Central Valley Winter Raptor Survey (2007-2010): Effects of the Presence of Riparian Elements on Habitat Associations

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As a part of our Central Valley wintering raptor study, we assessed the most common habitat type present in each of the areas surveyed. In addition, we also noted any survey blocks that contained a significant riparian element with a stream course and adjacent riparian vegetation. A few blocks where riparian was dominant were included in the "other" habitat category (see Pandolfino and Smith 2011a) because there were too few of them to produce statistically relevant results. Having this additional information about each block allowed us to assess whether the presence of a riparian element within otherwise open country might have a significant effect on raptor habitat associations. Because we also gathered data on Loggerhead Shrikes (*Lanius ludovicianus*) during our surveys, we also were able to look for effects of riparian on habitat associations for this species in grassland areas. We are unaware of any prior studies that have examined this question across a large geographic area, for a variety of dominant habitat types, or for a variety of raptor species.

STUDY AREA AND METHODS

Survey methods are described in the accompanying overview and methods paper (Pandolfino and Smith 2011a). We determined the average density of each species (birds per 40 ha block) in each habitat type and compared the densities in blocks with a riparian element to those without a riparian element for each habitat. In each case, we determined the 95% confidence interval around the average density using the Data Analysis Package of Microsoft Excel.

RESULTS AND DISCUSSION

Densities of Red-tailed Hawks (Figure 1) and most other species were not significantly affected by the presence of a riparian element in any habitat type. Ferruginous Hawks, however, were significantly less abundant in grassland blocks containing a riparian element than in grassland blocks that lacked a riparian element (Figure 2). Similarly, the Rough-legged Hawks and Prairie Falcon, which like the Ferruginous Hawk were positively associated exclusively with grassland (Pandolfino et al. 2011), also occurred at lower density in grassland when a riparian element was present than in areas

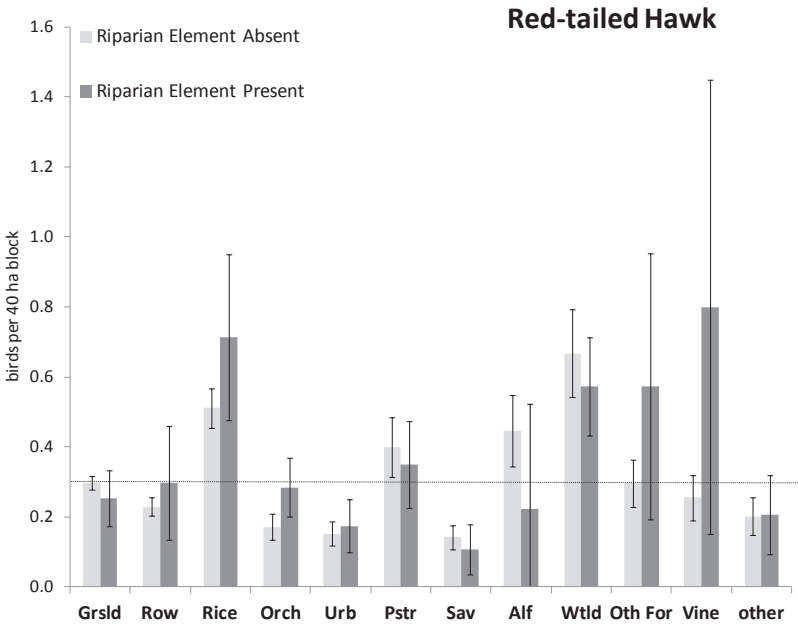

Figure 1. Comparison of density (birds per 40 ha block) of Red-tailed Hawks when a riparian element was absent or present in various habitat types. Error bars represent 95% confidence interval. The horizontal line represents the overall average density across all habitat types. (Grsld = grassland, Row = row crop, Orch = orchard, Urb = urbanized, Pstr = irrigated pasture, Sav = savannah, Alf = alfalfa, Wtld = wetland, Oth For = other forage, Vine = vineyard).

lacking riparian, although the decreases were not statistically significant (Figure 3).

The three grassland raptor species, Ferruginous Hawk, Rough-legged Hawk, and Prairie Falcon, all strongly favor open country, so perhaps the simple presence of a wooded element nearby makes the grassland less attractive. Alternatively, the Red-tailed Hawk's tolerance of riparian areas and its habitat-generalist nature may increase the potential for competition between this much more abundant raptor and the three strongly grassland-associated species when a riparian element is present, thus causing the true grassland specialists to avoid such areas. Finally, it also is possible that grasslands near riparian areas may support different soil types or depths, plant composition, wind, or temperature conditions that may affect raptor use.

In order to see if the simple presence of an elevated perching element within grassland could influence the density of these species, we also compared raptor densities between grassland blocks that included utility poles to those without utility poles (Figure 4). All three of the grassland-specialist raptors, Ferruginous and Rough-legged Hawks and Prairie Fal-

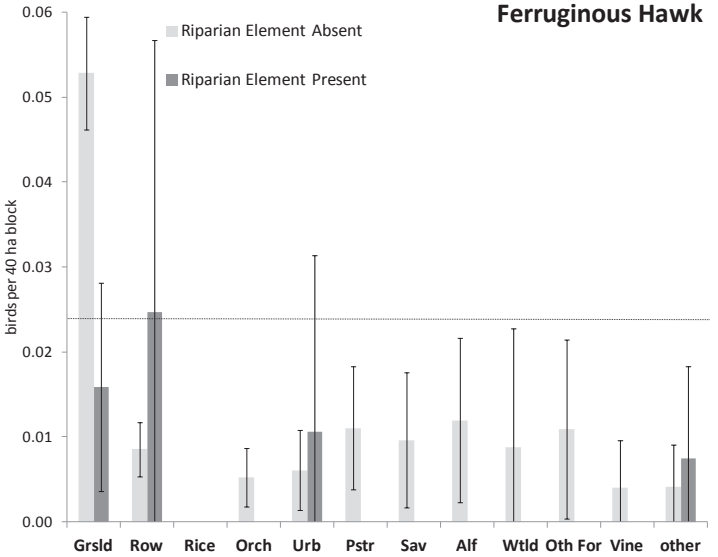

Figure 2. Comparison of density (birds per 40 ha block) of Ferruginous Hawks when a riparian element was absent or present in various habitat types. Error bars represent 95% confidence interval. The horizontal line represents the overall average density across all habitat types. Habitat codes are as noted in Figure 1 legend.

cons were present in significantly lower densities in grassland that included utility poles than in those lacking poles. This finding was particularly interesting for Prairie Falcons, which frequently use these poles as perches (Pandolfino and Smith 2011b).

Avoidance of grasslands with utility poles by the three most grassland-associated species suggests that the presence of a vertical element within an otherwise open landscape, or the perch opportunities it may provide to competitors, may influence the behavior of these raptors. Red-tailed Hawks showed no preference among lands with and without poles, and American Kestrels, which frequently perch on utility poles and wires, was the only species that occurred at a significantly higher density in grassland where poles were present. Because we observed significant differences in raptor density among grassland on different routes (Pandolfino and Smith 2011c), it also was important to rule out any bias among the routes for presence or absence of utility poles in grassland. A comparison of all routes in grassland showed that the distribution of poles in grassland did not differ among routes ($\chi^2_{20\ df} = 24$, $p = 0.25$), thereby indicating that differences in pole availability did not affect raptor densities among routes.

The grassland-associated Loggerhead Shrike also showed a marked lower density in grassland with riparian habitats than where riparian was absent. Shrike densities also were non-significantly lower when riparian

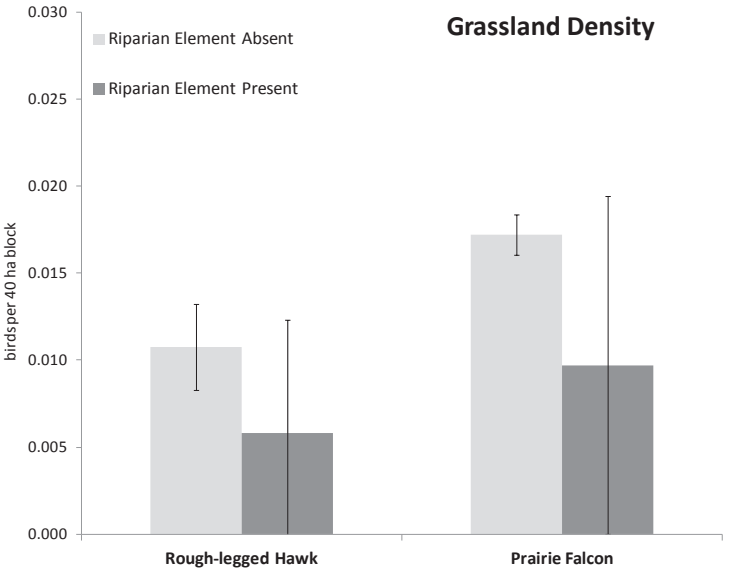

Figure 3. Comparison of density (birds per 40 ha block) of when a riparian element was absent or present in grassland habitat. Error bars represent 95% confidence interval.

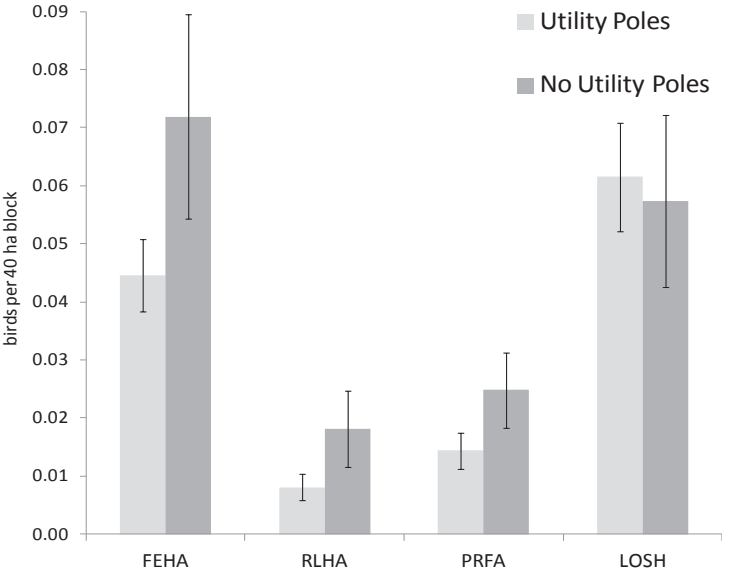

Figure 4. Comparison of density (birds per 40 ha block) of when utility poles (U. Poles) were absent or present in grassland habitat. Error bars represent 95% confidence interval. (FEHA = Ferruginous Hawk, RLHA = Rough-legged Hawk, PRFA = Prairie Falcon, LOSH = Loggerhead Shrike).

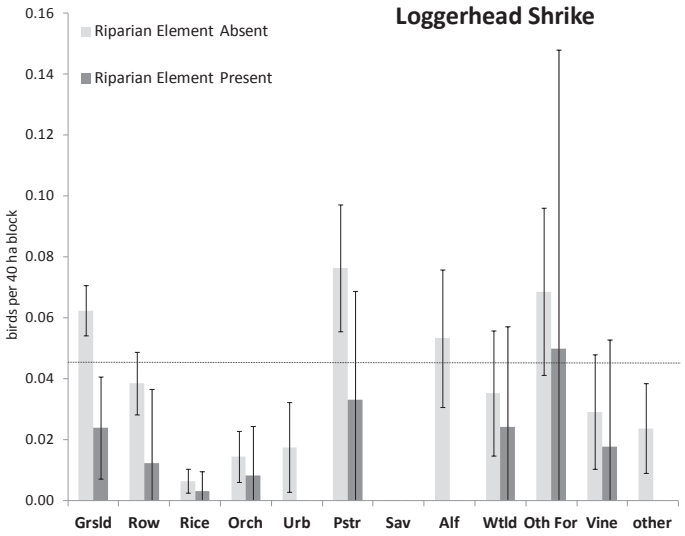

Figure 5. Comparison of density (birds per 40 ha block) of Loggerhead Shrikes when a riparian element was absent or present in various habitat types. Error bars represent 95% confidence interval. The horizontal line represents the overall average density across all habitat types. Habitat codes are as noted in Figure 1 legend.

habitat was present in all eight of the other habitat types where densities could be compared (Figure 5). The presence of riparian woodland or scrub may increase risk of attack by predators, making such areas less attractive, consistent with a general avoidance of wooded areas shown by this species (Bohall-Wood 1987, Smith and Kruse 1992, Gawlik and Bildstein 1993). Loggerhead Shrikes showed no significant difference between grassland with or without poles.

We omitted the Red-shouldered Hawks (*Buteo lineatus*), Cooper's Hawk (*Accipiter cooperii*), and Sharp-shinned Hawk (*Accipiter striatus*) from full analyses in prior work (Pandolfino et al. 2011), because of low detection rates. These species all are known to be strongly associated with riparian habitats (Curtis et al. 2006, Bildstein and Meyer 2000, Dykstra et al. 2008). Therefore, we examined our data for any sign of riparian effects for the Red-shoulder Hawk and accipiters (both species combined; Figure 6. Despite limited data, these species seemed to strongly favor the presence of a riparian element. For Red-shouldered Hawks, the presence of riparian habitat increased density significantly within grassland. In the "other" habitat category, which includes blocks dominated by riparian habitat and other wooded habitats, densities of Red-shouldered Hawks were non-significantly higher in every habitat type when a riparian element was present. We found similar results for accipiters, with densities non-signifi-

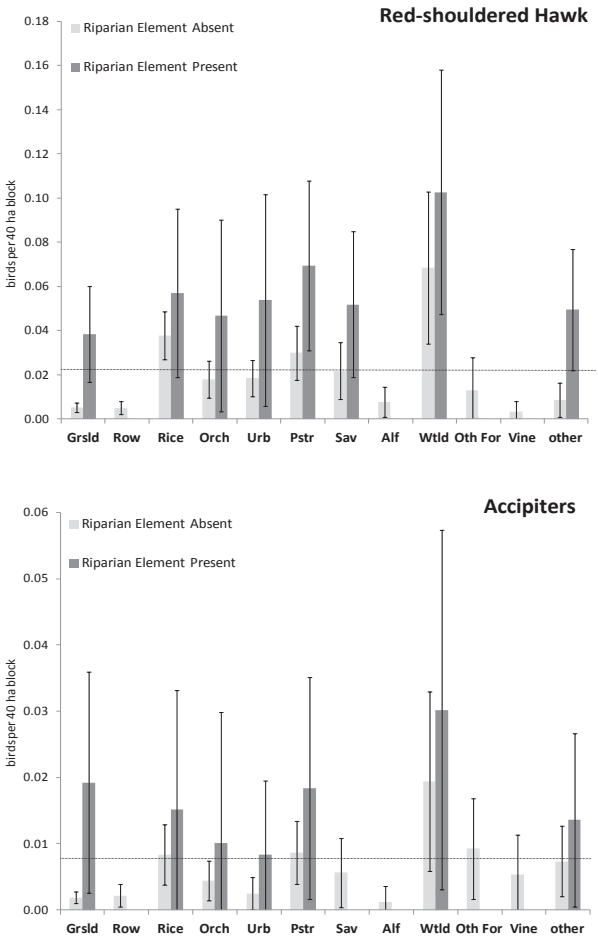

Figure 6. Comparison of density (birds per 40 ha block) of Red-shouldered Hawks and Accipiters (Cooper's and Sharp-shinned hawks combined with unidentified Accipiters) when a riparian element was absent or present in various habitat types. Error bars represent 95% confidence interval. The horizontal line represents the overall average density across all habitat types. Habitat codes are as noted in Figure 1 legend.

cantly higher in every habitat type where a comparison could be made, with that difference approaching significance for grassland.

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