

13 May 2019
Kaitlin Brown and Marcie Mathieu
Humboldt State University
1 Harpst street, Arcata, CA 95521
707-826-3953
kab1519@humboldt.edu, mmm1412@humboldt.edu

RH: Brown and Mathieu-

Changes in Abundance of Corvid Habitat Usage in Arcata, CA, USA from 2011-2019

KAITLIN BROWN, MARCIE MATHIEU, *Humboldt State University, 1 Harpst Street, Arcata, CA 95521*

ABSTRACT

American crows and common ravens abundance has increased globally and more around urbanized areas. Their distributions have been described as complementary so we predicted that if ravens and crows are utilizing different habitat types then there will be different abundances in the varying habitat types. We conducted our study across three gradient types (urban, agriculture, and forest) in the city of Arcata, California. We found that ravens and crows used specific habitats in different abundances and that within each year that crows and ravens varied in usage of habitats. This information points to understanding what individual variables affect the abundance differences within crows and ravens of different years.

KEYWORDS: raven, crow, difference, distribution, Humboldt, land gradient, seasonal, variance,.

American crow (*Corvus brachyrhynchos*) and common ravens (*C. corax*) are distributed across North America (Gorenzel and Salmon 1992, Boarman and Heinrich 1999) Common raven and American crow numbers have been increasing across their range (Kelly et al. 2002, Withey and Marzluff 2005). American Crows have had a shift from rural to urban nesting and roosting sites

especially in the Sacramento and San Joaquin valley (Gorenzel and Salmon 1992, Withey and Marzluff 2005). American Crow populations in urban areas have higher numbers and have more population growth (Shoemaker and Phillips 2011). Even though crow reproduction is low in cities, they may be choosing more urban areas to move to for some benefit. Rural nesting has been recorded to be higher than suburban residential crows and they had higher protein levels in urban areas which may be due to food limitations in suburban nesting (Heiss et al. 2009).

American crows and common ravens tend to have complementary distributions which is why we see ravens to be in agricultural areas and crows within cities (Kelly et al. 2002.) A study in 2015 looked at the home ranges and movements of little raven (*Corvus mellori*). They reported the birds having large home ranges and distribution of anthropogenic food could have influenced their movement since birds closer to human settlements have smaller home ranges (Whisson et al. 2015). Another study looked at vegetation, visitors, and human food availability regarding bird distributions where they found common ravens used areas with fewer people but a high density near road edges (Walker and Marzluff 2015). Juvenile common ravens have had an increase in abundance near anthropogenic food sources which has increased their social opportunities (Webb et al. 2007). There have been variation in habitat use across corvid species. Is there a shift in habitat utilization of ravens and crows across the years?

Our objectives of this study are (1) to identify habitat of American crow and common ravens, (2) to see if there is a shift in habitat from 2011 data to 2019 data in corvid habitat utilization. Our hypothesis is that crow and raven will utilize different habitats. We predict that if they are utilizing different habitat types then there will be different abundances in the varying habitat types.

STUDY AREA

We conducted our study in the northern part of California more specifically in the city of Arcata, California 95521. The sites were picked from previous classes where they chose 16 sites across 3 land types: urban, agriculture, and forest. This is a total of 48 sites distributed across the city of Arcata. Arcata is the ideal place to conduct this study because it has all the land types as it is alongside a redwood forest to the east and to the west is agricultural pasture land. Arcata population census from 2017 has estimates of about 18,000 people (US Census Bureau 2017).

METHODS

Students conducted point counts of crows and ravens during fall months of 2011 and spring months of 2012, 2017, and 2019. Point counts were conducted during the hours after sunrise until 11am. Sixteen sites were surveyed three times each by different pairs of students. Surveyors located sites and stood within a 50 m radius of the GPS point. We then recorded environmental data of presence of human food, precipitation, wind speed, cloud cover, visibility, human presence, car traffic, and presence of trash cans or dumpsters and presence of trash outside of trash cans or dumpsters. We then conducted 15 minute point counts where we recorded presence of crows or ravens detected visually or by call and whether they were within a 50 m radius of our site or not. Number of crows or ravens flying over and what substrate type perched on was also noted. Behavioral data such as if the bird was foraging, flying, or engaging in social behavior (seen with another individual) was also taken.

Statistical Analysis

We conducted a two tailed t-test to analyze changes in abundance within crows and ravens from fall 2011 and spring 2019. We also utilized a 2-way ANOVA to look at the variance within crows and ravens across all three habitat types.

RESULTS

An average of 13.33 crows and ravens were surveyed in fall 2011 and spring 2019 once a week for three weeks. The 3 surveys from each year were then averaged to find our sample size for ravens and crows in 2011 and 2019 ($n=96$). Crow and raven abundance has not significantly changed from fall 2011 - spring 2019. Although no statistics were technically significant, there was greater number of ravens 2011 in urban areas ($t = 1.93$, $df = 30$, $P = 0.06$).

Crow abundance varied in fall 2011 ($F = 23.69$, $df = 2, 45$, $P < 0.001$) and spring 2019 ($F = 16.78$, $df = 2, 45$, $P < 0.001$). Raven abundance varied across land cover types in fall 2011 ($F = 3.98$, $df = 2, 45$, $P < 0.05$) but abundance was not significantly varied in spring 2019 ($F = 0.98$, $df = 2, 45$, $P = 0.38$).

DISCUSSION

Our results answered our two objectives of identifying habitat usage of American crow and common ravens and to see if there is a shift in habitat from 2011-2019. In 2011 and 2019, out of agricultural lands, forest habitats, and urban environments, crows were seen utilizing urban environments the most while ravens were seen using all habitat types but utilized agricultural land and forested environments for than crows (Fig 1, 2.). American crows and ravens can utilize open space habitats such as grasslands, farmlands, and use forests to roost, but common ravens tend to select for more natural areas while American crows can be found more in anthropogenically influenced areas (Berg 1999, Parr 2005).

Our results also stated that abundance of crows and ravens did vary between the years in the three habitat types except for spring 2019 for ravens. Possible reasons for the lack of cohesion for spring 2019 raven data may be environmentally driven. Because we chose to pull data from two different years and two different seasons, there may be other external seasonal pre Our 2011 data was taken in the fall so there may have been differences in seasonal habitat use as ravens have been known to use city environments during colder months (Baltensperger et al. 2013). If we would have used the spring 2012 data we may have had more cohesive data to pull findings from as they would have been the same season but different years.

MANAGEMENT IMPLICATIONS

With the increase in corvid numbers in and around cities it is important to know where they are found and what draws them into a particular site. Now that we know how corvids have been distributed around Arcata, the next step would to be look into what draws them to those sites and if there is a pattern of behavior at each site. Understanding what factors attract crows and ravens to certain environments is useful information for management so that we can mitigate corvid disturbance on endangered species and human and wildlife conflict with the increasing human and corvid population. For example, if crows are attracted to anthropogenic food waste then making sure areas near endangered species that crows are known to predate on would be important to eliminate possible attractants to the area.

ACKNOWLEDGMENTS

Thank you to Barbara Clucas for giving us the opportunity to do this study and use her previous classes data for analysis. A shout out to our classmates who went out every week to collect data.

LITERATURE CITED

Berg, R. 1999. "Corvus corax" (On-line), Animal Diversity Web. Accessed May 14, 2019 at https://animaldiversity.org/accounts/Corvus_corax/

Boarman, W. I., and B. Heinrich. 1999. Common raven (*Corvus corax*). Birds of North America. Cornell Lab of Ornithology, Ithaca, NT, USA. <https://doi.org/10.2173/bna.476>

Baltensperger, A. P., T. C. Mullet, M. S. Schmid, G. R. Humphries, L. Kover, and F. Huettmann. 2013. Seasonal observations and machine-learning-based spatial model predictions for the common raven (*Corvus corax*) in the urban, sub-arctic environment of Fairbanks, Alaska. Polar Biology 36: 1587-1599.

Gorenzel, W. P., and T. P. Salmon. 1992. Urban crow roosts in California. Proceedings of the Fifteenth Vertebrate Pest Conference 33.

Heiss, R. S., A. B. Clark, and K. J. McGowan. 2009. Growth and nutritional state of American crow nestlings vary between urban and rural habitats. Journal of Wildlife Rehabilitation 19:829-839.

Kelly, J. P., K. L. Etienne, and J. E. Roth. 2002. Abundance and distribution of the common raven and American crow in the San Francisco Bay Area, California. Western Birds 33: 202-217.

Parr, C. 2005. "Corvus brachyrhynchos" (On-line), Animal Diversity Web. Accessed May 14, 2019 at https://animaldiversity.org/accounts/Corvus_brachyrhynchos/

Shoemaker, C. M., and R. S. Phillips. 2011. Observation of ground roosting by American crows. The Wilson Journal of Ornithology 123: 185-187.

United States Census Bureau. 2017. U.S. Department of Commerce.

- Walker, L. E., and J. M. Marzluff. 2015. Recreation changes the use of a wild landscape by corvids. *The Condor* 117:262-283.
- Webb, W. C., W. I. Boarman, and J. T. Rotenberry. 2007. Movements of juvenile common ravens in an arid landscape. *The Journal of Wildlife Management* 73:72-81.
- Whisson, D. A., M. A. Weston, and K. Shannon. 2015. Home range, habitat use and movements by the little raven (*Corvus mellori*) in a coastal peri-urban landscape. *Wildlife Research* 42:500-508.
- Withey J. C., and J. M. Marzluff. 2005. Dispersal by juvenile American crows (*Corvus brachyrhynchos*) influences population dynamics across a gradient of urbanization. *The Auk* 122:205-221.

TABLES/FIGURES

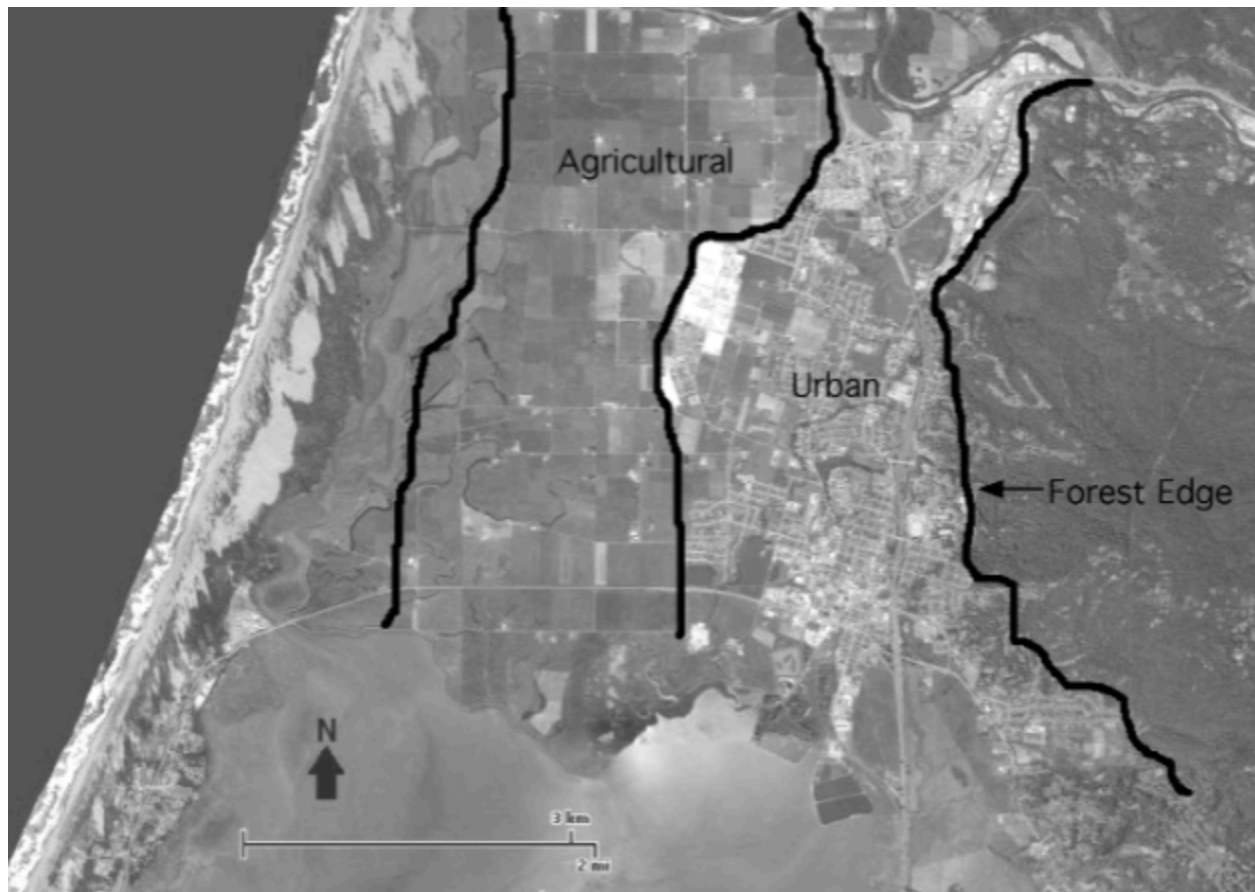


Figure 1. This is a map that the previous semesters used to shot the three different land cover types of Arcata, California, 95521.

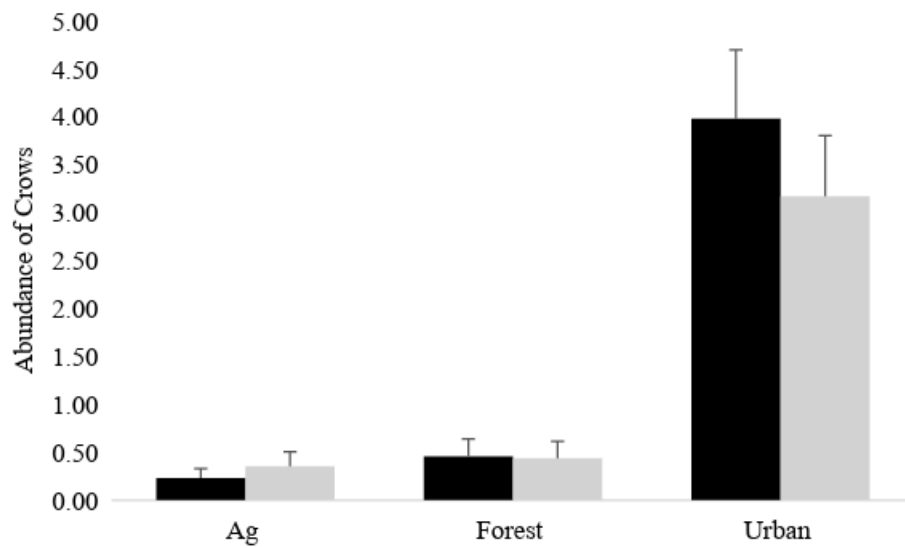


Figure 2. Abundance of crows across three habitats from Fall 2011 and Spring 2019 (Humboldt County, California, USA). Black represent 2011 and gray represents 2019 (n=16 per land cover types).

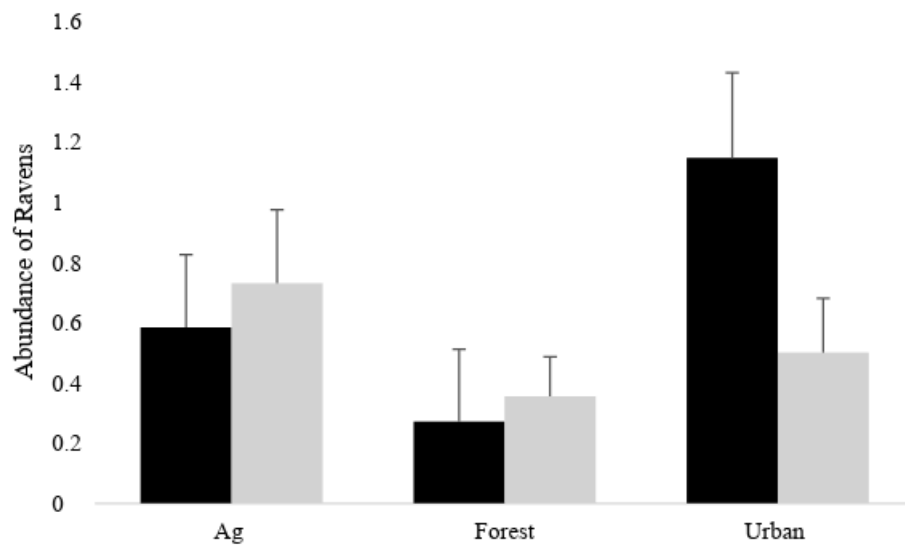


Figure 3. Comparing abundance of ravens across three habitats from Fall 2011 and Spring 2019 (Humboldt County, California, USA). Black represent 2011 and gray represents 2019 (n=16 per land cover types).

Source of variation	SS	df	MS	F	P-value	F crit
Between groups	141.3935185	2	70.69675926	23.6996896	9.3267E-08	3.204317292
Within groups	134.2361111	45	2.983024691			
Total	275.6296296	47				

Table 2. Variance between ravens in Fall 2011 across three habitat types and variance with in their groups (Humboldt County, CA, USA).

Source of variation	SS	df	MS	F	P-value	F crit
Between groups	6.291111574	2	3.145555787	3.988821215	0.025421281	3.204317292
Within groups	35.48667708	45	0.788592824			
Total	41.77778866	47				

Table 3. Variance between crows in Spring 2019 across three habitat types and variance with in their groups (Humboldt County, CA, USA).

Source of variation	SS	df	MS	F	P-value	F crit
Between groups	81.94907407	2	40.97453704	16.78986974	3.57103E-06	3.204317292
Within groups	109.8194444	45	2.440432099			
Total	191.7685185	47				

Table 4. Variance between ravens in Spring 2019 across three habitat types and variance with in their groups (Humboldt County, CA, USA).

Source of variation	SS	df	MS	F	P-value	F crit
Between groups	1.14351851 9	2	0.571759259	0.983802443	0.381783581	3.204317292
Within groups	26.1527777 8	45	0.58117284			
Total	27.2962963	47				