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8 January 2009

Cathy Bechtel
Mid County Parkway Project Manager
Riverside County Transportation Commission
4080 Lemon Street, 3rd Floor
Riverside, CA 92502-2208

Re: Comments on the Mid-County Parkway Draft EIR

Dear Ms. Bechtel:

As stewards of the University of California's Motte Rimrock Reserve, a unit of the University's Natural Reserve System, we view with alarm the selection of Alternative 9 as the Preferred Alternative alignment for the proposed Mid-County Parkway. This alarm is generated specifically because this alignment passes within a few meters of our reserve boundary, and from both a local-scale and landscape-scale perspective is likely to have significant impacts on the biota of the reserve, potentially compromising our mission to provide a natural, protected area for university-level teaching and research. We note that the Reserve is the *only* area within western Riverside County's diminishing coastal sage scrub vegetation type devoted specifically to teaching and research; thus, particular effort should be exerted to avoid compromising this resource. In a separate letter, we detail our concerns directly related to impacts to the Motte Reserve. But in addition, those concerns motivated us to look at some larger-scale potential impacts of the proposed alignments, resulting in the analyses we present below.

Specifically, we wish to challenge the interpretation that "Alternative 9 TWS DV is the least environmentally damaging alternative to both the natural and human environments" (e.g., p. S-20 in the Draft EIR/EIS). Without dissecting each of the individual rationales offered in support of a lesser impact (e.g., Section S.3.2.), our large-scale analysis suggests that Alternative 9 has potentially a greater collective impact on the habitat of plant and animal species of concern than several other alternatives still under serious consideration (Alternatives 4, 5, 6, and 7).

The analysis provided here is based upon previous work conducted in our lab on behalf of the California Department of Transportation.[1] A publication of that work, which describes in considerably more detail

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[1] Kristine L. Preston and John T. Rotenberry, 2007, "California State Department of Transportation and Center for Conservation Biology: WRC MSCHP Niche Model Task Order" (June 1, 2007). Center for Conservation Biology. Paper CCB2007.
http://repositories.cdlib.org/ccb/CCB2007

the methodology we employed, is freely available via the eScholarship Repository of the California Digital Library. The purpose of the research was to provide Caltrans with ecological niche (i.e., habitat) models for covered species for the assessment of the conservation potential of lands throughout the Western Riverside County Multiple Species Habitat Conservation Plan area (WRC MSHCP). Caltrans could then use these results to prioritize lands for further evaluation and potential acquisition in order to meet their Implementing Agreement commitments under the WRC MSHCP. Much of the description that follows is taken directly from the document prepared for Caltrans, which also contains supporting literature references.

Ecological niche modeling uses species occurrence data and GIS environmental variables to construct models that identify and map suitable habitat for species over large spatial areas. These models can be useful in conservation planning and in designing species monitoring and management plans. The models provide a spatially explicit assessment of habitat suitability; identifying where an appropriate combination of suitable environmental conditions occurs. Predictions about habitat suitability can be extended into areas where there is currently no information about the occurrence of a particular species. These spatially-explicit predictions not only facilitate conservation planning and assessments of the conservation potential of lands at a large scale, they can also be used at a finer scale to focus survey efforts in conducting on-the-ground parcel evaluations.

Numerous techniques for developing niche models have appeared in the ecological literature; we used one called partitioned Mahalanobis D^2. As is common for most of these modeling techniques, it connects the spatial locations of detections of a target species throughout a study area to the values at each location of an array of environmental variables (e.g., average temperature, soil type, vegetation type, distance to nearest urbanization) suspected or known to influence the species' distribution. Once the relationship between a species' known localities and the set of environmental variables has been determined by the modeling methodology, we can now assign some index of habitat suitability or probability of occurrence to any locality in the study area based on its particular values for each of the environmental variables. The more similar the values of environmental values at any particular locality in the study are to that combination of values where the species actually was detected, the higher the index.

With the preceding as background, we will outline our development of ecological niche models for a number of species covered under the WRC MSHCP, then show how those models were used to generate estimates of the potential cumulative impacts of five of the proposed Mid-County Parkway alternatives on selected species' habitats.

Model Development and Validation

1. We extracted precise location records (spatial precision < 125m) for WRC MSCHP Covered Species from UC-Riverside's Center for Conservation Biology's (CCB) database, which contained ~56,000 species location records up through 2005.

2. We divided the WRC MSCHP plan area into a grid of 74,832 240m x 240m cells. We calculated values for environmental variables for every cell across the landscape; environmental variables were derived from the California Department of Fish and Game's 2005 digital vegetation map (updated for development by the CCB) and from GIS-based climatic, topographic, soil, and land use layers. For each species we extracted the environmental variables for each grid cell in which the species was detected, and these values became the habitat data in calibration and validation datasets.

3. The "gold standard" for evaluating habitat models is to use a validation dataset generated independently from the observations used to construct the model in the first place (calibration dataset). Thus, in 2006 we also collected an independent dataset of species location records for different taxa from across the WRC MSHCP area to evaluate the performance of candidate models predicting species' occurrence. We focused on coastal sage scrub and chaparral habitats and conducted point count surveys for birds, area and time constrained searches for reptiles, and area constrained transects for rare plants. We added to these validation data several additional surveys for shrubland birds, riparian birds, and rare plants collected as part of independent projects. Some species were poorly represented in our independent datasets; for these, we randomly selected 30% of the localities from the original dataset, withheld them from model building, and used them for validation We used several statistical approaches to assess model quality based on how well models correctly handled these independent data, and based our analyses below only on those models deemed satisfactory.

4. For each species we produced one to several candidate niche models consisting of combinations of various biotic and abiotic environmental variables *a priori* hypothesized to affect the distribution of the target species. From the candidates we selected a species' best model based on its ability to predict validation data. For several species no model seemed to work well, and we do not include them. For this analysis we ultimately retained 19 bird, 6 mammal, 6 reptile, 1 amphibian, 1 insect, and 12 plant species (the latter number also excludes several species that are absent from this part of the plan area). Details of each model and its validation may be found in the Caltrans document.

Mapping Ecological Niche Models

1. As noted above, a model simply relates the distribution of a species to a set of environmental variables. More formally, a model states that the likelihood of the presence of, or the abundance of, or the habitat suitability for a species at a place is some function of the value of the relevant environmental variables at that place. If the model is quantitative (as are most ecological niche models), we can compute this function. Once we have the function, we can take any set of values for the environmental variables and compute that likelihood, abundance, or suitability. In essence, the particular technique we used, partitioned Mahalanobis D^2, generates the "distance" in environmental space the habitat at any place is from the mean habitat of the species based on all the localities where it was detected. The more similar the habitat at a place is to those places where most of the detections occurred, the shorter the distance; the less similar, the longer the distance. Because of the known statistical properties of D^2, we can convert this distance to a scale that ranges from one (habitat at a place is identical to that where the species was detected) to zero (far outside the habitat range of occurrence of the species). In our work we called this a Habitat Similarity Index, or HSI.

2. Once we have a model for a species, we can score each of the 74,832 cells in the WRC MSHCP area for its HSI for that species, based on the specific values of the relevant environmental variables for each cell. We can then plot these HSI values on a map to generate a spatially explicit ecological niche model for the plan area. I have attached a figure from the Caltrans document showing a niche model for Stephens' Kangaroo-rat (HSI's are grouped into three classes for clarity). *Note carefully that this (or any) model does not assert that SKR's will occur at all points where HSI is above a certain value, nor that they will not occur at all points where HSI is below a particular value, only that the habitat at each of these points is more (or less) similar to that where SKR are positively known to occur.* This caveat generalizes to the models provided below.

3. We can overlay these niche maps and add up the individual species' HSI values in a cell to generate a cumulative HSI for any particular group of species (e.g., CSS birds, all reptiles, all species). This value will range from zero (no similar habitat for any of the species) to *S* (very highly similar habitat for all species), where *S* is the number of species being considered.

4. We downloaded the image of the map describing the alternative routes from the Mid-County Parkway web site (http://www.midcountyparkway.org/uploads/map_2008.pdf), imported it into ARC GIS, digitized it, georectified it, then hand digitized the proposed alignments as lines. (Apparently, an already digitized GIS layer of the alignments is not available). We then created buffers of 100m, 200m, and 300m around each of the alignments, recognizing that the impacts of roads and highways on the surrounding biota extend beyond their literal footprint. (We note in passing that basic principles of landscape ecology, including the observation that effects of disturbances can be propagated well beyond the edges of the disturbance itself, appeared to have played little role in assessing potential impacts.)

5. We overlaid these alignment buffers on HSI maps of each of the 45 species for which we had suitable niche models. For each alignment for each buffer we summed the total area within the buffer and the amount of area within the buffer identified as "developed" on the 2005 CDFG vegetation map (Table 1). We also summed the HSI values for each species within the buffer (Table 1). Because HSI values are assigned to a cell, and because for many cells only a portion of the cell fell within a buffer, we weighted those HSI's by the proportion of the cell within the buffer (i.e., if 30% of a cell with an HSI of 0.90 fell within a buffer, we added the value $0.3*0.9 = 0.27$). In addition to each species' total HSI for each alignment for each buffer width, we also calculated the species' average HSI per cell by dividing the total HSI by the total number of cells (adding up both whole cells and proportions of cells) within the buffer (Table 2). We also computed total HSI (Table 3) and average HSI (Table 4) for various groups of species.

A species' total HSI within a buffer is an *index* of the cumulative amount of habitat for that species. Because alignments differ in area (and hence the number of modeled cells), we also calculated the mean HSI per cell to allow us to compare more directly. This, too, is an *index* to the average "quality" of habitat within a buffer.

Results

We are less concerned with the absolute values of either species or group HSI totals or averages, but more with the relative magnitude of these values across alignments. As it turned out, differences among the three buffer widths (once the proportional differences in their areas was taken into account) were relatively small, especially when compared to the differences among the five alignments for any particular buffer width. Thus, the tables only contain the results for the 100-m buffer.

Without too much elaboration, it is clear that *Alternative Alignment 9 contains the maximum total HSI for the great majority of species modeled* (36 out of 45; Table 1). These maxima for Alternative 9 average about a third greater than for the alignment with the next largest total HSI for the species, and for a few species are more than twice as much. While some of this represents species with relatively small totals to begin with (e.g., Southern Sagebrush Lizard, Grasshopper Sparrow), others are comparatively quite large (e.g., Coast Horned Lizard, Southern California Rufous-crowned Sparrow). Note that several species, such as Coulter's Goldfield and San Jacinto Valley Crownscale show almost no variation across alignments; this is principally because habitat for these species occurs almost entirely east of Perris, and all alignments share the same footprint in this region.

Likewise, it is clear that *Alternative Alignment 9 contains the maximum average HSI for the great majority of species modeled* (36 out of 45; Table 2). Although some of these averages are quite low (e.g., Mojave Tarplant, Southern Sagebrush Lizard), consistent with the observation that all of the alignments lie outside the general areas of distribution for these species, others are quite high (e.g., Sharp-shinned Hawk), implying the presence of substantial suitable habitat within the buffered area.

Note that our calculation of averages will tend to underestimate the presence of highly suitable modeled habitat within a buffer because our analysis does not taken into account variance among the cells in habitat quality. For example, in one case we might have 100 cells with HSI of 0.20 (a relatively low value and likely to have low chance of occupancy by the species) yielding a total HSI of 20.0 and a mean of 0.20. Alternatively, 25 cells might have HSI's of 0.77 (a high value with a good likelihood of occupancy in our experience) and 75 of 0.01 (highly unsuitable), and yield the same total of 20.0 and mean of 0.20. In the former case we might assert that the 100-cell parcel is generally of low quality, whereas in the latter we might conclude that the parcel contains a significant portion of high-quality habitat. Such an analysis is feasible, but beyond the scope of what we are presenting here.

Results of grouping species into classes essentially mirror those when species are considered separately, both for total HSI (Table 3) and average HSI (Table 4); all groups have maxima in Alignment 9. Regarding total HSI, it is clear that *coastal sage scrub animals (birds and reptiles) would be disproportionally affected under Alternative Alignment 9 than the other alignments*. Although we have not overlaid our buffers on the CDFG vegetation map, we suspect that Alternative 9 likely contains a greater area in coastal sage scrub and related vegetation types than the other alignments.

We did not undertake this analysis to provide criteria to support selection of one of the other alternatives; that presupposes the need for a Mid-County Parkway along any alignment has been fully rationalized, and we offer no opinion about that. That said, our results provide some suggestion that Alternative 7 may involve minimum total HSI's for more species than the other alignments.

Conclusions

By broadening our perspective to include the cumulative impact on potential habitat of species of concern at more relevant spatial scales (i.e., not simply within the footprint of construction or between the right-of-way boundaries), we challenge the assertion that Alignment 9 is the least damaging alternative to the natural environment, at least for those species covered under the WRC MSHCP and for which we have validated ecological models. Indeed, our analysis suggest it potentially has the most impact, and, based on our metrics, by a substantial margin over the other alignments. Moreover, we suggest that an appropriate analysis that considered relevant-scale impacts on other criteria (e.g., MSHCP criteria areas, aquatic resources, existing habitat reserves) rather than one confined to the project's immediate footprint might well lead to a reassessment of the ranking of those other criteria among alternative alignments.

Sincerely,

John T. Rotenberry
Professor of Biology
Campus Director, UCR Natural Reserve System

Table 1. Summed per-cell HSI values for modeled species within 100-m buffer around five different proposed Mid-County Parkway alignments. Total area, total "developed" area, and total number of modeling grid cells within each alignment buffer are also shown. Bold entries denote maximum value for each species across alignments.

	Buffer Width	100 m				
	Alignment Alternative	alt4	alt5	alt6	alt7	alt9
	Total Area (hectares)	1110.3	1078.9	1135.0	1070.9	1081.9
	Developed Area (hectares)	751.1	712.4	791.4	702.6	803.9
	Total Number of Cells	177.7	172.6	181.6	171.4	173.1
Birds	Bell's Sage Sparrow	25.60	20.86	20.44	19.99	**36.48**
	Cactus Wren	38.89	38.41	41.65	35.69	**48.99**
	California Gnatcatcher	24.51	24.59	19.72	20.93	**33.04**
	California Horned Lark	57.49	54.56	60.72	49.72	**68.52**
	Cooper's Hawk	52.31	51.76	49.26	48.24	**68.43**
	Downy Woodpecker	18.96	17.59	20.20	14.00	**24.20**
	Ferruginous Hawk	76.36	72.32	**81.44**	71.17	77.47
	Golden Eagle	54.23	52.64	51.19	51.09	**70.23**
	Grasshopper Sparrow	2.16	2.16	0.95	2.28	**7.47**
	Least Bell's Vireo	17.57	17.43	**28.44**	15.63	14.13
	Mountain Quail	9.24	7.84	8.47	7.30	**24.55**
	Northern Harrier	52.10	49.65	46.66	46.46	**66.13**
	Southern California Rufous-crowned Sparrow	13.29	13.16	12.09	13.56	**27.18**
	Sharp-shinned Hawk	90.00	85.61	97.18	82.24	**106.86**
	Turkey Vulture	47.80	44.54	46.33	40.97	**65.86**
	Western Burrowing Owl	**62.65**	57.96	58.45	58.31	47.77
	White-tailed Kite	51.31	49.44	50.82	45.08	**69.25**
	Yellow-breasted Chat	12.50	12.40	**13.77**	9.25	5.96
	Yellow Warbler	20.29	21.53	12.94	20.47	**44.87**
Mammals	Brush Rabbit	26.78	23.62	27.03	24.84	**31.13**
	Coyote	48.40	47.59	53.12	44.69	**62.46**
	Northwestern San Diego Pocket Mouse	44.56	43.59	39.62	41.16	**61.50**
	San Diego Black-tailed Jackrabbit	38.22	38.03	39.26	34.66	**55.95**
	San Diego Desert Woodrat	23.94	23.79	16.32	21.91	**39.35**
	Stephens' Kangaroo-rat	45.09	44.26	46.68	42.20	**53.98**
Plants	Coulter's Goldfield	25.74	25.74	25.74	25.74	25.74
	Engelmann Oak	15.94	14.96	18.49	13.78	**19.72**
	Graceful Tarplant	11.70	11.70	11.96	11.45	**22.32**
	Little Mousetail	28.47	28.47	28.42	28.40	**40.78**
	Long-spined Spineflower	39.07	37.52	37.40	32.91	**54.24**

Table 1 continued.

	Mojave Tarplant	2.49	2.45	2.48	2.34	**3.01**
	Munz's Onion	34.38	28.69	33.18	25.56	**47.35**
	Nevin's Barberry	33.34	31.94	34.29	31.02	**36.43**
	Rainbow Manzanita	0.63	0.63	**1.36**	0.72	0.63
	San Jacinto Valley Crownscale	27.77	27.91	27.77	27.92	**28.38**
	Small-flowered Microseris	21.84	19.26	16.96	20.84	**29.61**
	Smooth Tarplant	47.24	45.83	**51.18**	47.68	43.56
Reptiles	Coast Horned Lizard	22.49	22.49	13.72	19.57	**46.19**
	Coastal Western Whiptail	30.29	30.35	26.23	28.79	**52.89**
	Granite Spiny Lizard	11.43	11.41	15.41	10.24	**33.14**
	Northern Red Diamond Rattlesnake	41.01	40.21	37.07	38.69	**56.91**
	Orange-throated Whiptail	36.44	36.27	27.88	34.79	**50.67**
	Southern Sagebrush Lizard	0.44	0.42	0.44	0.38	**5.45**
Amphibians	Arroyo Toad	0.01	0.01	**0.53**	0.04	0.27
Insects	Quino Checkerspot Butterfly	**14.06**	11.82	12.78	12.63	12.76

Table 2. Average per-cell HSI values for modeled species within 100-m buffer around five different proposed Mid-County Parkway alignments. Total area, total "developed" area, and total number of modeling grid cells within each alignment buffer are also shown. Bold entries denote maximum value for each species across alignments.

	Buffer Width	100 m				
	Alignment Alternative	alt4	alt5	alt6	alt7	alt9
	Total Area (hectares)	1110.3	1078.9	1135.0	1070.9	1081.9
	Developed Area (hectares)	751.1	712.4	791.4	702.6	803.9
	Total Number of Cells	177.7	172.6	181.6	171.4	173.1
Birds	Bell's Sage Sparrow	0.14	0.12	0.11	0.12	**0.21**
	Cactus Wren	0.22	0.22	0.23	0.21	**0.28**
	California Gnatcatcher	0.14	0.14	0.11	0.12	**0.19**
	California Horned Lark	0.32	0.32	0.33	0.29	**0.40**
	Cooper's Hawk	0.29	0.30	0.27	0.28	**0.40**
	Downy Woodpecker	0.11	0.10	0.11	0.08	**0.14**
	Ferruginous Hawk	0.43	0.42	**0.45**	0.42	**0.45**
	Golden Eagle	0.31	0.30	0.28	0.30	**0.41**
	Grasshopper Sparrow	0.01	0.01	0.01	0.01	**0.04**
	Least Bell's Vireo	0.10	0.10	**0.16**	0.09	0.08
	Mountain Quail	0.05	0.05	0.05	0.04	**0.14**
	Northern Harrier	0.29	0.29	0.26	0.27	**0.38**
	Southern California Rufous-crowned Sparrow	0.07	0.08	0.07	0.08	**0.16**
	Sharp-shinned Hawk	0.51	0.50	0.54	0.48	**0.62**
	Turkey Vulture	0.27	0.26	0.26	0.24	**0.38**
	Western Burrowing Owl	**0.35**	0.34	0.32	0.34	0.28
	White-tailed Kite	0.29	0.29	0.28	0.26	**0.40**
	Yellow-breasted Chat	0.07	0.07	**0.08**	0.05	0.03
	Yellow Warbler	0.11	0.12	0.07	0.12	**0.26**
Mammals	Brush Rabbit	0.15	0.14	0.15	0.14	**0.18**
	Coyote	0.27	0.28	0.29	0.26	**0.36**
	Northwestern San Diego Pocket Mouse	0.25	0.25	0.22	0.24	**0.36**
	San Diego Black-tailed Jackrabbit	0.22	0.22	0.22	0.20	**0.32**
	San Diego Desert Woodrat	0.13	0.14	0.09	0.13	**0.23**
	Stephens' Kangaroo-rat	0.25	0.26	0.26	0.25	**0.31**
Plants	Coulter's Goldfield	0.14	0.15	0.14	0.15	0.15
	Engelmann Oak	0.09	0.09	0.10	0.08	**0.11**
	Graceful Tarplant	0.07	0.07	0.07	0.07	**0.13**
	Little Mousetail	0.16	0.16	0.16	0.17	**0.24**
	Long-spined Spineflower	0.22	0.22	0.21	0.19	**0.31**

Table 2 continued.

	Mojave Tarplant	0.01	0.01	0.01	0.01	**0.02**
	Munz's Onion	0.19	0.17	0.18	0.15	**0.27**
	Nevin's Barberry	0.19	0.19	0.19	0.18	**0.21**
	Rainbow Manzanita	0.00	0.00	0.01	0.00	0.00
	San Jacinto Valley Crownscale	0.16	0.16	0.15	0.16	0.16
	Small-flowered Microseris	0.12	0.11	0.09	0.12	**0.17**
	Smooth Tarplant	0.27	0.27	**0.28**	**0.28**	0.25
Reptiles	Coast Horned Lizard	0.13	0.13	0.08	0.11	**0.27**
	Coastal Western Whiptail	0.17	0.18	0.14	0.17	**0.31**
	Granite Spiny Lizard	0.06	0.07	0.08	0.06	**0.19**
	Northern Red Diamond Rattlesnake	0.23	0.23	0.20	0.23	**0.33**
	Orange-throated Whiptail	0.21	0.21	0.15	0.20	**0.29**
	Southern Sagebrush Lizard	0.00	0.00	0.00	0.00	**0.03**
Amphibians	Arroyo Toad	0.00	0.00	0.00	0.00	0.00
Insects	Quino Checkerspot Butterfly	0.08	0.07	0.07	0.07	0.07

Table 3. Summed per-cell HSI values for groups of modeled species within 100-m buffer around five different proposed Mid-County Parkway alignments. Bold entries denote maximum value for each group across alignments.

	Buffer Width	100 m				
	Alignment Alternative	alt4	alt5	alt6	alt7	alt9
Birds	All Birds (19)	727.3	694.4	720.7	652.3	**907.4**
	Coastal Sage Scrub Species (3)	63.4	58.6	52.3	54.5	**96.7**
	Grassland Species (3)	111.7	106.4	108.3	98.5	**142.1**
	Riparian Species (4)	69.3	68.9	75.4	59.3	**89.2**
	Raptors (7)	439.0	419.4	435.0	402.6	**506.1**
Mammals	All Mammals (6)	227.0	220.9	222.0	209.5	**304.4**
Plants	All Plants (12)	288.6	275.1	289.2	268.4	**351.8**
	Alkali Plant Community (4)	129.2	128.0	133.1	129.7	**138.5**
Reptiles	All Reptiles (6)	142.1	141.2	120.8	132.5	**245.2**
	Coastal Sage Scrub Reptiles (5)	141.7	140.7	120.3	132.1	**239.8**

Coastal Sage Scrub birds include Bell's Sage Sparrow, California Gnatcatcher, and Southern California Rufous-crowned Sparrow.
Grassland birds include California Horned Lark, Grasshopper Sparrow, and Northern Harrier.
Riparian birds include Downy Woodpecker, Least Bell's Vireo, Yellow Warbler, and Yellow-breasted Chat
Raptors include Cooper's Hawk, Ferruginous Hawk, Golden Eagle, Northern Harrier, Sharp-shinned Hawk, Western Burrowing Owl, and White-tailed Kite
Alkali plant community includes Coulter's Goldfield, Little Mousetail, San Jacinto Valley Crownscale, and Smooth Tarplant.
Coastal sage scrub reptiles include all reptiles except Southern Sagebrush Lizard.
See Table 1 for all birds, mammals, plants, and reptiles, and amphibians and insects.

Table 4. Average per-cell HSI values for groups of modeled species within 100-m buffer around five different proposed Mid-County Parkway alignments. Bold entries denote maximum value for each group across alignments.

	Buffer Width	100 m				
	Alignment Alternative	alt4	alt5	alt6	alt7	alt9
Birds	All Birds (19)	4.1	4.0	4.0	3.8	**5.2**
	Coastal Sage Scrub Species (3)	0.4	0.3	0.3	0.3	**0.6**
	Grassland Species (3)	0.6	0.6	0.6	0.6	**0.8**
	Riparian Species (4)	0.4	0.4	0.4	0.3	**0.5**
	Raptors (7)	2.5	2.4	2.4	2.3	**2.9**
Mammals	All Mammals (6)	1.3	1.3	1.2	1.2	**1.8**
Plants	All Plants (12)	1.6	1.6	1.6	1.6	**2.0**
	Alkali Plant Community (4)	0.7	0.7	0.7	**0.8**	**0.8**
Reptiles	All Reptiles (6)	0.8	0.8	0.7	0.8	**1.4**
	Coastal Sage Scrub Reptiles (5)	0.8	0.8	0.7	0.8	**1.4**

Coastal Sage Scrub birds include Bell's Sage Sparrow, California Gnatcatcher, and Southern California Rufous-crowned Sparrow.
Grassland birds include California Horned Lark, Grasshopper Sparrow, and Northern Harrier.
Riparian birds include Downy Woodpecker, Least Bell's Vireo, Yellow Warbler, and Yellow-breasted Chat
Raptors include Cooper's Hawk, Ferruginous Hawk, Golden Eagle, Northern Harrier, Sharp-shinned Hawk, Western Burrowing Owl, and White-tailed Kite
Alkali plant community includes Coulter's Goldfield, Little Mousetail, San Jacinto Valley Crownscale, and Smooth Tarplant.
Coastal sage scrub reptiles include all reptiles except Southern Sagebrush Lizard.
See Table 1 for all birds, mammals, plants, and reptiles, and amphibians and insects.

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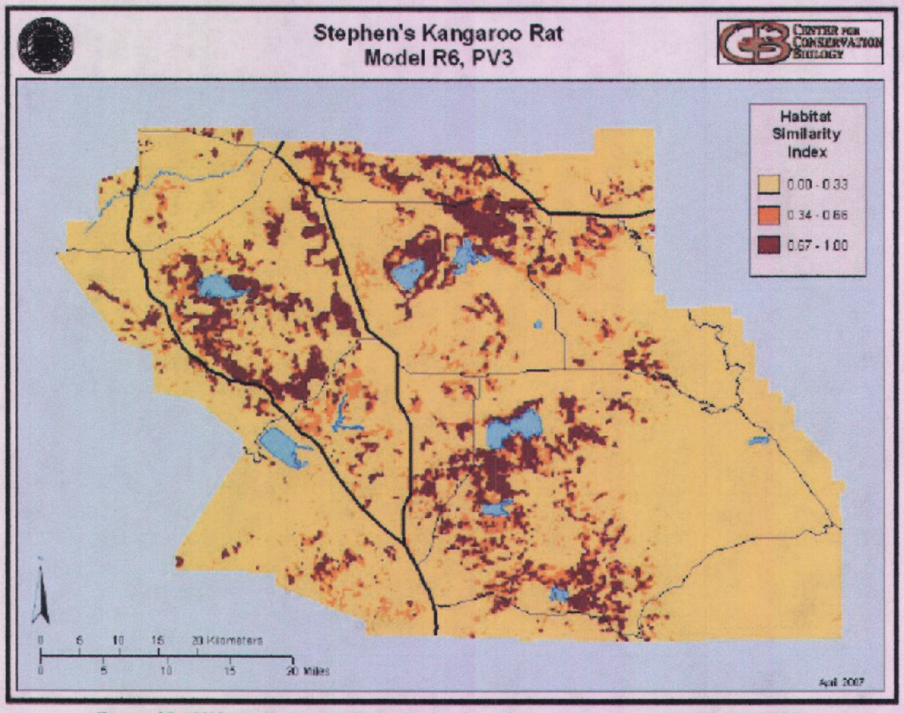

Figure 57. "HSI's" of habitat similarity for Stephens' kangaroo rat across the WRC MSHCP. The higher the HSI, the greater the similarity to occupied habitat.

Example of an ecological niche map for Stephens' Kangaroo-rat. Habitat Similarity Index (HSI) ranges from zero (least similar) to one (most similar), but values on map are grouped into three classes for clarity.