



Department of Defense Legacy Resource Management Program

PROJECT 07-290

**QUANTIFYING IMPACTS OF GROUNDWATER
WITHDRAWAL ON AVIAN COMMUNITIES IN DESERT
RIPARIAN WOODLANDS OF THE SOUTHWESTERN U.S.**

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**Quantifying impacts of ground water withdrawal on avian communities in
desert riparian woodlands of the southwestern U.S.**

Final Models

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Table 1. Final models for community-level bird parameters (species richness and total relative abundance) generated from stepwise multiple linear regression using data collected from April-September 2006 and 2007 at 21 study sites located in riparian woodlands of southeastern Arizona.

Variables selected in final models	<i>b</i>	SE	Beta	<i>t</i>	<i>P</i>
<u>Species richness (total)</u>					
Constant	67.800	4.655	-	14.6	<0.001
Year	-8.733	3.416	-0.506	-2.6	0.019
<u>Species Richness - Riparian Obligate Species</u>					
Constant	19.387	1.180	-	16.4	<0.001
Factor 2 (canopy height/volume of live POPFRE in canopy)	1.350	0.400	0.624	3.4	0.004
Factor 5 (volume of live grass in understory)	0.931	0.360	0.438	2.6	0.020
Factor 1 (volume of live vegetation. in understory and mid-story)	0.968	0.426	0.425	2.3	0.037
Year	-1.557	0.902	-0.339	-1.7	0.103
<u>Total relative abundance</u>					
Constant	19.558	2.555	-	7.654	<0.001
Stream size	-4.019	1.259	-0.573	-3.191	0.006
Factor 4 (volume of live Velvet Mesquite in mid-story and canopy)	3.409	0.666	0.978	5.120	<0.001
Surface water ¹	2.271	0.717	0.609	3.170	0.006
Year	-1.778	1.143	-0.231	-1.555	0.139

¹ Log10 +1 transformation applied to variable.

Table 2. Final models for 8 species of riparian birds that were associated with either the presence and extent of surface water (m²) or the percentage of dead or dormant vegetation ≤50 m from each bird survey point. Models were generated from stepwise multiple linear regression using data collected from April-September 2006 and 2007 at 21 study sites located in riparian woodlands of southeastern Arizona.

Variables selected in final models	<i>b</i>	SE	Beta	<i>t</i>	<i>P</i>
<u>White-winged Dove</u>					
Constant	1.182	0.070	-	17.0	<0.001
Stream size	-0.236	0.055	-0.819	-4.3	0.001
Factor 4 (volume of live Velvet Mesquite in mid-story and canopy)	0.138	0.031	0.967	4.501	0.001
Surface water ¹	0.110	0.033	0.719	3.4	0.004
Factor 2 (canopy height/volume of live Fremont Cottonwood in canopy)	-0.076	0.026	-0.514	-2.9	0.010
<u>Ladder-backed Woodpecker</u>					
Constant	1.098	0.010	-	112.0	<0.001
Factor 3 (volume of dead vegetation in understory, mid-story, and canopy)	0.028	0.013	0.450	2.3	0.036
Factor 1 (volume of live vegetation in understory and mid-story)	0.015	0.011	0.269	1.4	0.192
<u>Black Phoebe</u>					
Constant	-0.072	0.029	-	-2.5	0.024
Surface water ¹	0.066	0.016	0.925	4.3	0.001
Factor 4 (volume of live Velvet Mesquite in mid-story and canopy)	0.041	0.015	0.607	2.8	0.012
<u>Vermillion Flycatcher</u>					
Constant	0.603	0.072	-	8.4	<0.001
Factor 1 (volume of live vegetation in understory and mid-story)	-0.146	0.043	-0.347	-3.4	0.004
Stream size	-0.526	0.114	-0.677	-4.6	0.001
Factor 5 (volume of live grass in understory)	0.113	0.040	0.287	2.8	0.013
Factor 4 (volume of live Velvet Mesquite in mid-story and canopy)	0.182	0.050	0.471	3.6	0.003
Factor 3 (volume of dead vegetation in understory, mid-story, and canopy)	-0.215	0.057	-0.438	-3.8	0.002
Factor 2 (canopy height/volume of live Fremont Cottonwood in canopy)	0.097	0.043	0.242	2.3	0.040

Table 2 cont.

Variables selected in final models	<i>b</i>	SE	Beta	<i>t</i>	<i>P</i>
<u>Bewick's Wren</u>					
Constant	3.329	0.673	-	5.0	<0.001
Factor 2 (canopy height/volume of live Fremont Cottonwood in canopy)	0.222	0.074	0.495	3.0	0.011
Factor 3 (volume of dead vegetation in understory, mid-story, and canopy)	-0.339	0.176	-0.356	-1.9	0.077
Factor 4 (volume of live Velvet Mesquite in mid-story and canopy)	0.157	0.095	0.287	1.6	0.123
Stream size	0.169	0.085	0.391	2.0	0.068
Width riparian area (m) ²	-0.595	0.231	-0.685	-2.6	0.023
Factor 5 (volume of live grass in understory)	-0.329	0.150	-0.627	-2.2	0.047
<u>Lucy's Warbler</u>					
Constant	1.847	0.328	-	5.6	<0.001
Factor 4 (volume of live Velvet Mesquite in mid-story and canopy)	0.201	0.100	0.371	2.0	0.060
Year	-0.603	0.237	-0.505	-2.5	0.021
Factor 3 (volume of dead vegetation in understory, mid-story, and canopy)	0.240	0.137	0.349	1.8	0.096
<u>Common Yellowthroat</u>					
Constant	-0.216	0.322	-	-0.7	0.514
Stream size	-0.315	0.109	-0.493	-3.0	0.012
Factor 3 (volume of dead vegetation in understory, mid-story, and canopy)	-0.195	0.045	-0.483	-4.3	0.001
Factor 2 (canopy height/volume of live Fremont Cottonwood in canopy)	0.098	0.036	0.297	2.7	0.018
Factor 5 (volume of live grass in understory)	0.135	0.037	0.419	3.6	0.003
Width riparian area (m) ²	0.143	0.064	0.371	2.2	0.041
Factor 4 (volume of live Velvet Mesquite in mid-story and canopy)	0.073	0.041	0.229	1.8	0.099
<u>House Finch</u>					
Constant	1.296	0.346	-	3.8	0.002
Year	-0.397	0.249	-0.332	-1.6	0.130
Factor 4 (volume of live Velvet Mesquite in mid-story and canopy)	0.185	0.105	0.341	1.8	0.097
Factor 3 (volume of dead vegetation in understory, mid-story, and canopy)	-0.226	0.144	-0.328	-1.6	0.135

¹ *Log*10 + 1 transformation applied to variable.² *Ln* + 1 transformation applied to variable.

Predictive equations for total bird relative abundance and bird species positively associated with surface water (adapted from Table 1):

- Total bird relative abundance of birds (within 50 m of survey point) = $2.271(\text{extent of surface water [m}^2\text{] within 50 m of survey point}) + 3.409(\text{volume of live Velvet Mesquite in mid-story and canopy}) - 4.019(\text{stream size}) - 1.778(\text{year}) + 19.558$.
- Black Phoebe relative abundance (within 50 m of survey point) = $0.066(\text{extent of surface water [m}^2\text{] within 50 m of survey point}) + 0.041(\text{volume of live Velvet Mesquite in mid-story and canopy}) - 0.072$.
- White-winged Dove relative abundance (within 50 m of survey point) = $0.110(\text{extent of surface water [m}^2\text{] within 50 m of survey point}) + 0.138(\text{volume of live Velvet Mesquite in mid-story and canopy}) - 0.236(\text{stream size}) - 0.076(\text{Canopy height/volume of live Fremont Cottonwood in canopy}) + 1.182$.