1998. Migration and winter biology of Burrowing Owls in the USA. *In* Second international Burrowing Owl symposium. The Raptor Research Foundation, Inc. 3 pp.

Holroyd, G.L., R. Rodriguez-Estrella, and S.R. Sheffield. 2001. Conservation of the Burrowing Owl in Western North America: issues, challenges, and recommendations. *J. Raptor Res.* 35(4):399-407.

Holyroyd, G.L. 1998. A Burrowing Owl conservation action plan – what should it contain? *In* Second international Burrowing Owl symposium. The Raptor Research Foundation, Inc. 5 pp.

Hunting, K. 1998. Mitigating impacts to Burrowing Owl populations: case studies in California. *In* Second international Burrowing Owl symposium. The Raptor Research Foundation, Inc. 4 pp.

James, P.C. and R.H.M. Espie. 1997. Current status of the Burrowing Owl in North America: an agency survey. *J. Raptor Res.* 9:3-5.

James, P.C., T.J. Ethier, and M.K. Toutloff. 1997. Parameters of a declining burrowing owl population in Saskatchewan. *In* Lincer and Steenhof (Eds.). 1997. The Burrowing Owl, its Biology and Management *Raptor Res. Reports*, 9:34-37.

Johnson, B.S. 1988. Viability of small populations of the burrowing owl. *Bull. Ecol. Soc. Amer.* Suppl. 69 (2):182.

Johnson, B.S. 1992. Effects of demography, mating patterns, and sociality on the population genetics and dynamics of the Burrowing Owl Athene cunicularia. Doctoral Dissertation. University of California, Davis.

Johnson, B.S. 1997. Characterization of population family genetics of the burrowing owl by DNA fingerprinting with pV47-2. *In* Lincer and Steenhof (Eds.). 1997. The Burrowing Owl, its Biology and Management *Raptor Res. Reports*, 9:58-63.

Landry, R.E. 1979. Growth and Development of the Burrowing Owl, *Athene Cunicularia*. Long Beach, California State University. MA Dissertation. 74 pp

Lehman, R.N., L.B. Carpenter, K. Steenhof, and M.N. Kochert. 1991. Assessing relative abundance and reproductive success of shrub steppe raptors. *J. Field Ornithol.* 69(2)244-256.

Lincer, J.L. 1997. Toward an action plan: *In* Lincer and Steenhof (Eds.). 1997. The Burrowing Owl, its Biology and Management *Raptor Res. Reports*, 9:5:11-13.

Lincer, J.L. and K. Steenhof (Eds.). 1997. The Burrowing Owl, its biology and management including the proceedings of the first international Burrowing Owl symposium. Raptor Res. Rep. 9:1-177.

Lincer, J.L., R.J. Clark and J.S. Clark. 1998. Toward an update on Clark, Lincer and Clark's bibliography on *Speotyto cunicularia*. Presented at the second international Burrowing Owl symposium, Ogden, Utah. September 29-30, 1998.

Lincer, J.L., R.J. Clark and J.S. Clark. 1998 Towards a Burrowing Owl bibliography. *In* Second international Burrowing Owl symposium. The Raptor Research Foundation, Inc. 2 pp.

Martell, M.S. 1991. Grassland owls. Pp. 96-104 in Proceedings of the Midwest raptor management symposium and workshop (B.G. Pendleton and D.L. Krahe, Eds.). National Wildlife Fed. Sci. Tech. Series, No. 15. Washington, D.C.

MacCracken, J.G., D.W. Uresk, and R.M. Hansen. 1985. Vegetation and soils of burrowing owl nest sites in Conata Basin, South Dakota. *Condor* 87:152-154.

Merkel, K.W. and D.A. Mayer. 2000. 1999 Maintenance and monitoring report for the artificially created burrows for the Burrowing Owl (*Speotyto cunicularia*) at the Otay Water District use area property, Chula Vista, California. Merkel & Associates, Inc. 99-046-01.

Millsap, B.A., M.I. Bellocq, and M. Mullenix. 1997. Overview of literature on the burrowing owl. *In* Lincer and Steenhof (Eds.). 1997. The Burrowing Owl, its Biology and Management *Raptor Res. Reports*, 9:6-10.

Ogden (Ogden Environmental and Energy Services Co.). 1992. Otay Ranch Raptor Management Study. Submitted to Otay Ranch Project Team, Chula Vista, California.

Ogden. 1996. Biological Monitoring for the Multiple Species Conservation Program. Prepared for the City of San Diego, California Department of Fish and Game, and U.S. Fish and Wildlife Service. Revised 25 April.

Palacios, E., D.W. Anderson, E. Mellink, and S. Gonzalez-Guzman. 2000. Distribution and abundance of Burrowing Owls on the peninsula and islands of Baja California. *Western Birds*. 31:89-99.

Poulin, R.G., T. Wellicome, R. Longmuir, and Dave Scobie. No date. Burrowing Owl nest box: construction and installation procedures. Saskatchewan Environment and Resource Management. Fish and Wildlife Branch.

Priest, J.E. 1997. Age identification of nestling Burrowing Owls. *J. Raptor Res.* 9:125-127.

Recon. 2001. Otay Mesa Generating Project Biological Resources Mitigation Implementation and Monitoring Plan. Prepared for Otay Mesa Generating Company. 5 September. (Note: 2002-2003 updates on burrowing owl distribution based on personal communications between Fred Edwards and David Mayer, CDFG.)

Raptor Research Foundation, Inc. 2001. The Second International Burrowing Owl Symposium. *J. Raptor Res.* 35(4): 269-417.

Rich, T. 1984. Monitoring burrowing owl populations: implications of burrow re-use. *Wildl. Soc. Bull.* 12:178-180.

Rosenberg, D.K. and K.L.Haley. 2000. The ecology of Burrowing Owls in the agroesystem of the Imperial Valley, California.. *In* Press, Studies in Avian Biology. 40 pp.

Rosier, J.R., N.A. Ronan, and D.K. Rosenberg. 2001. Breeding season survival and dispersal of Burrowing Owls in an extensive California grassland. *Review: Condor.* 16 pp.

Rowe, Matthew P. 1984. California ground squirrels and their burrow coinhabitants: communicatory coevolution between predators and prey. Ph.d. Dissertation. Davis, University of California. 110 pp

Sheffield, S.R. 1998. Conservation of the Burrowing Owl in north America: problems, issues, and solutions. *In* Second international Burrowing Owl symposium. The Raptor Research Foundation, Inc. 5 pp.

Smith, B.W. and J.R. Belthoff. 1998. Burrowing Owls and development: results of short-distance nest burrow relocations to avoid construction impacts. *In* Second international Burrowing Owl symposium. The Raptor Research Foundation, Inc. 4 pp.

Smith, B.W. and J.R. Belthoff. 1999. Ectoparasites on Burrowing Owls: Potential effects on nest-site reuse and growth, body condition, and survival of juveniles. *In* Raptor Research Foundation Annual Meeting. November 3-7, 1999, La Paz, Baja California Sur, Mexico 12 pp.

Smith, B.W. and J.R. Belthoff. 2001. Burrowing Owls and development: short-distance nest burrow relocation to minimize construction impacts. *The Journal of Raptor Research.* 35(4):385-391 pp.

Snyder, N.F.R. and J. Wiley. 1976. Sexual size dimorphism in hawks and owls of North America. *Ornithol. Monogr.* No. 20.

Takats, D.L., G.L. Holroyd, J.R. Duncan, K.M. Mazur, C.M. Francis, R.J. Cannings, and W. Harris. 1999. Canadian nocturnal owl monitoring. Proceedings of National Nocturnal owl Monitoring meeting in Winnipeg on September 27-28, 1999. 16 pp.

Thomsen, L. 1971. Behavior and ecology of Burrowing Owls on the Oakland Municipal Airport. *Condo.* 73:177-192.

Trulio, L. 1995. Passive relocation: a method to preserve Burrowing Owls on disturbed sites. *J. Field Ornithol.* 66(1):99-106.

Trulio, L. 1996. The western Burrowing Owl (*Speotyto cunicularia hypugaea*). BO Document Department of Geography and Environmental Studies, San Jose State University. 1-17 pp.

Trulio, L. 1997. Burrowing Owl demography and habitat use at two urban sites in Santa Clara County, California. *J. Raptor Res. Report*. 9:84-89.

Trulio, L. 1998. The Burrowing Owl as an indicator of CEQA effectiveness and environmental quality in the Silicon Valley. *In Environmental Monitor. 4-5 pp.*

Trulio, L. and D. Rosenberg. 1998. Research on the demographic characteristics of Burrowing Owl populations in California: a progress report. *In* Second international Burrowing Owl symposium. The Raptor Research Foundation, Inc. 3 pp.

U.S. Fish & Wildlife Service. 2001. Draft of Status assessment and conservation plan for the western Burrowing Owl in the United States. United States Department of the Interior, U.S. Fish & Wildlife. 145 pp.

Walton, B.J. 1998. Burrowing Owl – Can the Endangered Species Act help? Presented at Second International Burrowing Owl Symposium. The Raptor Research Foundation, Inc. Ogden, UT. 5 pp.

Wellicome, T.I. and G.L. Holroyd. 2001. The Second International Burrowing Owl Symposium: background and context. *J. Raptor Res.* 35(4): 269-273.

Wellicome, T.I. and R.G. Poulin. 1998. Can we manage reproductive output in Burrowing Owls by managing their prey? *In* Second international Burrowing Owl symposium. The Raptor Research Foundation, Inc. 4 pp.

Wellicome, T.I., G.L. Holroyd and H.E. Trefry. 1999. Are breeding populations of the Western Burrowning owl (*Athene cunicularis hypugaea*) declining throughout North America. *In* Raptor Research Foundation Annual Meeting. November 3-7, 1999, La Paz, Baja California Sur, Mexico. 13 pp.

Winchell, C. S. 1994. Natural history and protection of burrowing owls. Proceedings of the Vertebrate Pest Conference 16: 83-86.

Woollett, J.S. and M.G. van Hattem. 1999. Western burrowing owl demographic and biogeographic traits in a coastal range of central California. Presented at the Raptor Research Foundation Annual Meeting, 3-7 November 1999. La Paz, Baja, Mexico.

WRI (Wildlife Research Institute, Inc.). 2003. Burrowing Owl Surveys on City of San Diego Properties (for the period January 1, 2001 – March 24, 2003). Prepared for City of San Diego. 24 March.

WRI (Wildlife Research Institute, Inc.). 2005. Burrowing Owl Management and Monitoring Plan Lower Otay Lake Burrowing Owl Management Area. Prepared for City of San Diego. 31 March.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report – NCCP/MSCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

York, M.M., D.K. Rosenberg, and K.K. Sturm. 1997. Diet and food-niche breadth of Burrowing Owls (*Athene cunicularis*). U.S. Fish and Wildlife Service. 21 pp.

Zarn, M. 1974. Burrowing Owl, Report No. 11. Habitat management series for unique or endangered species. Bureau of Land Management, U.S. Department of the Interior, Denver, CO. 25 pp.

Cooper's Hawk

Anderson, D.W. and J.J. Hickey. 1972. Eggshell changes in certain North American birds. Proc. Int. Ornithol. Congr. 15:514-540.

Boal, C.W. and R.W. Mannan. 1998. Nest site selection by Cooper's hawks in an urban environment. *J. Wildl. Manage.* 62:864-871.

Brown, W.H. 1973. Winter population trends in Marsh, Cooper's and Sharp-shinned hawks. *Amer. Birds* 27:6-7.

California Wildlife. 1982. Cooper's hawk *Accipiter cooperii. California's Wildlife.* 2:128-129.

DeLong, J. and S.W. Hoffman. 1999. Differential autumn migration of Sharp-shinned and Cooper's Hawks in western North America. *Condor.* 101:674-678.

Iverson, G.C. and M.R. Fuller 1992. Area-occupied survey technique for nesting woodland raptors. Proceedings of the Midwest Raptor Management Symposium and Workshop. Woodland Raptor Surveys Institute for Wildlife Research. National Wildlife Federation Scientific and Technical Series No. 15:1-7.

Lincer, J.L. (Consulting Editor). 1989. Raptor Habitat Management Under the U.S. Bureau of Land Management Multiple-Use Mandate by R.R. Olendorff *et al.* Raptor Research Report No. 8, Raptor Research Foundation, Inc. Allen Press. 80 pp.

Lincer, J.L. and R.J. Clark. 1978. Organochlorine residues in raptor eggs in the Cayuga Lake Basin, New York. *New York Fish Game J.* 25:121-128.

Mosher, J.A. and M.R. Fuller. 1996. Surveying woodland hawks with broadcasts of great horned owl vocalizations. Reprinted from *Wildlife Society Bulletin.* 24(3):531-536.

Mosher, J.A., M.R. Fuller, and M. Kopeny. 1990. Surveying woodland raptors by broadcast of conspecific vocalizations. *J. Field Ornithol.*, 61(4):453-461.

Ogden (Ogden Environmental and Energy Services Co.). 1992. Otay Ranch Raptor Management Study. Submitted to Otay Ranch Project Team, Chula Vista, California.

Remsen, Jr., J.V. 1978. Bird Species of Special Concern in California. California Department of Fish and Game, State of California, The Resources Agency, Department of Fish and Game. Wildlife Mgmt. Branch, Admin. Report No. 78-1. Pp.:31-32.

Risebrough, R.W., R.W. Reiche, D.B. Peakall, S.G. Herman, and M.N. Kirven. 1968. Polychlorinated biphenyls in the global ecosystem. *Nature* 220:1098-1102.

Rosenfield, R.N., J. Bielefeldt, and R.K. Anderson. 1988. Effectiveness of broadcast calls for detecting breeding Cooper's Hawks. *Wildl. Soc. Bull. 16(2):210-212.*

Rosenfield, R.N. and J. Bielefeldt. 1993. Cooper's hawk *Accipiter cooperii.* . *In* The Birds of North America, No. 75 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C. 24pp.

Rosenfield, R.N., J. Bielefeldt, and R.K. Anderson. 2000. Comparative breeding ecology of Cooper's Hawk in urban vs. exurban areas of southeastern Arizona. *J. Wildl. Manage.* 64(2):599-600.

Snyder, H.A and N.F.R. Snyder. 1974. Increased mortality of Cooper's hawks accustomed to man. *Condor.* 76:215-216.

Snyder, N.F.R., H.A. Snyder, J.L. Lincer, and R.T. Reynolds. 1973. Organochlorines, heavy metals and the biology of North American accipiters. *BioScience*, 23(5):300-305.

Walton, B.J., L.R. Mewaldt, and E.V. Johnson. 1976. Observations on Cooper's hawk (*Accipiter cooperii)* populations in California. 1972-1975. Unpubl. Rep. 12 pp.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring

Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report – NCCP/MSCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

Ferruginous Hawk

Atkinson, E.C. 1995. Survey and monitoring guidelines for Ferruginous Hawks in Montana. Raptor Research Center, Boise State University, Boise, Id. Unpubl. Rep. 42 pp.

Ayers, L.W. and S.H. Anderson. 1999. An aerial sightability model for estimating Ferruginous Hawk population size. *J. Wildl. Manage.* 63(1):85-97.

Bechard, M.J. and J.K. Schmutz. 1995. Ferruginous Hawk *Buteo regalis*. The Birds of North America. 172:1-20.

CDFG. 1991. Ferruginous Hawk *Buteo regalis*. Species of Special Concern, California Dept. of Fish and Game. Unpubl. Rep. 13 pp

Garrison, B.A. 1990. Trends in winter abundance and distribution of Ferruginous Hawks in California. *Trans. West. Sect. Wildl. Soc.* 26:51-56.

Lincer, J.L. (Consulting Editor). 1989. Raptor Habitat Management Under the U.S. Bureau of Land Management Multiple-Use Mandate by R.R. Olendorff *et al.* Raptor Research Report No. 8, Raptor Research Foundation, Inc. Allen Press. 80 pp.

Lehman, R.N., L.B. Carpenter, K. Steenhof, and M.N. Kochert. 1991. Assessing relative abundance and reproductive success of shrubsteppe raptors. *J. Field Ornithol.* 69(2)244-256.

McAnnis, D.M. 1990. Home range, activity budgets, and habitat use of Ferruginous Hawks (*Buteo regalis*) breeding in southwest Idaho. MS Thesis, Boise State University, Boise 81pp.

Moritsch, M.Q. 1985. Photographic guide for aging nestling Ferruginous Hawks. Unpubl. Rep. U.S. Bureau of Land Management, Boise, Idaho. 22 Pp.

Ogden (Ogden Environmental and Energy Services Co.). 1992. Otay Ranch Raptor Management Study. Submitted to Otay Ranch Project Team, Chula Vista, California.

Olendorff, R.R. 1993. Status, biology, and management of Ferruginous Hawks; a review. Raptor Res. And Tech. Asst. Center, Spec. Rep. U.S Dept. Interior, Bur. Land Manage., Boise, Id. 84 pp.

Steenhof, K. 1984. Use of an interspecific communal roost by wintering Ferruginous Hawks. *Wilson Bull.* 96:137-138.

Steenhof, K. and M.N. Kochert. 1985. Dietary shifts of sympatric buteos during a prey decline. *Oecologia* (Berlin) 66:6-16.

Tate, J. 1986. The Blue List for 1986. *Am. Birds* 40:227-236.

Tigner, J.R., M.W. Call and M.N. Kochert. 1996. Effectiveness of artificial nesting structures for Ferruginous Hawks in Wyoming. *In* Academic Press Ltd. 15:137-144

Woffinden, N.D. and J.R. Murphy. 1989. Decline of a Ferruginous Hawk population: a 20-year summary. *J. Wildl. Manage.* 53(4):1127-1132.

Woffinden, N.D. No date. A decade long extinction of a central Utah population of the Ferruginous Hawk *Buteo regalis.* Division of Natural Sciences, University of Pittsburgh, PA. Unpubl. Rep. 9 pp.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report – NCCP/MSCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

Golden Eagle

Anderson, D.W. and J.J. Hickey. 1972. Eggshell changes in certain North American birds. Proc. Int. Ornithol. Congr. 15:514-540.

Bittner, J.D. 1997. Golden Eagles in San Diego County. Presented at the Raptor Research Foundation Annual Meeting. Ogden, UT.

Bittner, J.D. and J. Oakley. 1999. Status of Golden Eagles in Southern California. Raptor Research Foundation Conference. Golden Eagle Symposium. November 2. La Paz, Baja California.

Bittner, J.D., J.L. Lincer, J. Oakley, Nick Muscolino, and J. Hannan. 2003. Golden Eagle reproduction in a drought period. Presented at Raptor Research Foundation's Annual Scientific Conference. September 2-7. Anchorage, AK.

Bloom, P. H. 1991. Status of the Golden Eagle population on Marine Corps Base Camp Pendleton. Unpubl. Rep. Santa Ana, California. 21 pp.

California. Department of Fish and Game. 1982. Golden Eagle *Aquila chrysaetos.* California's Wildlife. 2:142 p.

Collopy, M.W. 1983. A comparison of direct observations and collections of prey remains in determining the diet of Golden Eagles. *J. Wildl. Manage.* 47:360-368.

Collopy, M.W. 1983. Foraging behavior and success of Golden Eagles. *Auk* 100:747-749.

Collopy, M.W. 1986. Food consumption and growth energetics of nestling Golden Eagles. *Wilson Bull.* 98:445-458.

Collopy, M.W., and T.C. Edwards Jr. 1989. Territory size, activity budget, and role of undulating flight in nesting Golden Eagles. *J. Field Ornithol.* 60:43-51.

DeSmet, K.D. 1987. Status report on the Golden Eagle *Aquila chrysaetos.* Committee on the status of engangered wildlife in Canada, Ottawa, ON, Status assigned in 1982, reviewed in 1995. Unpubl. Rep.

Dixon, J.B. 1937. The Golden Eagle in San Diego County, California *The Condor.* 39(2)49-56.

Edwards, T.C., Jr., M.W. Collopy, K. Steenhof, and M.N. Kochert. 1988. Sex ratios of fledgling Golden Eagles. *Auk* 105:793-796.

Edwards, T.C., Jr., and M. N. Kochert. 1986. Use of body weight and length of footpad as predictors of sex in Golden Eagles. *J. Field Ornithol.* 57:317-319.

Harlow, D.L. and P.H. Bloom. 1989. Buteos and the Golden Eagle. *In* Western Raptor Management Symposium and Workshop. 102-110 pp.

Harmata, A.R. 1993. Heavy metal and pesticide contamination of Bald and Golden Eagles in the western United States. Unpubl. USEPA, December 1993. 43 pp.

Hinds, K.O. and H. de la Cueva. 1999. Habitat and competitive abilities of the Golden Eagle (*Aquila chrysaetos*), in Sierra San Pedro Martir, Baja California. *In* Raptor Research Foundation Annual Meeting, November 3-7. La Paz, Baja California Sur, Mexico. 20 pp.

Hoechlin, D.R. 1974. Behavioral ecology of nesting Golden Eagles (*Aquila chrysaetos*) in San Diego County. M.S. Thesis, San Diego State University, San Diego, California 113 pp.

Hunsicker, G.R. 1972. Nesting Behavior of the Golden Eagle, *Aeuila chrysaetos*, in San Diego County, California. M.S. Thesis, University of California Riverside 65 pp.

Kirk, D.A. 1996. Updated status report on the Golden Eagle *Aeuila chrysaetos.* Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario, Canada, Status assigned in 1996.

Kochert, M. N. 1980. Golden Eagle reproduction and population changes in relation to jackrabbit cycles: Implications to eagle electrocutions. pp. 71-86. *In* R. P. Howard and J. F. Gore [eds.], A workshop on raptors and energy developments. U.S. Fish and Wildlife Service and the Idaho Chapter of the Wildlife Society, Boise, ID. (RRTAC Reprint #2)

Kochert, M.N. and K. Steenhof. 1999. Golden Eagles in the U.S. and Canada; status, trends conservation challenges. Raptor Res. Rep. 11:1-19. (In Review: Raptor Research Report No. 11. Proceedings of the Golden Eagle Symposium – La Paz, Mexico, 2 Nov. 99).

Kochert, M.N., K. Steenhof, L.B. Carpenter, and J.M. Marzluff. 1999. Effects of fire on Golden Eagle territory occupancy and reproductive success. *J. Wildl. Manage.* 63:773-780.

Kochert, M.N., K. Steenhof, C.L. McIntyre, and E.H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). *In* The Birds of North America, No. 684 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C.

Lederle, P.E., J.M. Mueller, and E.A. Holt. 2000. Raptor surveys in south central Nevada, 1991-95. *J. Raptor Res.* 34(2): 133-136.

Lincer, J.L. (Consulting Editor). 1989. Raptor Habitat Management Under the U.S. Bureau of Land Management Multiple-Use Mandate by R.R. Olendorff *et al.* Raptor Research Report No. 8, Raptor Research Foundation, Inc. Allen Press. 80 pp.

Lincer, J.L. and J.D. Bittner. 2002. Use of Raptors to Monitor HCPs. Poster presented at the AOU/Raptor Research Foundation, New Orleans, September 24-28.

Lincer, J.L., J.D. Bittner, N. Muscolino, and, L. Swartz. 2003. A Raptor Protocol for Monitoring HCPs. Paper presented at the Raptor Research Foundation's Annual Scientific Conference. September 2-7. Anchorage, AK.

Lockhart, J.M. and M.N. Kochert. 1978. Effects of visual markers and telemetry devices on the nesting success of Golden Eagles. Draft manuscript. 14 pp.

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

Marzluff, J.M., M.S. Vekasy, M.N. Kochert, and K. Steenhof. 1997. Productivity of Golden Eagles wearing backpack radiotransmitters. *J. Raptor Res.* 31:223-227.

Mosher, J.A. and C.M. White. 1976. Directional exposure of Golden Eagles nests. *Can. Field-Nat.* 90:356-359.

Murphy, J.R. 1977. Eagles and livestock-Some management considerations. pp. 307-314. *In* World Conference on Birds of Prey. Vienna, 1-3 October, 1975. Report of proceedings, (R.D. Chancellor, ed.) International Council for Bird Preservation, London.

Ogden (Ogden Environmental and Energy Services Co.). 1992. Otay Ranch Raptor Management Study. Submitted to Otay Ranch Project Team, Chula Vista, California.

Olendorff, R.R. 1975. Golden Eagle county, 1st ed. Alfred A. Knopf, Inc., New York.

Opdycke, J.D. 1993. Potential impacts to Golden Eagles on Iron Mountain, Ramona, San Diego County, California. Fish and Wildlife Service, Ecological Services. Unpubl. Rep. 3 pp.

Phillips, R.L., J.L. Cummings, and J.D. Berry. 1991. Responses of breeding Golden Eagles to relocation. *Wildl. Soc. Bull.* 19:430-434.

Remsen, J. V. 1978. *Bird species of special concern in California: an annotated list of declining or vulnerable bird species*. Nongame Wildlife Investigations, Wildlife Management Branch, California Department of Fish & Game. Administrative Report No. 78-1.

Remsen, V. 1980. *Bird Species of Special Concern in California.* California Department of Fish and Game, Sacramento, California, 54 pp.

Schlorff, R.W. 1986. Nongame Wildlife Investigations, Golden Eagle status review. Job Final Report. State of California, The Resource Agency, Department of Fish and Game. W-65-R-2:11.

Schueck, L.S., J.M. Marzluff, M. Vekasy, M.R. Fuller, T.J. Zarriello, and W.S. Seegar. 1995. Abstract: Migration routes and winter ranges of Golden Eagles. *J. Raptor Res.* 29:72-73.

Scott, T.A. 1982. Human impacts on the Golden Eagle population of San Diego County from 1928 to 1981. M.S. Thesis, San Diego State University, San Diego, California 101 pp.

Small, A. 1976. Development of Golden Eaglets in southern California. Western Birds. 7:137-152.

Snow, C. 1973. Habitat management series of unique or endangered species. Report No. 7. Bureau of Land Management, Denver, Colorado. 52 pp.

Spofford, W.R. 1969. Brief reports: The status of eagles. Problems of the Golden Eagles in North America. pp. 345-347. *In* Peregrine Falcon populations: their biology and decline, (J.J. Hickey, ed.). University of Wisconsin Press, Madison.

Steenhof, K., M.N. Kochert, and J.H. Doremus. 1983. Nesting of subadult Golden Eagles in southwestern Idaho. *Auk* 100:743-747.

Steenhof, K., M.N. Kochert, and T.L. McDonald. 1997. Interactive effects of prey and weather on Golden Eagle reproduction. *J. Anim. Ecol.* 66:350-362.

Thelander, C.G. 1974. Nesting territory utilization by Golden Eagles (*Aquila chrysaetos*) in interior Central Coast Ranges of California. Jones & Stokes Associates, Inc., Sacramento, CA.

Thelander, C.G. 1974. Nesting territory utilization by golden eagles in California during 1974. California Department of Fish and Game, Wildl. Manage. Branch, Admin. Report No. 74-7. 19pp.

Watson, J. 1997. The Golden Eagle. T & AD Poyser. London. 374 pp.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report – NCCP/MSCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report for NCCP/MSCP Raptor Monitoring Project (2001-2003); Golden Eagles of the San Diego MSCP Area. Prepared for California Department of Fish and Game. 31 March.

Northern Harrier

California. Department of Fish and Game. 1982. Northern Harrier *Circus cyaneus.* California's Wildlife. 2:124 p.

California. Department of Fish and Game. 1987. Job Final Report. Nongame Wildlife Investigations, Northern Harrier Breeding Survey, Job No. II-18. 6pp.

California Department of Fish and Game. 1990. California statewide wildlife habitat relationships system. Volume II: Birds, D. Zeiner, W. Laudenslayer, K. Mayer, and M. White (eds.). The Resource Agency, Sacramento. 731 pp.

Collopy, M.W. and K.L. Bildstein. 1987. Foraging behavior of Northern Harriers wintering in southeastern salt and freshwater marshes. *Auk.* 104:11-16.

Estep, J.A. 1986. Nongame Wildlife Investigations, Marsh hawk status survey. Job Progress Report. State of California, The Resource Agency, Department of Fish and Game. W-65-R-3:5.

Larsen, C.J. 1987. Nongame Wildlife Investigations, Northern Harrier breeding survey. Job Final Report. State of California, The Resource Agency, Department of Fish and Game. W-65-R-4:6.

Lederle, P.E., J.M. Mueller, and E.A. Holt. 2000. Raptor surveys in southcentral Nevada, 1991-95. *J. Raptor Res.* 34(2):133-136.

Lehman, R.N., L.B. Carpenter, K. Steenhof, and M.N. Kochert. 1991. Assessing relative abundance and reproductive success of shrubsteppe raptors. *J. Field Ornithol.* 69(2) 244-256.

Lincer, J.L. (Consulting Editor). 1989. Raptor Habitat Management Under the U.S. Bureau of Land Management Multiple-Use Mandate by R.R. Olendorff *et al.* Raptor Research Report No. 8, Raptor Research Foundation, Inc. Allen Press. 80 pp.

Macwhirter, R.B. and K.L. Bildstein. 1996. Northern Harrier *Circus cyaneus. In* The Birds of North America, No. 210 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C.

Martin, J.W. 1987. Behavior and habitat use of breeding Northern Harriers in southwestern Idaho. *J. Raptor Res.* 21(2):57-66.

Nesbitt, S.A. 1985. Northern Harriers. *Eyas* 8(2) 28-29.

Ogden (Ogden Environmental and Energy Services Co.). 1992. Otay Ranch Raptor Management Study. Submitted to Otay Ranch Project Team, Chula Vista, California.

Preston, C.R. 1990. Distribution of raptor foraging in relation to prey biomass and habitat structure. *Condor.* 92:107-122.

Remsen, Jr., J.V. 1978. Bird Species of Special Concern in California. California Department of Fish and Game, Wildlife Mgmt. Branch, Admin. Report No. 78-1. 54 pp.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report – NCCP/MSCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

Peregrine Falcon

Anderson, D.W. and J.J. Hickey. 1972. Eggshell changes in certain North American birds. Proc. Int. Ornithol. Congr. 15:514-540.

Banks, R.C. 1969. Peregrine Falcon in Baja California and the Gulf of California, Peregrine Falcon populations: their biology and decline, (J. J. Hickey, ed.). University of Wisconsin Press, Madison. 81-91 pp.

Cade, T.J., J.L. Lincer, C.M. White, D.G. Roseneau and L.G. Swartz. 1971. DDE residues and eggshell changes in Alaskan falcons and hawks. *Science*, 172:955-957.

Cade, T, J. Enderson, C. Thelander, and C. White (Eds.). 1987. Peregrine Falcon Populations: Their Management and Recovery. Published by the Peregrine Fund, Inc.

California. Department of Fish and Game. 1980. American Peregrine Falcon *Falco peregrinus anatum. At the crossroads*. 91-92 pp.

California. Department of Fish and Game. 1982. Peregrine Falcon *Falco peregrinus.* California's Wildlife. 2:148 p.

Dawson, W.L. 1923. The Peregrine Falcon (*Falco peregrinus anatum*). Agency Review Draft. 24 pp.

Fuller, M.R., W.S. Seegar, and L.S. Schueck. 1998. Routes and travel rates of migrating Peregrine Falcons *Falco peregrinus* and Swainson's Hawks *Buteo swainsoni* in the western hemisphere. Journal of Avian Biology 29:433-440. (Proceedings: "Optimal Migration", Lund University, Lund, Sweden, November 5-8, 1997).

Fyfe, R., R.W. Risebrough, J.G. Monk, W.M. Jarman, D.W. Anderson, L.F. Kiff, J.L. Lincer, I.C.T. Nisbet, W. Walker II, and B.J. Walton. 1987. DDE, Productivity and Eggshell Thickness Relationships Within the Genus Falco. Chapter 33 *In* Peregrine Falcon Populations: Their Management and Recovery. Edited by T. Cade, J. Enderson, C. Thelander, C. White. Published by the Peregrine Fund, Inc.

Hays, L. and S. Grandberry. 1998. The Peregrine Falcon is back: babbit announces proposal to remove world's fastest bird from endangered species list. U.S. Fish and Wildlife Service, Carlsbad, California.

Hickey, J. J. (ed.). 1969. Peregrine Falcon populations: their biology and decline, University of Wisconsin Press, Madison.

Jurek, R.M. 1989. Five year status report-American Peregrine Falcon. State of California, The Resource Agency, Department of Fish and Game. 1-15 pp.

Lincer, J.L. 1975. The effects of dietary DDE on eggshell-thinning in the American kestrel: A comparison of the field situation and laboratory results. *J. Applied Ecol.*, 12(3): 781-793.

Lincer, J.L. (Consulting Editor). 1989. Raptor Habitat Management Under the U.S. Bureau of Land Management Multiple-Use Mandate by R.R. Olendorff *et al.* Raptor Research Report No. 8, Raptor Research Foundation, Inc. Allen Press. 80 pp.

McWilliams, S.R., J.P. Dunn, and D.G. Raveling. 1994. Predator-prey interactions between eagles and cackling Canada and Ross' geese during winter in California. *Wilson Bull.* 106:272-288.

Porter, R.D., A.M. Jenkins, M.N. Kirven, D.W. Anderson, and J.O. Keith. 1988. Status and reproductive performance of marine peregrines in Baja California and the Gulf of California, Mexico. *In* Peregrine Falcon populations: Their management and recovery, (T. J. Cade, J. H. Enderson, C. G. Thelander, and C. M. White, eds.). The Peregrine Fund, Inc., Boise, ID. 105-114 pp.

Smith, B. 1989. Plan for Bald Eagles sought at Cachuma. Santa Barbara News Press (Santa Barbara, CA) (March 6): A1, A5.

Steinhot, P. 1990. American Peregrine Falcon *Falco peregrinus anatum.* California Wildl. Heritage. Threatened and endangered animals in the golden state. Department of Fish and Game. 27-28.

Thelander, C.G. 1975. Distribution and reproductive success of Peregrine Falcons (*Falco peregrinus anatum*) in California-1975. State of Calif. Resour. Agency. Dept. Fish and Game. Wildl. Manag. Branch. Admin. Rep. No. 75-6. 12 pp.

Thelander, C.G. 1976. Distribution and reproductive success of Peregrine Falcons (*Falco peregrinus anatum*) in California during 1975 and 1976. State of Calif. Resour. Agency. Dept. Fish and Game. Wildl. Manag. Branch. Admin. Rep. No. 76-3. 13 pp.

Thelander, C.G. 1977. The breeding status of Peregrine Falcons in California. MA Thesis, San Jose State Univ., San Jose, California 112 pp.

Walton, B.J. 1981. Peregrine Falcon management in California - update for 1981. Unpubl. rep., Santa Cruz Predatory Bird Res. Group, Univ. of California, Santa Cruz. 58 pp.

Watson, J.F. 1981. Ecological characterization of the central and northern California coastal region. Volume II, Part 2. Species. Unpub. rep. FWS/OBS/46.2, October 1981. Prepared by Jones & Stokes Assoc., Inc., Sacramento, California. (Pages II-151 and II-152 only)

Wendt, A., G. Septon, and J. Moline. 1991. Juvenile urban-hacked Peregrine Falcons (*Falco peregrinus). J. Raptor Res.* 25:94-95.

Wootton, J.T., and D.A. Bell. 1992. A metapopulation model of the Peregrine Falcon in California: viability and management strategies. *Ecol. Appl.* 2(3):307-321.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report – NCCP/MSCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

Swainson's Hawk

Bloom, P.H. 1980. The status of the Swainson's Hawk in California. State of California, The Resource Agency, Department of Fish and Game. Bureau of Land Management, and Federal Aid in Wildlife Restoration, Project W-54-R-12. 42 pp.

California Department of Fish and Game. 1982. Swainson's Hawks *Buteo swainsoni.* California's Wildlife. 2:134 p.

California Department of Fish and Game 1988. Five year status report Swainson's Hawks *Buteo swainsoni*. Nongame Bird and Mammal Section, Wildlife Management Division, 1-9 pp.

California Department of Fish and Game. 1990. Mitigation criteria for Swainson's Hawks, Region 2, State of California. 2 pp.

California Department of Fish and Game. 1990. Mitigation guidelines for Swainson's Hawks *Buteo swainsoni* in the Central Valley of California. Region 2, State of California. 1-12 pp.

Cox, J.D. 1997. Surprised researchers find California hawks don't join in migration to Argentina. The San Diego Union-Tribune. Scripps-McClatchy Western Service.

Estep, J.A. 1989. Biology, movements, and habitat relationships of the Swainson's Hawk in the Central Valley of California, 1986-87. Wildlife Management Division, Nongame Bird and Mammal Section, State of California, The Resource Agency, Department of Fish and Game. 51 pp.

England, A.S., M.J. Bechard, and C. S. Houston. 1997. Swainson's Hawks *Buteo swainsoni. In* The Birds of North America, No. 265 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C. 27 pp.

England, A.S., J.A. Estep, and W.R. Holt. 1995. Nest-site selection and reproductive performance of urban-nesting Swainson's Hawks in the Central Valley of California. *J. Raptor Res.* 29:179-186.

Fuller, M.R., W.S. Seegar, and L.S. Schueck. 1998. Routes and travel rates of migrating Peregrine Falcons *Falco peregrinus* and Swainson's Hawks *Buteo swainsoni* in the western hemisphere. Journal of Avian Biology 29:433-440. (Proceedings: "Optimal Migration", Lund University, Lund, Sweden, November 5-8, 1997).

Goldstein, D.L., and N.G. Smith. 1991. Short communications. *J. Raptor Res.* 25(3):87-88.

Hall, R.S. No date. Preliminary status report and notes on the breeding biology of the Swainson's Hawk in Northwest Arizona. *In* Press. 1-6 pp.

Lincer, J.L. (Consulting Editor). 1989. Raptor Habitat Management Under the U.S. Bureau of Land Management Multiple-Use Mandate by R.R. Olendorff *et al.* Raptor Research Report No. 8, Raptor Research Foundation, Inc. Allen Press. 80 pp.

Risebrough, R.W., R.W. Schlorff, P.H. Bloom, and E.E. Littrell. 1989. Investigations of the decline of Swainson's Hawk populations in California. *J. Raptor Res.* 23(3):63-71.

Schlorff, R.W. 1985. Diurnal raptor population monitoring program. Nongame Wildlife Program, State of California, Department of Fish and Game. W-65-R-2:24 pp.

Schlorff, R.W. and P.H. Bloom. 1980. Importance of Riparian systems to nesting Swainson's Hawks in the Central Valley of California. Nongame Wildlife Program, State of California, Department of Fish and Game. 13 pp.

Sharp,B. 1986. Management guidelines for the Swainson's Hawk. Region 1. U.S. Fish and Wildlife Service, Portland, Oregon. 1-28 pp.

Sharp, C.S. 1902. Nesting of Swainson Hawk. *Condor* 4:116-118.

Woodbridge, B. 1991. Habitat selection by nesting Swainson's Hawks: a hierarchical approach. M.S. Thesis. Oregon State University. 80 pp.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report – NCCP/MSCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

General and Raptor Management Literature

Anderson, D.E., G.J. Hongstad, and W.R. Myiton. 1985. Line transect analysis of raptor abundance along roads. *Wildl. Soc. Bull.* 13:533-539.

Avian Power Line Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute. Washington, D.C. 78pp.

Avian Power Line Interaction Committee (APLIC). 1996 Suggested Practices for Raptor protection on power Lines: State of the Art in 1996. Edison Electric Institute/Raptor Research Foundation. Washington, D.C.

Barrows, C.W. 1989. Diets of five species of desert owls. *Western Birds.* 20:1-10.

Bloom, P.H. 1985. Raptor movements in California. *In* M. Harwood [Ed.,], Proceedings of Hawk Migration Association of North America, North Wales, PA U.S.A. 313-324 pp.

Buckland, K.P., D.R. Anderson and J.L. Laake. 1981. Line transect estimation of bird population density using a Fourier series. *Stud. Avian Biol.* 6:466-482.

Buckland, S.T. 1987. On the variable circular plot method of estimating animal density. *Biometrics* 43:363-384.

Buckland, S.T., D.R. Anderson, K.P. Burnham, and J.L. Laake. 1993. Distance sampling: estimating abundance of biological populations. Chapman and Hall, London, U.K.

Clark, W.S. and B.K. Wheeler. 1987. A Field Guide to Hawks North America. Houghton Mifflin Company. Boston.

Everett, W.T. 1979. Threatened, declining and sensitive bird species in San Diego County. *Sketches* June.

Fuller, M.R. and J.A. Mosher. 1981. Methods of detecting and counting raptors: a review. *Stud. Avian Biol.* 6:235-246.

Gould, W. R., and M. R. Fuller. 1995. Survival and population size estimation in raptor studies: A comparison of two methods. *J. Raptor Res.* 29:256-264.

Iverson, G.C. and M.R. Fuller 1992. Area-occupied survey technique for nesting woodland raptors. Proceedings of the Midwest Raptor Management Symposium and Workshop. Woodland Rapt. Surv. Institute for Wildlife Research. National Wildlife Federation Scientific and Technical Series No. 15:1-7.

Kochert, M. N., K. Steenhof, and M. Q. Moritsch. 1983. Evaluation of patagial markers for raptors and ravens. *Wildl. Soc. Bull.* 11:271-281.

Johnsgard, P.A. 1990. Hawks, eagles & falcons of North America: biology and natural history. Smithsonian Institution Press, Washington , D.C.

Lehman, R. N., L. B. Carpenter, K. Steenhof, and M. N. Kochert. 1998. Assessing relative abundance and reproductive success of shrubsteppe raptors. *J. Field Ornithol.* 69:244-256.

Lincer, J.L. 1982. "Protecting Endangered Species at the Local Governmental Level." Paper presented at the 46th Annual Meeting of the Florida Academy of Sciences, April 22-24, DeLand, FL. *Florida Scientist*, 45(1): 40.

Lincer, J.L. 1983. "But Release Them to Where?" Raptor Research & Rehabilitation Program Newsletter, 4-(Winter). 1982-83:6-8.

Lincer, J.L. 1984. The Priority of Proper Habitat Management. The EYAS (a newsletter of the National Wildlife Federation's Raptor Information Center), Vol. 7.

Lincer, J.L. (Consulting Editor). 1989. Raptor Habitat Management Under the U.S. Bureau of Land Management Multiple-Use Mandate by R.R. Olendorff *et al.* Raptor Research Report No. 8, Raptor Research Foundation, Inc. Allen Press. 80 pp.

McDermott, F. 1999. Pacific continental flyway. *HMANA Hawk Migration Stud.* 25:24-32.

Mosher, J. A., and M. R. Fuller. 1996. Surveying woodland hawks with broadcasts of great horned owl vocalizations. *Wildl. Soc. Bull.* 24:531-536.

Myers, R.I.G. Morrison, P.Z. Antas, B.A. Harrington, T.E. Lovejoy, M. Sallaberry, S.E. Senner, and A. Tarrak. 1987. Conservation strategy for migratory species. *Am. Sci.* 75:18.

National Wildlife Federation. 1989. Proceedings of the western raptor management symposium and workshop. National Wildlife Federation, Washington, D.C., 320 pp.

Newton, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, SD USA.

Ogden (Ogden Environmental and Energy Services Co.). 1992. Otay Ranch Raptor Management Study. Submitted to Otay Ranch Project Team, Chula Vista, California.

Olendorff, R.R., A.D. Miller, and R. N. Lehman. 1981. Suggested practices for raptor protection on power lines--the state-of-the-art in 1981. Raptor Res. Rep. No. 4. Raptor Research Foundation, Inc. St. Paul Minn. 111pp.

Reynolds, R.T., J.M. Scott, and R.A. Nussbaum. 1990. A variable circular-plot method for estimating bird numbers. *Condor* 82:309-313.

Schueck, L. S., M. R. Fuller, and W. S. Seegar. 1989. Falcons. pp. 71-80. *In* B. G. Pendleton, M. N. LeFranc Jr., M. B. Moss, C. E. Ruibal, M. A. Knighton, and D. L. Krahe [eds.], Proceedings of the northeast raptor management symposium and workshop. National Wildlife Ferderation, Washington, DC. May 16-16, 1988, Syracuse, N.Y. (Scientific and Technical Series; no.13)

Steenhof, K., and M.N. Kochert. 1982. An evaluation of methods used to estimate raptor nesting success. *J. Wildl. Manage.* 46:885-893.

Steenhof, K., and M.N. Kochert. 1985. Dietary shifts of sympatric buteos during a prey decline. *Oecologia* 66:6-16.

Steenhof, K., and M.N. Kochert. 1988. Dietary responses of three raptor species to changing prey densities in a natural environment. *J. Anim. Ecol.* 57:37-48.

Steenhof, K., M.N. Kochert, and J.A. Roppe. 1993. Nesting by raptors and common ravens on electrical transmission line towers. *J. Wildl. Manage.* 57:271-281.

Sutherland, W.J. 1996. Ecological census techniques. A handbook. Cambridge Univ. Press, Cambridge, U.K.

Tate, J., Jr. and D.J. Tate. 1982. The Blue List for 1982. *Am. Birds* 36:126-135.

Tate, J. 1986. The Blue List for 1986. *Am. Birds* 40:227-236.

Williams, R. D. and E.W. Colson. 1989. Raptor associations with linear rights-of-way. Pages 173-192 *in* B. G. Pendleton, ed. Proc. Western Raptor Management Symp. Natl. wildl. Fed. Scientific and Tech. Series No. 12. Washington, D.C.

Thiollay, J.-M. 1976. Les decomptes de rapaces le long des routes: essai de standardization. *Passer* 13:69-76.

Unitt, P. 1984. The Birds of San Diego County. San Diego Society of Natural History, Memoir 13. Luster Industries.

U.S. Department of the Interior. 1996. Effects of military training and fire in the Snake River Birds of Prey National Conservation Area. U.S. Geol. Survey, Biol. Res. Div., Snake River Field Station, Boise, ID, BLM/IDARNG Research Project Final Report.

WRI (Wildlife Research Institute, Inc.). 2002. Year 1 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2001). Prepared for California Department of Fish and Game. 30 July.

WRI (Wildlife Research Institute, Inc.). 2004. Year 2 Report for NCCP Raptor Monitoring Project (January 1 – December 31, 2002). Prepared for California Department of Fish and Game. 19 March.

WRI (Wildlife Research Institute, Inc.). 2005. Final Report for NCCP Raptor Monitoring Project (2001-2003). Prepared for California Department of Fish and Game. 31 March.

APPENDIX B

BREEDING SEASON RAPTOR NESTS AND TERRITORIES BY SITE (2001-2003)

The following pages reflect raptor breeding territories which were typical of the below study sites for the period 2001-2003. To facilitate the reader's access to the following topographic maps, they are listed below alphabetically and by site number.

Number	Name	Name	Number
1	Crestridge	Boden Canyon	2
2	Boden Canyon	Border Fields	44
3	Jamul Ranch	Brown Field Complex	22
4	SDNWR*/Salt Works/Egger Ghio	Crestridge	1
5	McGinty Mountain Complex	Grasslands/Route 67	30
6	San Diego Bay NWR (winter only)	Hollenbeck Canyon	34
7	Lake Hodges	Immenschuh	39
8	Penasquitos Lagoon	Iron Mountain	11
9	Torrey Pines	Jamul Ranch	3
10	Sycamore Canyon	Lake Hodges	7
11	Iron Mountain	Los Montanas (North)	40
12	Otay Mountain	Los Montanas (South)	41
13	Marron Valley	Marron Valley	13
14	Otay Lakes	McGinty Mountain Complex	5
15	SDNWR* Sweetwater Marsh	Miramar Reservoir	20
16	San Vicente	Mission Bay	21
17	Sycuan Peak	Mission Trails	24
18	Point Loma	North Island	19
19	North Island	Otay Lakes	14
20	Miramar Reservoir	Otay Mountain	12
21	Mission Bay	Penasquitos Canyon	33
22	Brown Field Complex	Penasquitos Lagoon	8
23	SDNWR*/San Miguel Mountain	Point Loma	18
24	Mission Trails	Proctor Valley	25
25	Proctor Valley	Rancho San Diego (East)	42
26	San Diego River	Rancho San Diego (West)	43
27	Route 67 South	Rock Mountain	35
28	San Dieguito Lagoon	Rockwood Canyon	32
29	Route S-6 (deleted/safety issue)	Route 67 South	27
30	Grasslands/Route 67	Route 94 (North and South)	38
31	Sloan Canyon	Route S-6 (deleted/safety issue)	29
32	Rockwood Canyon	San Diego Bay NWR (winter only)	6
33	Penasquitos Canyon	San Diego River	26
34	Hollenbeck Canyon	San Dieguito Lagoon	28
35	Rock Mountain	San Pasqual	36
36	San Pasqual	San Vicente	16
37	SDNWR*Tijuana Slough	SDNWR* Sweetwater Marsh	15
38	Route 94 (North and South)	SDNWR*/Salt Works/Egger Ghio	4
39	Immenschuh	SDNWR*/San Miguel Mountain	23
40	Los Montanas (North)	SDNWR*Tijuana Slough	37
41	Los Montanas (South)	Sloan Canyon	31
42	Rancho San Diego (East)	Sweetwater Reservoir	45
43	Rancho San Diego (West)	Sycamore Canyon	10
44	Border Fields	Sycuan Peak	17
45	Sweetwater Reservoir	Torrey Pines	9

*San Diego National Wildlife Refuge

LEGEND

Symbols

Center of raptor/corvid territory or assumed or documented nest site.

Note: Above symbol without an acronym following it indicates that a stick nest was documented but species was not determinable. If species was known for the nest or territory, the above symbol is followed by the appropriate acronym (see below).

Acronyms for Raptor and Corvid Species

AC	American crow
AK	American kestrel
BE*	**BALD EAGLE**
BH	Black hawk
BR	Barn owl
BO*	**BURROWING OWL**
CH*	**COOPER'S HAWK**
CR	Common raven
FH*	**FERRUGINOUS HAWK**
GE*	**GOLDEN EAGLE**
GO	Great-horned owl
HH	Harris' hawk
LO	Long-eared owl
MR	Merlin
NH*	**NORTHERN HARRIER**
OS	Osprey
PF*	**PEREGRINE FALCON**
PR	Prairie falcon
RS	Red-shouldered hawk
RT	Red-tailed hawk
SE	Short-eared owl
SO	Screech owl
SS	Sharp-shinned hawk
SH*	**SWAINSON'S HAWK**
TV	Turkey vulture
UA	Unidentifiable accipiter
UB	Unidentifiable buteo
UF	Unidentifiable falcon
UR	Unidentifiable raptor
WK	White-tailed kite
WH	White-tailed hawk
ZH	Zone-tailed hawk

* MSCP target species.

APPENDIX C

LONG -TERM RAPTOR MONITORING PROTOCOL

BACKGROUND

The Multiple Species Conservation Program (MSCP) is a comprehensive, long-term habitat conservation plan that addresses the needs of multiple species and the preservation of natural vegetation in San Diego County (County of San Diego 1997). The size and configuration of the preserve network is continually evolving but it may ultimately encompass approximately 172,000 acres. In order to determine if the MSCP or any management area, for that matter, is functioning correctly, a meaningful monitoring plan must be in place. A vast area, such as the MSCP, cannot be comprehensively monitored for any but a few species with very limited and specific habitat requirements. Raptor species will, therefore, be monitored using a reproducible sampling approach. Details of this approach are described below after reminding the reader of the ultimate monitoring objectives.

OBJECTIVES

The overall goal of the MSCP monitoring is to detect changes in habitat quality and population trends in those habitats and species covered by the MSCP (Ogden 1996). Specific objectives, as they relate to raptors, are as follows:

1. Document the protection of target species as specified in subarea plans and implementing agreements.
2. Document changes in preserved populations of covered species.
3. Describe new biological data collected.
4. Evaluate impacts of land uses and construction activities in and adjacent to the preserve.
5. Evaluate management activities and identify enforcement difficulties.

The purpose of this document is to provide guidance for consistency in the approach to surveying for raptors *during the breeding season and during the wintering period.* The below protocol is generic in nature but site-specific details, as to route, viewshed locations, and other important site features, are provided for each Raptor Monitoring Area (RMA) in Appendix C-1.

APPROACH

The following provides methodological details for the professional, with adequate raptor expertise, to conduct the breeding season and wintering period raptor monitoring in a consistent manner. The ability to detect trends (e.g., in raptor numbers, distribution, diversity, etc.) will be extremely important in order that adaptive management decisions be made in a timely manner. If trend analyses are to be interpretable, it is essential that the same locations within the preserve be monitored in a consistent manner. This would best be accomplished if the same individual or team monitored all locations, for all surveys.

ACRONYMS AND DEFINITIONS

Acronyms and definitions are attached (Appendix C-2). Use them consistently in order that there be continuity and clarity in all observations and record keeping.

SPECIES

Although all raptor species will be noted, there are eight MSCP, so-called "target," raptor species: Bald Eagle (BE), Burrowing Owl (BO), Cooper's Hawk (CH), Ferruginous Hawk (FH), Golden Eagle (GE), Northern Harrier (NH), American Peregrine Falcon (PF), and the Swainson's Hawk (SH). Although you will not, necessarily, be searching for the BO at the most desirable time of day (early morning/early evening), any observations of BO or any other raptor species should be documented. Raptors will be the focus of the surveys but any observed sensitive species (regardless of taxa), interesting road kill, unusual biological observation, breeding colony, bird roost site, or other unique resource should also be noted on the WRI "Field Datasheet" (Appendix C-3).

TIMING AND FREQUENCY OF SURVEYS

Although it is common for ornithologists to identify a specific time of year as the "breeding season," it is not possible to specify a timeframe, for our local raptors, that does not overlap with what is considered the wintering period. Because of the latitude of the MSCP, raptors are not restricted to a brief portion of the spring within which to breed. Many of our local raptors start breeding while other wintering and migrating raptors are still in the MSCP study area and environs. Therefore, the time of year that we call the "breeding season" could span December through August but varies considerably by species. Some GEs, for instance, can start nest building as early as December and still have nestlings in that nest as late as June. BOs, on the other hand, can start laying eggs in early April but fledge some young as late as August.

EQUIPMENT/SUPPLIES

Field vehicles should have 4WD capability if terrain requires. Binoculars, a camera, and a spotting scope of sufficient power for raptor observations are required. A magnification of 10X for binoculars and a range of approximately 20-60X for scopes are recommended. A cell phone may be very helpful in some locations, as could a set of "walkie-talkies" if more than one investigator will be in the field at the same time. Bring these survey guidelines, a copy of any authorization letters from resource agencies, any windshield placards (that indicates that you are under contract to conduct these surveys), local and project-generated site maps, and an adequate supply of "Transect Data Sheets" (Appendix C-3). To this, add your standard field equipment and supplies (field guides, hat, water, snacks, etc.). Although observers should be thoroughly familiar with all the local raptors, field guides that should be helpful include the Peterson guide, *Hawks* (Clark and Wheeler 1987) and the accompanying photographic guide (Wheeler and Clark 1999).

WEATHER

Monitoring should be conducted only during certain desirable weather conditions to maximize chances of documenting raptors. Inclement weather (rain, fog, winds greater than 20 mph, etc.) should be avoided. Occasional drizzle and winds up to 20 mph will not normally affect most raptor behavior. Observation in cold or wet weather should be done very carefully or completely discouraged. If an incubating bird is accidentally flushed during surveys, total nest failure could result for that season.

TIME OF DAY

The time of day, during which observations are made, is more important during the breeding season surveys than for the winter surveys (for most raptor species). Monitoring should take place from dawn through 1200, although professional experience may allow for some flexibility. Although BOs are not, necessarily, most active during this timeframe, you may note them and they should be documented as indicated below, as you would any raptor species. Since this is a crepuscular species, however, schedule sites that may support BOs for the early morning and/or early evening, whenever possible, to maximize chances of seeing this crepuscular species.

TWO TYPES OF OBSERVATIONS

Observations will be made two ways: (1) in vehicles, along established routes, and (2) at designated viewshed (i.e., observation) points. In addition, all reliable reports provided by interested individuals and cooperators will be verified and included in the data set but noted as "personal communications" with the appropriate documentation.

Vehicular Transects

Many of the breeding season raptor observations, and all those for the winter period, will be conducted from a vehicle. Therefore, vehicle speed will be an important variable. Speed will vary between road transects, depending on the road conditions, including traffic, and weather. That speed, however, should be consistent (year-to-year) for a particular transect in order that meaningful data comparisons can be made over time. Speed on a busy highway will have to be adequate to safely keep up with traffic. Some highway transects, that were deemed too dangerous, were removed from consideration. On a backcountry road, however, 10 mph may be the right speed. Safety should be the highest priority, and for that reason, an assistant to the driver is recommended to make observations and take notes, especially on busy roads.

Point/View shed Observations

Observation points have been established along some vehicle routes and at other desirable view shed locations for breeding season monitoring (see Appendix C-1). These will be especially important for riparian areas and inaccessible mountainous, and other, areas, where limited vehicle access prevents a reasonable survey of a RMA. At observation points along vehicle routes, a minimum of 10 minutes of actual observation is required. This means allowing whatever time is necessary to stop the vehicle in a safe, repeatable location, get out of the vehicle, and set up equipment (spotting scope, etc.) before starting the formal ten-minute observation (i.e., watching *and* listening). In situations where the observer is driving *through* the relevant habitat, a 5-minute observation period may be adequate. At some viewshed locations (like the top of a mountain), the observation time will be longer (perhaps 30 minutes). The most important issue here is that, once a viewing time period has been established for a particular RMA, it is maintained for consistency each year.

WHAT TO NOTE

All relevant data must be documented (see Transect Data Sheet, Appendix C-3). Sightings for *all* raptors will be documented. Note specific location of the raptor species *the first time it is observed* on each day of observation. Note age, sex, and any unusual plumage (if relevant) and

describe location(s) of any band(s) (metal right or metal left and sequence and numbers of any color bands), transmitter, or patagial wing markers. Avoid duplicate counts by noting unique characteristics of an individual and, when a bird is moving, its direction and relative speed. Record courtship and nesting behavior. If a nest is observed during the "winter" surveys, note its location on the topo map, what species of tree its in, height, size of nest, composition, and whether you consider it active. Indicate the basis for assumed activity (for instance, presence of an adult or pair near the nest, young, recent whitewash or greenery in /around nest).

CONTROL NUMBERING

Each control number for a study site and day of observation will be alphanumeric. For each species observed, the control number will start with the acronym for that species (see Appendix C-2) and be followed by "01." The following control numbers, for that species, will end with 02, 03, etc., in the sequence in which the observations take place. This number is entered on the field data sheet (with all of its associated observations) and on the topo survey map, on which is always placed the survey date and the name(s) of the biologist(s). For instance, if the first observation of the day, at Mission Trails Regional Park, is a RT (Red-tailed Hawk), the control number will be "RT01." The second RT will receive the control number "RT02." If the next observation were a Cooper's Hawk, it would be "CH01." It will simplify records if each Transect Data Sheet and topo map is only used for one day's observation at each site. However, there may be situations (such as when it takes more than one day to adequately survey a site or when it may lead to duplication or confusion later) when it makes sense to enter more than one day's information on the same data sheet/map. It may also be beneficial to have all the breeding data on one map which keeps the picture in front of the observer at all times. This allows the observer to see gaps for certain species and explore areas not previously covered. The most important objective is to make sure the record is clear as to the date of each observation/set of observations and the name of the investigator so that clarification can be sought, if necessary.

Raptor, and other, nests are often less visible later in the breeding season, when deciduous trees have regained their foliage. However, note any stick nests in the area as "SN" followed by the appropriate observation number. Indicate on the data sheet if you know or suspect what species it belongs to and why. When summarizing yearly data, it will be important to determine which nests are alternate nests of the same pair and which represent additional pairs/territories. Do not get close enough to potentially disturb any nests, without approval from the Project Manager (PM) and Management Unit administrator.

Keep careful track of miles driven and times spent during vehicle transects and point location observations. Deduct any miles/time not spent on monitoring. These details are very important in order to allow data to be normalized over both time and distance to properly analyze for trends. There may be situations when you will not be able to track mileage or the miles you track are complicated by circling back through a study area to recheck a nest to confirm nesting, etc. Just keep good records that can be interpreted by someone else.

ENFORCEMENT/MANAGEMENT ISSUES

Note any enforcement or management problems or opportunities. Suggest corrective action or adaptive management, as appropriate, to the PM. Report any significant enforcement problems to the PM as soon as possible, but no later than within 24 hours of the observation.

RECORDS MANAGEMENT

Management of records is extremely important. Two-hole punched field forms and computer-generated project topo maps must be kept in Study Site folders (in a hard plastic or other secure file box provided) unless being copied. Field forms and topo maps must be attached to the inside of the Study Site folders using the two-hole clips at the end of each field day. Unless other provisions are made, field record copying should be done no less frequently than once a week, during the active field season, with copies placed in the appropriate administration project file for security.

THE SURVEYS

Breeding Season

In some management units, where a fulltime knowledgeable biologist is on staff, daily observations may be made, thereby providing greater potential for trend detection. However, the objective of these guidelines is to conduct up to 6 surveys at each of 12 RMAs (Figure C-1) for the breeding season raptor monitoring, where the assemblage of species dictates the actual number of replicates. Many stick nests will be located during the winter when the deciduous trees have lost their leaves. The next best opportunity to survey will often be early in the breeding season (December through April) when the adult raptors are establishing their territories and courting. Note that each species has a chronology for these behaviors. Some (like the GE, RT, and RS) will start breeding-related behaviors in December or January, while others (like the CH) may not display until April. At this time, they are obvious and concentrating their activities around the likely, and alternative, nest sites. In order to adequately characterize the raptor species present throughout the breeding season, the initial surveys at each site should be separated by 10-14 days, if possible. Subsequent surveys should be scheduled based on the raptor species present and where they are in their reproductive cycle. There will be a period, during which one of the adults will be incubating eggs or sheltering young, while the other adult is off hunting. During this time, it will be difficult to document many raptors and fieldwork may not be the best use of your time for that RMA. The next logical time to concentrate on conducting breeding season surveys will be when the young have fledged but are still dependent on the adults for food. At this time, there is a lot of activity and an increased chance of spotting a family unit because of the increased number of individuals per territory and, in some cases, the young will call attention to themselves by begging and/or calling to the parents.

The following times are recommended for the (breeding season) Raptor Monitoring Program:

- Late-December
- Mid-January
- Mid-February
- March
- Mid-April
- Mid-May

There are 12 RMAs that will be surveyed (Table C-1).

TABLE C-1. MSCP Raptor Monitoring Areas (Breeding Season)

Area	Name	Study Sites* (original number(s)
A	San Pasqual	San Pasqual (36), Lk. Hodges (7), Boden Cyn. (2), Rockwood (32)
B	Ramona Grasslands	Ramona Grasslands (30)
C	Penasquitos Canyon	Penasquitos Canyon (33)
D	Iron Mountain Complex	Iron Mountain** (11), San Vicente ((16), Route 67 (27)
E	San Diego River	San Diego River (26)
F	Sloan Canyon	Sloan Canyon (31), McGinty Mtn. North (5), Sycuan Mtn. North (17)
G	Sweetwater River	Sweetwater Reservoir (45), Rcho. S.D. East (42), Rcho. S.D. West (43), San Miguel Mtn. North (23)
H	Proctor Valley	Proctor Valley (25), San Miguel Mtn. South (23), Upper Otay Lk.(14)
I	Rancho Jamul	Jamul Ranch (3), Hollenbeck Canyon (34)
J	Border Fields	Border Fields (44), Tijuana River (part)
K	Brown Field Complex	Brown Field (22), Otay River, Spring Cyn. (part), Dennery Cyn. (part)
L	Otay Mountain	Otay Mountain (12), Marron Valley (13), Lower Otay Lake (14)

* In some cases, only a portion of a study site is included because of access, visibility, or some other reason (see detailed maps, Appendix C-1, for details).
** Including Monte Vista Ranch.

Each study site is followed by a number, which corresponds to the original study site number that was assigned to it (WRI 2002, 2004).

Winter Surveys

In keeping with the timing of many "winter" surveys (e.g., County Bird Atlas), the MSCP winter raptor surveys will occur primarily from *mid-December through February*, with possible changes in response to changes in weather conditions (i.e., global warming, cycles, etc.). This "winter" time period is somewhat arbitrary and we are not suggesting that raptors observed during this period are, necessarily, only birds that have migrated in and are wintering within the MSCP and environs. Similarly, the winter visit by some species may extend before and/or after this timeframe. The FH, for instance, can arrive on its MSCP wintering grounds by mid-September and not leave until mid-March. Many of the birds that you observe will be the same ones that you document during the "breeding season" surveys. The objective is to conduct three (3) vehicle-based surveys, along the coastal route depicted by Figure C-2. In order to adequately characterize the raptor species present throughout the winter season, the three surveys should be conducted according to the following schedule:

- Late December
- Mid-to-late January
- Mid-to-late February

Raptor, and other, nests are often more visible in the winter, when deciduous trees have lost their foliage. Knowledge about nest and breeding pair locations will help the monitor separate wintering birds from resident pairs. When summarizing yearly data, it will also be important to determine which nests are alternate nests of the same pair and which represent additional pairs/territories. Note any raptor nests in the area and/or if any nesting behavior is observed. Do not approach any nests, without approval from the PM and Management Unit administrator.

LITERATURE CITED

Clark, W.S. and B.K. Wheeler. 1987. Peterson Field Guides—Hawks. Houghton Mifflin Company. Boston.

County of San Diego. 1997. "Multiple Species Conservation Program", County of San Diego; Subarea Plan. Adopted by the Board of Supervisors October 22, 1997.

Ogden. 1996. "Biological Monitoring for the Multiple Species Conservation Program." Prepared for the City of San Diego, California Department of Fish and Game, and U.S. Fish and Wildlife Service. Revised April 25.

Wheeler, B.K and W.S. Clark 1999. A Photographic Guide to North American Raptors. Academic Press. San Diego.

APPENDIX C-2
ACRONYMS AND DEFINITIONS

Raptor and Corvid Species

AC	American crow
AK	American kestrel
BE*	**BALD EAGLE**
BH	Black hawk
BR	Barn owl
BO*	**BURROWING OWL**
CH*	**COOPER'S HAWK**
CR	Common raven
FH*	**FERRUGINOUS HAWK**
GE*	**GOLDEN EAGLE**
GO	Great-horned owl
HH	Harris' hawk
LO	Long-eared owl
MR	Merlin
NH*	**NORTHERN HARRIER**
OS	Osprey
PF*	**PEREGRINE FALCON**
PR	Prairie falcon
RS	Red-shouldered hawk
RT	Red-tailed hawk
SE	Short-eared owl
SO	Screech owl
SS	Sharp-shinned hawk
SH*	**SWAINSON'S HAWK**
TV	Turkey vulture
UA	Unidentifiable accipiter
UB	Unidentifiable buteo
UF	Unidentifiable falcon
UR	Unidentifiable raptor
WK	White-tailed kite
WH	White-tailed hawk
ZH	Zone-tailed hawk

* MSCP target species.

Other Abbreviations

AB	Active burrow
Ad	Adult
CDFG	California Department of Fish and Game
CN	Cavity nest
F	Female
HY	Hatching year (when a bird is in its first year; i.e., the same calendar year as hatched).
Imm	Immature (a non-specific term that means "not adult").
M	Male
Mel	Melanistic (black/dark)
Ruf	Rufous/reddish
Sa	Sub adult (plumage that precedes adult plumage and appears much like it but with some characters that are not in adult plumage; used only for species, like the Golden Eagle, that can be distinguished at this age).
SN	Stick nest.
U	Unknown (e.g., unknown species, age, or sex).
USFWS	U.S. Fish and Wildlife Service

APPENDIX C-3

TRANSECT DATA SHEET

Wildlife Research Institute, Inc.				BIOLOGIST(S):
		TIME (24hr)	Start / Finish	(minus time out) = TOTAL TIME:
		TEMP (F):		OTHER WEATHER INFO.:
DATE:	PAGE __OF __	CLOUD CVR (%):		TRANSECT MILEAGE BEGIN:
TRANSECT NAME & NUMBER:		WIND (mph):		TRANSECT MILEAGE END:
		VISIBILITY (m):		SUBTRACT MILEAGE:
	#	PRECIP:		TRANSECT TOTAL MILEAGE:

	WAYPOINTS (Start/End Points of Transects, Road Names.etc.)	SPECIES	TIME DURATION	SEX	AGE	PAIR	PERCHING	HUNTING	FEEDING	COURTSHIP	SOARING	NESTING	COMMENTS, MILEAGE, TIME, ETC
1													
2													
3													
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COMMENTS: (USE REVERSE FOR DRAWINGS OR ADDITIONAL NOTES)

Attachment C3

LEAST BELL'S VIREO

Vireo bellii pusillus

Author: Michael A. Patten, Department of Biology, University of California, Riverside, California 92521

Management Status: Federal: Endangered
California: Endangered (CDFG, 1998)

General Distribution:

The Least Bell's Vireo is a subspecies of the Bell's Vireo. The Bell's Vireo breeds in the southwestern United States and northwestern Mexico, northward through the Great Plains of the central United States to the southwestern fringe of the Great Lakes (Brown, 1993). This species winters in southern Baja California, on the Pacific slope of mainland Mexico from Sonora south through northern Nicaragua (Brown, 1993), and on the Atlantic slope from Veracruz south to Honduras (AOU, 1998).

Distribution in the West Mojave Planning Area:

The Least Bell's Vireo breeds in southwestern California and adjacent northwestern Baja California (Wilbur, 1980, Garrett and Dunn, 1981); it largely occurs in cismontane southern California, but it does extend into transmontane areas along the western flank of the Anza-Borrego Desert (San Diego County; Unitt, 1984), in the vicinity of Palm Springs (Riverside County; C. McGaugh pers. comm.), at Leona Valley (Los Angeles County; summering, breeding not proven; K.L. Garrett in litt.), and in San Bernardino County at Morongo Valley and along the Mojave River (Patten, 1995; S. J. Myers in litt.). There are breeding records for this subspecies just north of the WMPA in the southern Owens Valley of Inyo County and it regularly breeds just northwest of the WMPA at the South Fork of the Kern River Preserve (Kern County; M.T. Heindel pers. comm.). Elsewhere within the WMPA, the Bell's Vireo is an occasional migrant.

The eastern limit of the range of the Least Bell's Vireo in California is contentious, in that the ranges of the Least Bell's Vireo and the Arizona Bell's Vireo (*V. b. arizonae*) in California are based more on supposition than on direct evidence. It is generally believed that the Arizona Bell's Vireo is confined to the Lower Colorado River Valley, whereas the Least Bell's Vireo occurs in cismontane southern California and on the western edge of the deserts, extending north up the Mojave River into the Owens Valley, and eastward into Death Valley National Park, along the Amargosa River (Inyo County) and at Fort Piute in the East Mojave Desert (Goldwasser, 1978; Goldwasser et al., 1980; Garrett and Dunn, 1981; Regional Environmental Consultants, 1986; Franzreb, 1987a, 1987b, 1989; Brown, 1993; Small, 1994). Considering the biogeography of similarly-distributed cismontane and transmontane species pairs (Grinnell and Miller, 1944; Garrett and Dunn, 1981), such as California (*Callipepla californica*) and Gambel's quail (*C. gambelii*), Nuttall's (*Picoides nuttallii*) and Ladder-backed woodpeckers (*P. scalaris*), and California (*Toxostoma redivivum*) and Crissal thrashers (*T. crissale*), it is probable that Arizona Bell's Vireo is in fact the subspecies occurring in the East Mojave Desert (including Fort Piute and the Amargosa River) northward through Death Valley, and this subspecies may occasionally occur in the extreme eastern portion of the WMPA. Data to support this contention is provided

by the observations that spring birds in Death Valley and at Fort Piute are more brightly-colored (i.e., they have a greener back and yellower flanks), and thus more like *V. b. arizonae*, than are birds along the Mojave River or at Morongo Valley, which are grayer and thus more like *V. b. pusillus* (M.A. Patten pers. obs.). Also, there is a late February specimen of the Arizona Bell's Vireo taken in the Anza-Borrego Desert (Unitt, 1985; Phillips, 1991), showing that this subspecies can occur well west of its described range.

Natural History:

The Bell's Vireo is a conspicuous member of riparian habitats where it occurs because of its lively, complex song. However, given its penchant for dense vegetation, it is far more often heard than seen. Its song belies its rather subtle, drab plumage: this small passerine is basically olive-gray (with emphasis on the latter in *V. b. pusillus*) above with a single faint wingbar, a thick bill, thin but distinct "spectacles," and a long tail that is flipped expressively from side-to-side. In overall plumage and behavior, this species most closely resembles a Gray Vireo (*V. vicinor*), a species with a very different song that occurs in pinyon-juniper and redshank-chaparral associations.

The Least Bell's Vireo and the Arizona Bell's Vireo differ slightly in size and subtlety of color, with the latter being slightly smaller and more brightly colored (Ridgway, 1904; Phillips, 1991). Specimens of Bell's Vireo from eastern California (e.g., Death Valley) were identified as Least Bell's Vireo (Ridgway, 1904; Grinnell, 1923). However, these specimens were taken in spring (Fisher, 1893; Grinnell, 1923), when the plumage of a Bell's Vireo can be quite worn (Unitt, 1985), thus confounding subspecific identification. An examination of specimens at the Natural History Museum of Los Angeles County, the Museum of Vertebrate Zoology, University of California, Berkeley, and elsewhere indicates that evidence for defining the eastern extent of the range of Least Bell's Vireo is weak (M.A. Patten unpubl. data; A.R. Phillips in litt.; N.K. Johnson in litt.). Seven external characters have proven useful in distinguishing these subspecies (Ridgway, 1904; Phillips, 1991): exposed culmen length, wing chord, tail length, rump color, flank color, mantle color, and undertail covert color. These subspecies may also have slight differences in song (L.R. Hays pers. comm.), and they apparently differ in habitat choice (see below).

The Least Bell's Vireo arrives on its breeding grounds in mid-March (Brown, 1993), with males arriving slightly before females (Nolan, 1960; Barlow, 1962). This vireo shows a high degree of nest site tenacity (Greaves, 1987). Most individuals depart by September (Brown, 1993), although some individuals remain on their breeding grounds into late November (Rosenberg et al., 1991). This subspecies winters primarily in Baja California, with occasional individuals remaining through the winter in cismontane southern California (there is also a record for the Sonoran Desert at this season, although the subspecies in not known). Nesting takes place from early April through the end of July, with two broods usually being attempted. Nests are suspended from forks in dense bushes or small trees; over 60 species of plants have been used by Bell's Vireos for nest sites (Brown, 1993), but the Least Bell's Vireo predominantly uses willows (*Salix* spp.). The Bell's Vireo feeds almost exclusively on arthropods, with insects and spiders comprising over 99% of their diet (Brown, 1993).

Habitat Requirements:

The Bell's Vireo occurs in riparian habitats. The Least Bell's Vireo typically breeds in willow riparian forest supporting a dense, shrubby understory of mulefat (*Baccharis salicifolius*) and other mesic species (Goldwasser, 1981; Gray and Greaves, 1984; Franzreb, 1989). Oak woodland with a willow riparian understory is also used in some areas (Gray and Greaves, 1984), and individuals sometimes enter adjacent chaparral, coastal sage scrub, or desert scrub habitats to forage (Brown 1993; L.R. Hays pers. comm.). The Least Bell's Vireo and the Arizona Bell's Vireo probably have different habitat requirements. Least Bell's Vireos in cismontane California occur in riparian forest dominated by willows (Goldwasser, 1981; Gray and Greaves, 1984), whereas Arizona Bell's Vireos tend to occur in riparian woodland dominated by mesquite (*Prosopis* sp.; Rosenberg et al., 1991; Brown, 1993; L.R. Hays pers. comm.; M.A. Patten pers. obs.). Similar habitats are used during the winter months. Although the Arizona Bell's Vireo will use non-native salt cedar (*Tamarix* spp.) in parts of its range (Brown, 1993), the Least Bell's Vireo avoids riparian areas dominated by these plants.

Population Status:

The most recent published population censuses for the Least Bell's Vireo indicated that this subspecies was critically endangered, with a total population estimated to be only a few hundred pairs (Goldwasser, 1978; Goldwasser et al., 1980; Wilbur 1980). Primarily as a result of extensive efforts to restore riparian habitat and to remove Brown-headed Cowbirds (*Molothrus ater*) from breeding areas, populations of the Least Bell's Vireo have increased dramatically at several locations in cismontane southern California (L.R. Hays pers. comm.; Brown, 1993), particularly at the two core population sites of the Santa Margarita River, San Diego County (±400 pairs) and the Prado Basin, Riverside County (±150 pairs). The total population breeding within the WMPA is much smaller, with only a 1-3 pairs at Morongo Valley and 1-2 pairs along the Mojave River (M.A. Patten pers. obs.; S.J. Myers in litt.).

Threats Analysis:

Loss of habitat, combined with increased brood parasite pressure from Brown-headed Cowbirds (Goldwasser, 1978; Beezley and Rieger, 1987), has led to the two breeding subspecies in California, Least Bell's Vireo and Arizona Bell's Vireo, being listed as Endangered by the State of California and, for *V. b. pusillus*, by the federal government (Franzreb, 1989; Franzreb et al., 1992; Salata, 1992; U.S. Fish and Wildlife Service, 1992). Losses of habitat similarly have affected the Bell's Vireo throughout its range (Brown, 1993). Habitat loss within the WMPA probably most often results from flood control efforts (e.g., stream channelization or vegetation clearing along the Mojave River). Conversion of occupied habitat to parks or golf courses is generally less of a problem, if only because it occurs more rarely.

Although Brown-headed Cowbirds are perhaps less prevalent in transmontane sites occupied by this vireo, cowbirds nevertheless can have a huge negative impact on the breeding success of the Least Bell's Vireo (Goldwasser, 1978; Beezley and Rieger, 1987; Clark, 1988), and they have increased dramatically in California in the past century (Laymon, 1987; Rothstein, 1994). Populations of the Least Bell's Vireo have responded dramatically to efforts to remove cowbirds from breeding areas (see above), underscoring the severe impact of brood parasitism. The recent, albeit slow, northwesterly range expansion of the Bronzed Cowbird (*M. aeneus*), could present this vireo with yet another brood parasite (M.A. Patten unpubl. data).

Biological Standards:

Much effort has been expended to maintain minimum viable populations of the Least Bell's Vireo at certain core population sites in cismontane southern California (e.g., the Santa Margarita River, the Prado Basin, and the Santa Ynez drainage in Santa Barbara County). Recovery efforts have generally been extremely successful; prospects for the long-term survival of the Least Bell's Vireo are much better now than they were 15-20 years ago when recovery was initiated (L.R. Hays pers. comm.). However, even historically this vireo has occurred only in low numbers within the WMPA, and in few locations, so management of vireo habitat within its boundary likely will not have a substantial effect on the subspecies as a whole. Nevertheless, conservation and sustainable management of the small breeding populations at Morongo Valley and along the Mojave River could be accomplished through (1) limiting the destruction of riparian habitat in these areas, including less invasive flood control management activities, (2) eradication of non-native salt cedar, giant reed (*Arundo donax*), and Russian olive (*Elaeagnus angustifolius*) from sites occupied by the vireo, with willows and mulefat planted in their place, (3) extensive trapping and removal of Brown-headed Cowbirds from breeding areas, and (4) restoration of riparian habitats, because cowbird parasitism is reduced woodland habitats with lower edge to area ratios (Laymon 1987). An additional measures could be the limiting access of both cattle and humans (hikers and off-highway vehicle users) to prime nesting areas.

Literature Cited:

American Ornithologists' Union (AOU). 1998. Check-List of North American Birds, 7th ed. Amer. Ornithol. Union, Washington, D.C.

Barlow, J.C. 1962. Natural history of the Bell vireo, *Vireo bellii* Audubon. Univ. Kansas Publ. Mus. Nat. Hist. 12:241-296.

Beezley, J.A., and J.P. Rieger. 1987. Least Bell's vireo management by cowbird trapping. West. Birds 18:55-61.

Brown, B.T. 1993. Bell's Vireo (*Vireo bellii*). No. 35, *In:* A.F. Poole and F. B. Gill, (eds.), Birds of North America. Acad. Nat. Sci. Philadelphia and Am. Ornithol. Union, Washington, D.C.

Clark, C.F. 1988. Observations on the nesting success of Bell's vireo in southern Arizona. West. Birds 19:117-120.

Fisher, A.K. 1893. Report on the ornithology of the Death Valley expedition of 1891, comprising notes on the birds observed in southern California, southern Nevada, and parts of Arizona and Utah. N. Am. Fauna 7.

Franzreb, K.E. 1987a. Least Bell's vireo recovery plan. U.S. Fish Wildl. Serv., Portland. Franzreb, K. E. 1987b. Endangered status and strategies for conservation of the least Bell's vireo (*Vireo bellii pusillus*) in California. West. Birds 18:43-49.

Franzreb, K.E. 1989. Ecology and conservation of the endangered Least Bell's Vireo. U.S. Fish Wildl. Serv. Biol. Rep. 89.

Franzreb, K.E., L. Salata, L. Hays, K. Kramer, and B. Ruesink. 1992. Revised proposed determination of critical habitat for the least Bell's vireo (*Vireo bellii pusillus*). Fed. Register 57:34892-34908.

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

Goldwasser, S. 1978. Distribution, reproductive success and impact of nest parasitism by Brown-headed Cowbirds on Least Bell's Vireo. Proj. rep. W-54-R-10, Calif. Dept. Fish Game, Sacramento, California.

Goldwasser, S. 1981. Habitat requirements of the least Bell's Vireo. Proj. rep. E-W-4, Calif. Dept. Fish Game, Sacramento, California.

Goldwasser, S., D. Gaines, and S. Wilbur. 1980. The least Bell's vireo in California: A de facto endangered race. Amer. Birds 34:742-745.

Gray, M.V., and J.M. Greaves. 1984. Riparian forest as habitat for the Least Bell's Vireo. pp. 605-611, *In:* R.E. Warner and K. M. Hendrix, (eds.), California riparian systems: Ecology, conservation, and productive management. Univ. California Press, Berkeley, California.

Greaves, J.M. 1987. Nest-site tenacity of Least Bell's Vireos. West. Birds 18:50-54.

Grinnell, J. 1923. Observation upon the bird life of Death Valley. Proc. Calif. Acad. Sci. 8:43-109.

Grinnell, J., and A.H. Miller. 1944. The distribution of the birds of California. Pac. Coast Avifauna 27.

Laymon, S.A. 1987. Brown-headed cowbirds in California: Historical perspectives and management opportunities in riparian habitats. West. Birds 18:63-70.

Nolan, V. 1960. Breeding behavior of the Bell Vireo in southern Indiana. Condor 62:225-240.

Patten, M.A. 1995. Checklist of the birds of Morongo Valley. Bureau Land Manage., Morongo Valley, California.

Phillips, A.R. 1991. The known birds of North and Middle America, pt. II. Allan R. Phillips, Denver, Colorado.

Regional Environmental Consultants. 1986. Draft Comprehensive Species Management Plan for Least Bell's Vireo. Unpubl. rep., San Diego Assoc. Govern., San Diego, California.

Ridgway, R. 1904. The birds of North and Middle America, pt. 3. U.S. Natl. Mus. Bull. 50.

Rosenberg, K.V., R.D. Ohmart, W.C. Hunter, and B.W. Anderson. 1991. Birds of the Lower Colorado River Valley. Univ. Ariz. Press, Tucson, Arizona.

Rothstein, S.I. 1994. The cowbird's invasion of the far west: History, causes and consequences experienced by host species. pp. 301-315 *In:* J.R. Jehl, Jr., and N.K. Johnson, (eds.), A century of avifaunal change in western North America. Stud. Avian Biol. 15.

Salata, L. 1992. Notice of public hearings on revised proposal to designate critical habitat for the Least Bell's Vireo. Fed. Register 57:43685-43686.

Small, A. 1994. California Birds: Their Status and Distribution. Ibis Publ., Vista, California.

United States Fish and Wildlife Service. 1992. Least Bell's vireo survey guidelines. U.S. Fish Wildl. Serv., Laguna Niguel, California.

Unitt, P. 1984. The birds of San Diego County. San Diego Soc. Nat. Hist. Memoir 13.

Unitt, P. 1985. Plumage wear in *Vireo bellii*. West. Birds 16:189-190.

Wilbur, S.R. 1980. The Least Bell's Vireo in Baja California, Mexico. West. Birds 11:129-133.