

INDEPENDENT SCIENCE ADVISORS REPORT

**ORANGE COUNTY TRANSPORTATION
AUTHORITY
M2 NCCP/HCP**

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1.0 Executive Summary

The following report is the result of an independent scientific review of the Orange County Transportation Authority's (OCTA) draft M2 Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP) (2011). Overall, the plan provided a scientifically valid and defensible approach to conservation planning and management. OCTA is to be commended for developing a plan that integrates into other regional conservation efforts. They go well beyond the basic requirements of conservation planning by not only addressing the mitigation required for roadway improvement impacts, but also providing additional regional benefits through a creative strategy of habitat conservation critical to the regional long-term success species and habitat conservation in the region. It is refreshing to see a permittee go beyond the minimal requirements and assume a proactive role in regional conservation planning and management, particularly when the predicted project-related impacts to species and habitats are relatively low.

The following observations are intended to provide additional guidance and support for the conservation plan and with modest revision may help to enhance the existing conservation plan. There are five main areas that we address, with both general and specific guidance provided:

1. Goals and Objectives
 - a. Clearly state the underlying goal of the plan
 - b. Identify measurable and tangible targets
 - c. Provide clear links between quantitative conservation objectives and the goal of increasing, expanding, or enhancing habitat
 - d. Develop opportunities for stakeholder involvement
2. Covered Species and Occurrence Data
 - a. Supplement current species distribution data with additional other available data and information
 - b. Species specific comments are provided
3. Modeling
 - a. Include expert opinion to support/supplement the modeling approach
4. Conservation Strategies and Reserve Design
 - a. Make sure to address potential small or fragmented habitats that may be important in the overall regional conservation program
 - b. Determine whether longer performance standards for restoration
5. Management, Monitoring, and Oversight
 - a. Develop a scientific advisory committee to participate in the process
 - b. The monitoring program should prioritize species, and include thresholds for management action
 - c. Develop Resource Management Plans for each property conserved, linking the plan back to the goals and objectives of the HCP/NCCP

2.0 Introduction

The science advisory group for the Orange County Transportation Authority (OCTA) was established to provide an independent scientific review of the draft M2 Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP). The panel consists of four members. Dr. Matt Rahn was the lead science advisor, with Dr. Peter Bowler, Dr. Kristine Preston, and Trish Smith. Bruce DiGennaro facilitated the review and meetings. The advisors represent subject matter experts in conservation planning, endangered species, habitat restoration, and environmental policy and regulation. The advisors also have significant experience within the proposed project planning area on reserve design, ecosystem management, and conservation programs for various rare, sensitive, and endangered species.

The science advisors provided independent scientific review and input into the following elements of the M2 NCCP/HCP development process:

1. Process for selection of the proposed covered species
2. Species profiles describing the ecology, distribution in the plan area, status, and potential threats to each proposed covered species
3. Natural community profiles describing the composition, distribution in the plan area, status, and potential threats to natural community
4. Predicted species distribution model and associated documented locations for each proposed covered species
5. Conservation goals for covered species and natural communities
6. Conservation strategy to achieve conservation goals

The advisors were provided with the biological inventory report and associated appendices for review in mid March, 2011. This report included background information on the methods, process, and initial results of items 1 – 6, above. The group met in San Diego on April 1. They were provided presentations by organizations previously involved in the planning process (including the Conservation Biology (CBI) Institute and Technology Associates International Corporation [TAIC]). The science advisors discussed the draft document, and had an opportunity to ask questions of the regulatory/resource agencies and OCTA staff. The ISA facilitator and lead scientist facilitated a discussion, questions, comments, and initial recommendations during the later part of the workshop.

The following draft report is provided on behalf of the science advisors, summarizing their comments and input as formal recommendations to OCTA. The OCTA is to be praised for its use of M2 funding to purchase ecologically significant additions to and linkages between existing reserves, and to create meaningful restoration projects that enhance the ecological condition of preserved sites. This is an enlightened amelioration strategy, and goes far beyond that which could be accomplished by merely mitigating

roadway improvement impacts within existing easements. While this project was initiated because of the potential freeway project impacts, the conservation program is much more broadly integrated into regional conservation efforts, attempting to supplement existing efforts by filling in the gaps and linkages of existing HCPs/NCCPs and regional preserves. The CBI Conservation Assessment forms a strong basis for these positive actions, and with modest modifications it can be enhanced to meet the highest standards of conservation.

3.0 Goals and Objectives

3.1 Conservation Program Goals

The first step in monitoring plan development is the creation of goals and objectives (Mulder et al. 1999, USFWS & NMFS 1996, Gibbs et al. 1999, Noon 2003). This is often the most underappreciated portion of many conservation programs. In our evaluation, the HCP/NCCP did an admirable job of addressing this important component of the plan.

While the goals and objectives establish the foundation of a monitoring program, the future monitoring program should include specific criteria and be clear and robust enough to provide assurances that the plans will be successful. The underlying goal of all HCPs is to protect the covered species from jeopardy, and to minimize and mitigate the impacts of take to the maximum extent practicable. This primary goal should be explicitly stated in the plan.

There is a clear emphasis on scientific rigor and core principles for guiding the plan. However, the specific program goals should be grouped into sub areas. For example, those goals that address “scientific” goals should be in a separate group from the “business” goals, or “regulatory” goals. As described below, the goals lack certain specificity necessary to determine whether they are being met or not. For example, the goals include statements such as “less costly,” or “coordinate,” or “provide opportunities for...” These terms are rather ambiguous, and lack a quantitative or qualitative basis on which to assess success or failure. This could be resolved by creating objectives under each goal that provides additional specificity and necessary rigor.

The importance of these “business and regulatory goals” cannot be overstated. The OCTA plan has attempted to address these needs; however it falls short with regard to detail and certainty. For example, the Plum Creek HCP described the “business goals” and objectives associated with commercial forestry, emphasizing the inherent consumptive nature of the permitted activities while defining how these stressors can be mitigated or minimized while also acknowledging the constraints and needs of the business. One of their business goals was to “create an environment of regulatory predictability to preserve the ability to confidently make long-term business decisions”, and the objectives are to: “retain the ability to manage timber and land resources in a profitable manner of a long-term planning horizon” and to “protect certainty and confidence for long-term business planning and investment.” By articulating the conservation and business goals, objectives, and commitments, it is very clear how the conservation program is intended to operate and maintain the covered species, habitats, and permitted activities. This may be a useful exercise for the OCTA conservation plan, and provide additional certainty and transparency.

3.2 Biological Goals and Objectives

In our assessment of the biological goals and objectives for the OCTA plan, we specifically addressed the following areas:

- Are the biological goals and objectives appropriate for the conservation planning context of this NCCP/HCP (i.e., relatively small impacts, and a conservation strategy based on acquisition and restoration to contribute to a significant existing preserve system)?
 - What is the best way to set quantitative goals?
 - How should we relate project impacts to goals?
 - How should we assign conservation credit from restoration in an equitable and even way consistent with (apples to apples) the credits from acquisitions?

The plan uses terms in the biological goals such as “increase, expand, and enhance.” These goals lack measurable and tangible targets. Mulder (1999) indicated goals should express a clear statement of the information and value provided by the monitoring program while Bisbal (2001) stressed the need for simple and clearly defined goals not open to interpretation. A simple framework is often more useful than detailed goals and objectives, largely due to the variability and uncertainty involved in large-scale, long-term plans. Therefore, it is important that the goals have a realistic temporal and spatial scale that are readily measured or assessed through monitoring (Bisbal 2001). Ringold et al. (1999) felt hierarchical goal creation ensured priority goals are clearly linked to more specific objectives while Mulder (1999) argued goals should be designed in rigorous, quantitative terms that help suggest potential indicators to measure. Clearly, both approaches have merit. Overall, the goals for this plan are lofty, but lack specific targets or desired conditions. If there is no ability to provide this type of metric, the plan should include a section that describes how those measurable targets (etc.) will be identified in the future.

The section of quantitative biological objectives attempts to address this issue. However, the plan lacks a clear link between the broad goals, and the specific targets generally focused on conservation of acreage and restoration programs. It is important to show a clear link between the quantitative conservation objective, and how that feeds back to addressing the goal of “increasing, expanding, or enhancing.”

Objectives are often misunderstood and improperly defined in conservation programs. First, objectives must be clearly defined and directly linked to the goals. In essence, monitoring objectives are supposed to support the goals, providing information for decision-makers (Gibbs et al. 1999). Gibbs et al. (1999) and Bisbal (2001) suggest that objectives should describe the targeted outcome, which in turn helps identify what actually needs to be measured in a monitoring program. Finally, Mulder et al. (1999) and

Noon (2003) stress the need to identify potential barriers to attaining the goals and objectives. Potential remedies to avoid these pitfalls can then be identified in the plan, or at least contingencies put in place should the potential barrier impact the implementation of the conservation plan. For the OCTA plan, it is important to integrate the notion of realistic temporal and spatial scales into the description of the objectives.

The Clark County MSHCP provides another example of unique goals and objectives. This plan provided straightforward, specific goals and objectives linking many, but not all of these, to the monitoring plan. Some of the goals were focused on the scientific nature of the HCP (like the OCTA plan). However, their scientific goals also included specific objectives to develop and adopt biologically sound methodology for detecting status of species and another that focused on the identification of alleged stressors and threats to covered species. The planning process was also addressed in the goals and objectives, where the plan specifically calls for the identification of additional stakeholders and integration into future planning, along with the development of a coordination committee for oversight and planning. This is an extremely important part of all conservation plans. This level of specificity could be beneficial in the OCTA plan.

4.0 Covered Species and Species Occurrence Data

The treatment of the covered species and species occurrence data could be expanded, and there are good templates and significant additional information that would strengthen this aspect of the report. The species distribution and occurrence data could be improved, and the considerations of population size and viability could be incorporated. Many species are omitted, and there appears to be a focus on particular groups – at least in terms of the number of taxa included – such as bats, for example. While the California Natural Diversity Data Base and similar data collection points such as the digital database of the Consortium of California Herbaria (<http://ucjeps.berkeley.edu/consortium/>) are useful, they do not capture all of the information included in status reports and population censuses for many of these species. For example, there are Fish and Game management plans for the Pacific Pond Turtle that require monitoring populations. Although there are a few records of pond turtles in the Newport Back Bay area, the largest natural population in the County is at the University of California Natural Reserve System’s San Joaquin Freshwater Marsh Reserve, with an estimated 236 individuals in a robust age class distribution. Robert Goodman (see Goodman, 2009) has surveyed this population over a number of years, and the data in his reports would be useful to reflect in the treatment of the species. We recommend working with CDFG and the USFWS in seeking reports, status analyses, and the names of individuals – consultants or agency personnel – who provide better current information for use in this document. It would be useful to examine the U.S. Department of the Interior National Natural Landmark database, vegetation maps, and surveys of the Irvine Ranch National Natural Landmark. Links to state and federal recovery plans for listed taxa should be provided. For example, it would be useful to link the U.S. Fish and Wildlife Service Tidewater Goby Recovery Plan (U.S. Fish and Wildlife Service, 2005) with the descriptor of *Eucyclogobius newberryi* in the review document.

Overall, the covered species section needs to be evaluated; some species could be discarded. Specific examples are discussed below. There are many models that could be considered in revising this section, going beyond older ones such as Stephenson and Calcarone (1999), for example.

4.1 Specific Comments on Natural Community and Species Accounts

Note that general comments on species distribution models can be found in Section 3.0.

- Coniferous forest – the discussion of Tecate cypress could be updated with 2009 survey results and the management plan for this species referenced (NROC website). There should be a brief discussion of the threats to this species from frequent fire.
- Page A-9 – Is there a basis for the claim that chaparral is not a primary foraging and reproductive habitat for mountain lions? A study of radio-collared lions in

the Santa Ana Mountains by the UC Davis Wildlife Health Center documents frequent use of chaparral in addition to other habitats.

- Page A-16. Regarding the statement that the “annual grasses and forbs vegetation community was found to be under-protected...”, is this referring to non-native grassland? The focus should be on protecting native grasslands and forb lands. Non-native grasslands should be prioritized for conservation only if they provide a specific conservation benefit. This could include conserving non-native grassland with environmental attributes favorable for restoration to native grassland or sites that are important for retaining connectivity, that support other sensitive species, or provide important foraging habitat for raptors.
- Southern tarplant is not widely distributed in Orange County and the model indicates substantially more potential habitat than is realistic (see Modeling Section).
- The Fisher 2000 report (CDFG website) has specific distribution and abundance information for reptiles and amphibians in Orange County’s Central and Coastal NCCP.
- The southwestern pond turtle model appears to over-predict suitable habitat based upon the actual known distribution. Many of the small drainages identified as suitable are not (e.g., no pools). Species experts at United State Geologic Survey (USGS) and researchers studying populations in the San Joaquin Marsh should be consulted to update this account.
- The Southwestern Willow Flycatcher model indicates a substantial amount of suitable riparian habitat in the study area. However, the species is usually found in wider floodplains with standing or slow moving water. Many of the riparian drainages indicated as suitable do not fit this description.
- All scrub below 1,758’ is predicted by the Cactus Wren distribution model to be suitable habitat, even though the species is restricted to cactus scrub. The model does not realistically depict suitable habitat for this species. The account should be revised to reflect the significant decline (>80%) of Cactus Wren in central and coastal Orange County over the last two decades. The population estimates in the account are no longer applicable. Reports can be downloaded from the NROC and CDFG Local Assistance Grant websites describing the current status of this species in Orange County. It is important to note that in addition to population declines in coastal and central Orange County, populations in the north were also recently impacted by wildfire.

- It is not clear why so many bat species have been identified as covered species in the NCCP. It would be helpful to explain the rationale for this in Section 5. There should be some documentation of bats roosting under freeway bridges in southern California. There are few or no location records for all five of the bat species covered by the NCCP. It is unclear how a species can be covered if it is not documented as occurring in the plan area. There should be more information on bat species distribution in the plan area. Trish Smith of the Nature Conservancy should be contacted regarding bat mist netting studies conducted in central Orange County.
- The bat models are overly predictive as they identify roost habitat as any slope >85%. Not all steep slopes are suitable, as it is the rock crevices and cliffs that provide habitat. The foraging habitat models are also not helpful as just about all natural habitats in the plan area are indicated as suitable. The models do not provide information for identifying parcels that are actually of importance to bats.
- It is not clear why so many bat species are included in the plan. If there are concerns regarding infrastructure use by bats and potential project impacts (e.g. bridge roosting species), then it is recommended to provide specific concerns and appropriate mitigation measures for these specific roost types. For example, certain species (e.g. *Tadarida brasiliensis* or *Yuma myotis*) are commonly associated with bridges, however mitigation of the loss of this habitat type through the conservation of general native habitat is not typically a suitable offset. Artificial structures often provide roosting opportunities and encourage colony sizes that may not actually occur on the native/natural landscape. Some bat species take advantage of anthropogenic roosts, which may require specialized avoidance, minimization, and mitigation measures.
- Additional bobcat information can be found in the 2000 mammalian carnivore report on the CDFG website.
- The mountain lion account should indicate that lions have not been detected in the San Joaquin Hills for many years. The habitat model does not take into account fragmentation and isolation of habitat patches making some areas unsuitable for lions. The 2000 mammalian carnivore report on the CDFG website provides some information on mountain lion detections. Dr. Winston Vickers from UC Davis and his collaborators are currently studying mountain lion movement and mortality in the Santa Ana Mountains. He should be contacted for information on their current distribution, movements and threats to conservation. He can also provide recommendations regarding important areas for conserving connectivity for mountain lions in the Santa Ana Mountains.

5.0 Modeling

5.1 Species Inventory and Data

A Conservation Assessment was conducted for the OCTA M2 NCCP/HCP to develop regional conservation priorities, identify components of a regional reserve network, and develop specific conservation objectives and to use this information to identify areas where conservation should be prioritized (CBI 2009). This comprehensive review included evaluation of lands in relation to landscape integrity, vegetation, special status species locations, core habitat patches, connectivity, and land use buffers. OCTA has also developed criteria for evaluating and prioritizing private parcels from willing sellers for acquisition and inclusion in the NCCP/HCP. This parcel evaluation includes both biological and non-biological criteria.

The OCTA M2 NCCP/HCP Biological Inventory and Baseline Data Report (ICF International 2011) was developed to summarize the scientific information gathered for developing the NCCP/HCP. This report summarized the methods used in the species list development process. In short, an initial list of 22 species was included from the NCCP/HCP Planning Agreement (California Department of Fish and Game 2009). The initial list increased to 38 species based on a search using a comprehensive species occurrence database developed for Orange County. This effort ensured that all special-status species within the Plan Area were evaluated for coverage under the plan. Based on location data and an evaluation of five criteria, 21 plant and animal species were selected for coverage under the NCCP/HCP. The next phase in the OCTA Conservation Strategy is integrate the regional conservation priorities and specific conservation objectives with baseline data to compare and evaluate parcels in order to identify and prioritize those parcels that meet the conservation goals and objectives and that are high priority for acquisition and conservation.

The inventory and baseline data are based upon existing datasets, which are largely biased toward publicly owned and already conserved lands. In reviewing the species distribution maps it becomes apparent that known species locations were missing for some species, indicating that not all species information is incorporated into the inventory. The report acknowledges this (Table 4-2) and identifies additional information and questions that were not included in development of the inventory, and which could be relevant to natural community and species profiles. Compiling a more complete database of known species occurrences would improve the reserve selection process.

However, even if all known species locations were compiled, there will still be a gap in knowledge of species distributions, particularly for privately-owned lands. Surveys are not planned or feasible to fill in these information gaps. Other approaches are needed to supplement species occurrence data and prioritize lands for conservation that meet

species goals and objectives. To augment species occurrence data the authors developed species distribution models to identify potentially suitable habitat for the 21 species covered by the NCCP/HCP.

5.2 Modeling Approach

The modeling approach employed in the NCCP/HCP represents a type of species distribution modeling used when there is little species occurrence data. It incorporates computer based Geographical Information Systems software and environmental data layers (Marcot 1986, Clevenger et al. 2002, Petit et al. 2003, Johnson and Gillingham 2004). In this approach, environmental variables considered important to the species are identified and decision rules are formulated to determine whether habitat is suitable for the species in regards to a particular variable. Several variables can be included in a Boolean decision making framework.

Optimization modeling is a well-established and powerful tool for comparing reserve design alternatives in conservation planning (Margules and Pressey 2000, Possingham et al. 2000, 2006). This approach attempts to maximize conservation values in the most efficient manner. MARXAN is an accepted method for systematic reserve selection, however it is sensitive to the uncertainty associated with species occurrence data and habitat suitability model predictions (Rondinini et al. 2005, Grand et al. 2007, Langford et al. 2009, Smith et al. 2009, Underwood et al. 2009). For these reasons, it is important that the uncertainty of the habitat models be reduced and the species distribution data made more comprehensive if they are to form the basis of the model input.

We understand that the preparers of the NCCP are well aware that there are limitations to this type of modeling. It is sometimes criticized for being overly simplistic. It is often difficult to explain complex ecological relationships in computer models, while often expert opinion can also introduce uncertainty and bias (Clevenger et al. 2002, Petite et al. 2003, Johnson and Gillingham 2004). Finding a suitable middle-ground is often a challenge. One approach is to use species occurrence data to make spatially explicit predictions of habitat suitability based on empirically derived habitat relationships. These models typically consist of multivariate environmental relationships derived from a statistical model or machine learning algorithm (Guisan and Zimmerman 2000, Elith et al. 2006, Rotenberry et al. 2006, Phillips and Dudik 2008). In using species distribution models for conservation planning, it is critical that each model is tested to determine how well it predicts species habitat and to evaluate uncertainty associated with predictions. Models that perform well in predicting suitable habitat can provide a powerful tool for conservation planning.

Although the models used in this conservation plan are new, this approach tends to err on the side of caution, which may over-predict potential habitat for species such as southern tarplant, southwestern pond turtle, Southwestern Willow Flycatcher, San Diego Cactus Wren, the various bat species, and mountain lion. This over-prediction

may result in commission (false-positive) errors in which land is considered suitable and potentially occupied when it is not. This is a risk inherent to all habitat modeling techniques, particularly since habitat can be unoccupied for reasons other than suitability.

An example of this over-simplification and over-prediction is the southwestern pond turtle distribution model. Most drainages across the study area are predicted as suitable habitat when the species has more defined habitat requirements and is very limited in distribution. Furthermore, the predictions of models based on environmental attributes that do not define a species distribution can also lead to erroneous predictions. The southern tarplant is restricted to seasonally moist saline soils within salt marshes, alkaline meadows, vernal pools and occasionally grasslands. The OCTA M2 NCCP/HCP model includes grassland as a variable defining suitable habitat and predicts the species as potentially widespread, since grassland is widespread. However, the species only occurs in a limited number of locations within the County. Similarly the Cactus Wren model predicts the species as likely to occur in scrub habitats below 1,750' throughout the plan area. However, this species is confined to a subset of coastal sage scrub that supports cactus, which is not reflected by the model.

Comparing Tables 7-2 and 7-3 indicates there is a discrepancy between actual conservation of known occurrences and predicted habitat for the existing network of protected areas. Potentially suitable habitat is $77.6\% \pm 5.8$ (std) conserved across 29 species, whereas $54\% \pm 11.2$ (std) of occurrences for the 16 species with location records are conserved in the Plan Area. While the species occurrence data is problematic because it is not comprehensive, this discrepancy between levels of potential habitat conservation and known species locations indicate that neither dataset may be performing well in predicting actual levels of conservation. The problem with using overly broad predictions of suitable habitat in the reserve selection process is that it is difficult to distinguish parcels that may have the highest conservation values.

5.3 Recommendations

Despite these potential drawbacks, species distribution models can be important planning tools when they are well validated and the uncertainty in predictions is quantified. For these reasons, the California Gnatcatcher model may be useful in reserve selection. This model incorporates several variables into a more complex habitat relationship and has been validated for San Diego County (Winchell and Doherty 2006). The gnatcatcher also has the advantage of being a habitat specialist so that its distribution is relatively easy to model. However, one serious limitation is whether this model can be applied more broadly to the conservation goals for other species based on our limited understanding of the species and their ecological associations.

It appears that there may be enough data for several of the species to develop species-specific models. However, for those species with insufficient data, OCTA could create

better decision tree models incorporating additional environmental variables (similar to the gnatcatcher model).

Based on a review and an understanding of species habitat relationships we suggest that at a minimum the following models in their current form be removed as part of the overall reserve design analysis:

- southern tarplant
- southwestern pond turtle
- southwestern willow flycatcher
- San Diego cactus wren
- all bat species models

For the remaining models, most have some species location data for Orange County and an analysis could be performed to see how well the models predict these occurrences (i.e., see Fielding and Bell 1997). The mountain lion model should be reviewed by Winston Vickers who has many thousands of lion locations from an ongoing radio-tracking study in Orange County. He could refine the model to reflect where the lions actually occur.

Using the current habitat model predictions as input into MARXAN may not be very informative. It may be worth considering incorporating additional expert opinion regarding important lands for conservation. If species specific habitat models are used, some assessment of how well the models perform in predicting species' occurrences should be provided.

The panel realizes there is a relatively small level of impact to covered species from OCTA M2 projects as most construction will be within existing freeway right-of-ways. Thus, the covered species are likely to be adequately mitigated through establishment of a large reserve system that significantly exceeds standard mitigation requirements. This provides an opportunity to prioritize and select parcels for conservation based on reserve design attributes and to use restoration to enhance degraded areas important for connectivity. To that end, rather than relying solely on the species distribution models it may be better to focus on the Conservation Assessment (CBI 2010) and prioritize parcels that augment and link already conserved lands and encompass a diversity of vegetation communities. Species occurrence data and expert knowledge can be used to inform these prioritizations. Under this approach, it would be important that experienced biologists conduct site visits to candidate acquisition parcels to assess existing habitat value or restoration potential and the potential for occurrence of Covered Species. The NCCP/HCP is unique as there are already large blocks of land conserved within the plan area and the focus can be on filling gaps in conservation and providing greater connectivity.

6.0 Conservation Strategies and Reserve Design

The overall conservation strategy – that of purchasing inholdings and expanding preserved areas, emphasizing linkage and connectivity, and raising ecological condition through restoration – is innately valid. This approach has regional benefits that extend well beyond the actual impact area for the project. The prioritization of funding commitment is correct in that preserving additional habitat outweighs limited restoration efforts or those of mitigating isolated impacts. In terms of reserve design, connectivity and linkages are a fundamental principle as urbanization, roads and other anthropocentric actions continue to divide and isolate the larger reserve areas. In this regard, simply adding to existing preserves – just adding acreage – is not always the most productive approach. Bigger is not always better – in part, additions to reserves depend upon the condition of the added landscape and the condition of the habitat to which it is amended. With limited funding, there is strong merit in the “string of pearls” concept in which stepping stones link habitat allowing meta-population communication that would be restricted were expansion of a reserve the sole consideration. An excellent example of this is the creation of patches of cacti to provide line of site connections between isolated populations, such as those in Newport Bay and the UCI Ecological Preserve. In this sense despite being isolated, small fragments have great importance as linking archipelagos and buffered refugia integrating and bridging distributional gaps in larger preserved habitats.

Fragments can serve as refugia for some species, providing value even if not directly connected to larger habitats. In 1993 and 2007 large fires decimated coastal cactus wren populations in the Orange County, and the pairs surviving in isolated fragments became extremely important in sustaining genetic diversity and providing out-migrants for re-colonization of burned areas.

Linkages are not just migration corridors, but they are connectors that assist in the sustenance of biodiversity, even if only for birds and insects (organisms that can fly when a fragment is surrounded by roads or urban development). High priority linkage areas need to be re-visited and it should be determined if there are key sites/connections that are missing. Species lists can be used to assist in evaluating potential linkage needs.

In summary, don't overlook small habitat areas – fragments – that may provide important functions such as refuge from catastrophic events like fire in larger preserved areas, preservation of genetic diversity, and as connectors or stepping stones between larger preserves. Biological corridors, reserve design, and linkages have been discussed in relevant ways to this project in references such as Beier and Lowe (1992), Beier and Noss, (1998), Noss, et. al. (2001), Noss, et. al. (2002), NCCP Core Group Report, (1997), and Stephenson and Calacaron (1999), among many others. Bowler (1992) suggested the important role filled by disturbed lands as buffers and corridors. While no specific recommendations are provided in our analysis, this may be a useful exercise to conduct

with regional conservation experts and planning staff, and may already be addressed by the recommendations above.

6.1 Restoration

Potential restoration opportunities should be prioritized with the same rigor as potential acquisition opportunities. Funding should target areas where restoration could have immediate benefits (e.g., key linkage areas such as the State Route 91 Coal Canyon wildlife crossing). Acquisitions should include areas with opportunities for riparian restoration – which will be needed along with upland restorations. It is important to remember that restoration as discussed here means whole community restoration, not just canalized elements of community such as shrubs – a characteristic of mitigation approaches.

Establishing performance standards such as those for mitigation projects could be useful, with monitoring over a longer period of time to assess effectiveness. Targeting “real” restoration goals (e.g., 90% cover by native plants after 15 years, or for example) would help ensure that restoration projects contribute and are sustainable over a long period of time. However, restoration targets need to be realistic, and can be based off of the existing conditions in the region. For example, based on the characteristic diversity of the region, it may be unrealistic to set a restoration goal of 90% cover (based on soil characteristics, slope, aspect, etc.) and some invasive species may never be adequately removed from the ecosystem. This more pragmatic approach is particularly necessary in areas with significant historic degradation or continuing urban influence.

Finally, restoration requires a long-term commitment that extends beyond the traditional 5 to 10-year targets for percent cover or percent native species. Because of the potential for continued impact, restoration projects often become degraded over time and the original habitat integrity and utility can be lost. It is important that long-term commitments are made so that restorations are sources, not sinks (Bowler, 2000).

6.2 Other

Although often overlooked, some habitat features like rock outcrops are important for lichens, bryophytes, and other cryptogams as well as selected rare plants, bats, raptors and reptiles. Thus they should be recognized as having ecological value for these groups, rather than disregarded as having no role in a habitat.

Climate change considerations must be addressed, and could place new challenges upon the selection of sites to be added to preserved lands. Predictions for the study area include, among others, a rise in sea level between 12 and 18 inches by 2050, the local climate will be hotter and drier, wildfires will increase in frequency and intensity, and there will be local extinctions (The San Diego Foundation, 2010). Dawson et al. (2011) suggest developing a “vulnerability assessment” in predicting which species and habitats are placed in greatest risk. Considering the development of other risk criteria for

species could be another approach worth exploring. How close is a species to losing viability, how resilient is it and its ecological context to climate change, for example? Other recent approaches include the SAFE analysis (Clement, et. al., 2011), which incorporates earlier studies of the minimum population size needed for a species survival, then estimating how close the taxon is to the minimum viable population size. This tool is intended to be a “relative threat” risk estimate that uses a formula to determine the distance a population is from its minimum viable population as an indicator of vulnerability. According to the authors, it is meant to be an adjunct to the methods used by the International Union of for Conservation of Nature (IUCN) Red List of Threatened Species, and it has been found to be particularly effective in estimating vulnerability and risk in mammalian taxa. Another approach (Angert, et al., 2011) suggests assessing the rapidity with which species can migrate either in elevation or latitude in response to climate change. As they note, “The species that aren’t able to expand their range are the ones we need to spend more resources protecting.”

In view of the climate changes predicted and the strategies discussed above, it might be prudent to consider topography in selecting new sites for preservation – so that diversity in landscape and elevation could provide a more heterogeneous template in which species could adjust as the ecology changes. Finally, going back to the original goals of the project, and the limited habitat impacts predicted, climate change (while an important issue) is likely addressed simply due to the disproportionate habitat acquisition and restoration activities (when compared with actual project-related impacts). Furthermore, the focus on protecting vital linkages and ensuring connectivity is substantially related to the ability for species to migrate and adapt to climate change, with one caveat: consider including an analysis for conserving (or ensuring the protection) of areas that allow for migration along altitudinal gradients. This needs to be highlighted within the plan to let the readers know that the existing conservation approach used in the plan is already (inherently) providing climate change mitigation.

7.0 Management, Monitoring, and Oversight

7.1 Oversight of the NCCP/HCP

Successful implementation of the NCCP/HCP is largely dependent on maintaining strong involvement, support and oversight of a governing body. The Science Advisors support adopting the existing “Environmental Oversight Committee” as an oversight entity. The entity body should be part of a review of annual work plans, monitoring and management. The US Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG), in particular, should maintain a strong leadership role, providing direct oversight of research and management programs and review and approval of annual work plans and management plans. In addition, if the makeup of the governing body is largely non-scientific, it may be worth creating a Technical Advisory Committee (TAC) to review and help direct science-related management and monitoring programs for conserved lands. The TAC could be comprised of independent scientists/biologists with background and experience in southern California ecosystems.

A major potential unforeseen problem that should be addressed at the outset is the need for OCTA and its agents to have access to the conserved properties to complete monitoring and management activities. Currently, it is difficult for researchers and biological monitors to gain timely access to publicly conserved lands in Orange County due to onerous permit processes and insurance requirements. Regular communication between the landowner and the OCTA biomonitor on the design, timing, and ongoing results of monitoring actions could help ensure that monitoring and management actions are streamlined. We therefore recommend that the Framework Monitoring and Management chapter include discussion of the need to coordinate monitoring and management among preserve areas and between preserve management entities, including facilitating access to property for biological monitoring.

7.2 Long-Term Management and Monitoring Endowment

The Science Advisors applaud the establishment of long-term endowment for monitoring and management of the conserved lands. We also strongly support the endowment be held and managed by a single entity such as OCTA. OCTA will likely be able to implement a more aggressive investment strategy than other public agencies, thereby generating more funding for monitoring and management. The endowment should not be held or managed by the various potential land manager/owners of the conserved properties. If the investment remains pooled and held by one entity, release of management funding to landowner/managers can be tied to performance, providing an incentive for manager/owners to provide a high level of resource management on the conserved properties. It is our experience that over time, some properties may require greater financial resources on occasion due to unexpected, natural or human induced impacts to covered species and habitats. A funding strategy that addresses this may be worth including in the document.

7.3 Biological Monitoring

1. Experience gained from existing NCCPs in southern California has taught us that the monitoring program developed for the plan should not be prescriptive but rather responsive to changing circumstances and technologies. The monitoring program should be able to sufficiently document trends for covered species but flexible enough so that it can be changed in response to changing circumstances, such as catastrophic fire events, emerging invasive species (?), disease, and new monitoring technologies.
2. We recognize that it would be financially infeasible to monitor all covered species; therefore, the development of the monitoring program should include a process for prioritizing species/habitats for monitoring. We suggest that OCTA model their prioritization efforts after the process developed for the San Diego Multiple Species Conservation Plan (Franklin, et al. 2006). This prioritization scheme uses a step-down approach that firsts assigns a Risk Category to each species (from most to less endangered) and then identifies and ranks the degree of threats (high, medium, low) for each species. The threats were further identified as covering a high, moderate, or low portion of the species range in San Diego County. The temporal response of species to the threats was also identified as short-term or long-term. A similar approach was used for prioritizing habitats used by the covered species. Those species/habitats that were identified as highly endangered or having high-ranking threats were given high priority for monitoring.
3. All biological monitoring that is tied to permit conditions should be overseen and conducted by a third party ("OCTA Biomonitor") that is not a landowner or manager of the conserved properties. Centralizing monitoring efforts (versus delegating the monitoring to land managers) will better ensure that monitoring is performed rigorously, consistently and as scheduled.
4. The monitoring program should link, whenever possible, to monitoring programs established for nearby HCP/NCCPs, such as the Nature Reserve of Orange County's long-term cactus wren, gnatcatcher and vegetation monitoring programs. This would provide cost savings and provide a larger regional data set to assess trends through time for target species and habitat types.
5. There should be centralized data storage and dissemination made available (after QA/QC) as either an annual report or part of a regional database.
6. The adaptive management and monitoring program should follow the process identified by USGS in the 2004 report "Designing monitoring programs in an adaptive management context for regional multiple species conservation plans" (Atkinson, Trenham et al. 2004). This process includes 1) developing monitoring goals and objectives, 2) identifying species/habitats to be monitored, 3) developing conceptual models for the species to be monitored as well as hypotheses to be tested, 4) identifying thresholds for management intervention, 5) implementing a pilot/baseline data collection phase, 6) analyzing data, 7) implementing management or additional research action based on data, and 8)

refining monitoring goals, methods, hypotheses and conceptual models based on results of analyses. Periodic review of monitoring programs should follow this general process every 5-10 years.

7. Monitoring programs for species and habitats should identify thresholds for intervention. Intervention may consist of direct management action to reverse the change and/or additional directed research to target the reasons for the detected change.

These recommendations all point to the need to invest a great deal of time and effort into planning and designing the monitoring program for the NCCP/HCP. This planning phase can be costly, and include a period of research, however, having a clear statistically sound monitoring design and analysis approach saves costs over the long term (Lengyel, Deri et al. 2008; Marsh and Trenham 2008).

7.4 Resource Management

1. A Resource Management Plan (RMP) should be prepared for each property that specifically identifies how the property will be managed, and what the priorities for management should be. Management Plans should address: baseline conditions for biological species and habitat, goals and objectives for resource management (which should reflect the goals of the NCCP/HCP), the nature, location and extent of public use and trails, areas for fencing and exclusion, habitat restoration (identify what habitats could be restored where, as well as priorities for restoration), invasive species control (species, locations, and priorities for control), fire management (prevention, suppression and post fire response) and enforcement.
2. If the primary purpose of the conserved lands is mitigation for impacts to habitats and species, then it should be specifically stated in management agreements, deed restrictions/conservation easements, and plans that natural resource conservation and protection shall receive priority over public use and recreation.
3. Activities of landowner/managers should be guided by annual work plans and budgets that are tied to the goals and objectives of the RMPs and NCCP/HCP. Annual work plans should be reviewed and approved by the governing board (with DFG and USFWS providing a major role in reviewing work plans).
4. Conflicts or questions regarding resource management should be resolved by CDFG and USFWS in consultation with OCTA.
5. All annual monitoring and management reports should be posted on OCTA's website. OCTA may also want to consider holding annual public meetings to present the status of implementation of the plan as well as results of monitoring and management actions for the NCCP/HCP. This could also be good for public outreach and education.

8.0 Literature

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