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The potential impacts of saltcedar eradication (*Tamarix* sp.) on the birds of the Cimarron National Grassland

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Saltcedar (*Tamarix* sp.) is a non-native woody invasive species that reduces groundwater supplies. Natural resource agencies and private landowners are seeking to eradicate this exotic species from watersheds in western Kansas, including from along the Cimarron River on the Cimarron National Grasslands. Our research studied the effects of saltcedar eradication on species richness and abundance of avian populations in riparian habitats. Nine, 500-m transects were established. Three were located in areas of dense saltcedar, three were in treated areas where saltcedar had been removed, and three were in areas dominated by cottonwood (*Populus deltoides*). For four consecutive years (2006–2009), each of the nine transects was walked twice during the typical avian breeding season (22 May to 5 July). The number of individuals for each bird species seen or heard within 50 m of the 500-m transect line was recorded. Twenty-seven bird species were found to be nesting in saltcedar. Saltcedar eradication efforts may negatively impact local populations of these species. Yellow-breasted Chat (*Icteria virens*), Field Sparrow (*Spizella pusilla*), and Indigo Bunting (*Passerina cyanea*) were found only in saltcedar-encroached areas and therefore may be particularly negatively affected by saltcedar removal. The removal of the woody vegetation created more grassland habitat thereby potentially benefiting the seven species of grassland birds found exclusively in the treated areas. Riparian areas dominated by cottonwood had the highest species richness with 36 species found, including 14 species that were found only in these areas. If successful, the current efforts of the US Forest Service (USFS) to establish and maintain cottonwood forest along the Cimarron River likely will result in significantly increased avian species richness.

Key words: riparian habitats, avian species richness, vegetation management

INTRODUCTION

Saltcedar (*Tamarix* sp.) is a non-native woody phreatophyte that reduces groundwater supplies. State and federal government agencies and private landowners are seeking to eradicate this exotic species from watersheds in western Kansas, including from along the Cimarron River on the Cimarron National Grassland.

Several studies have found that although saltcedar (*Tamarix* sp.) is an invasive species native to Asia, its presence does not necessarily have a negative effect on bird populations

in North America. For example, Ellis (1995) conducted year-around surveys in cottonwood (*Populus fremontii*) and saltcedar (*Tamarix chinensis*) in the Middle Rio Grande Valley, New Mexico, to compare avian use of these two vegetation types. She found that species richness in cottonwoods and saltcedar did not differ in any season, although species composition varied. Yard et al. (2004) found that all of the six insectivore bird species studied in the Grand Canyon fed on non-native leafhoppers (*Opsius stactagolus*) specific to *Tamarix chinensis*. Lucy's Warblers (*Vermivora luciae*) in particular seemed to

prefer these leafhoppers, as they made up 49% of the birds' diet. Owen, Sogge and Kern (2005) examined how the health of the endangered Southwestern Willow Flycatchers differed between those breeding in native *Salix* habitats and those in *Tamarix* habitats. Their findings indicate that, at least in some parts of their range, there is no significant difference in the health or nutritional condition of flycatchers found in *Tamarix* stands compared with native stands of *Salix*. Van Riper et al. (2008) studied birds and *Tamarix* along the Lower Colorado River to determine the best approach to habitat restoration. The authors found that for many studied bird species, abundance was greatest with intermediate levels of *Tamarix* (40–60%), and the greatest increase in bird abundance occurred when small amounts of native vegetation were present in *Tamarix*-dominated habitats. They concluded that a more cost-effective way of enhancing avian abundance and diversity in monocultures of *Tamarix* would be to add 20 to 40% native species to the habitat rather than attempting to replace all of the *Tamarix* with native species. Brand, White and Noon (2009) compared bird species richness across four habitat types: cottonwood-willow, salt-cedar, mesquite, and grassland. Cottonwood-willow (*Salix* sp.) and mesquite (*Prosopis* sp.) areas yielded significantly higher species richness compared with salt-cedar habitats. Moreover, saltcedar did not provide habitat for rare and unique bird species, so it contributed little to regional avian diversity compared with native woody riparian vegetation.

Shanahan et al. (2011) examined whether restoration practices that replaced the invasive saltcedar with native cottonwoods (*Populus* sp.) and willows (*Salix* sp.) benefited the native avian community in the Las Vegas Wash, Nevada. They found no overarching benefits to the avian community or threatened species by replacing *Tamarix* with these native species. They did, however, discover a few species-specific benefits, although none of them were associated with species of conservation

concern. They concluded that saltcedar replacement projects may not inherently provide benefits to birds.

Fick and Geyer (2010) reported on the effectiveness of “cut-stump” treatment of saltcedar with various herbicides. This procedure involves cutting saltcedar at ground-level and applying herbicides to the fresh stump to discourage re-spouting. The USFS wishes to understand the ramifications of such vegetation management actions on nesting birds.

Sogge, Sferra and Paxton (2008) studied *Tamarix* as avian habitat in the southwestern U.S. and concluded that “the ecological benefits of *Tamarix* control are likely to be species and site specific.” They recommended that examinations of the relationship between *Tamarix* and bird populations be conducted on a site-by-site basis for project managers wanting to control and restore *Tamarix* areas. Our study attempted to add to the understanding the effects of saltcedar control on species richness and abundance of avian populations by conducting such a site-specific study on the Cimarron National Grasslands (CNG).

METHODS

The Cimarron National Grassland (CNG) contains 43,776 ha in Morton and Stevens Counties in southwestern Kansas. This is the largest area of public land in Kansas and the only parcel in the state managed by the USFS. Elevation ranges from 960 m to 1079 m, and the area typically receives less than 40 cm of rainfall annually, although in recent years the CNG has experienced significant drought.

Areas with dense saltcedar were also vegetated by alkali sacaton (*Sporobolus airoides*), sand dropseed (*Sporobolus cryptandrus*), western ragweed (*Ambrosia psilostachya*), and kochia (*Kochia scoparia*). Soils were predominately Happyditch loamy fine sand, occasionally flooded and Happyditch loamy sand, rarely

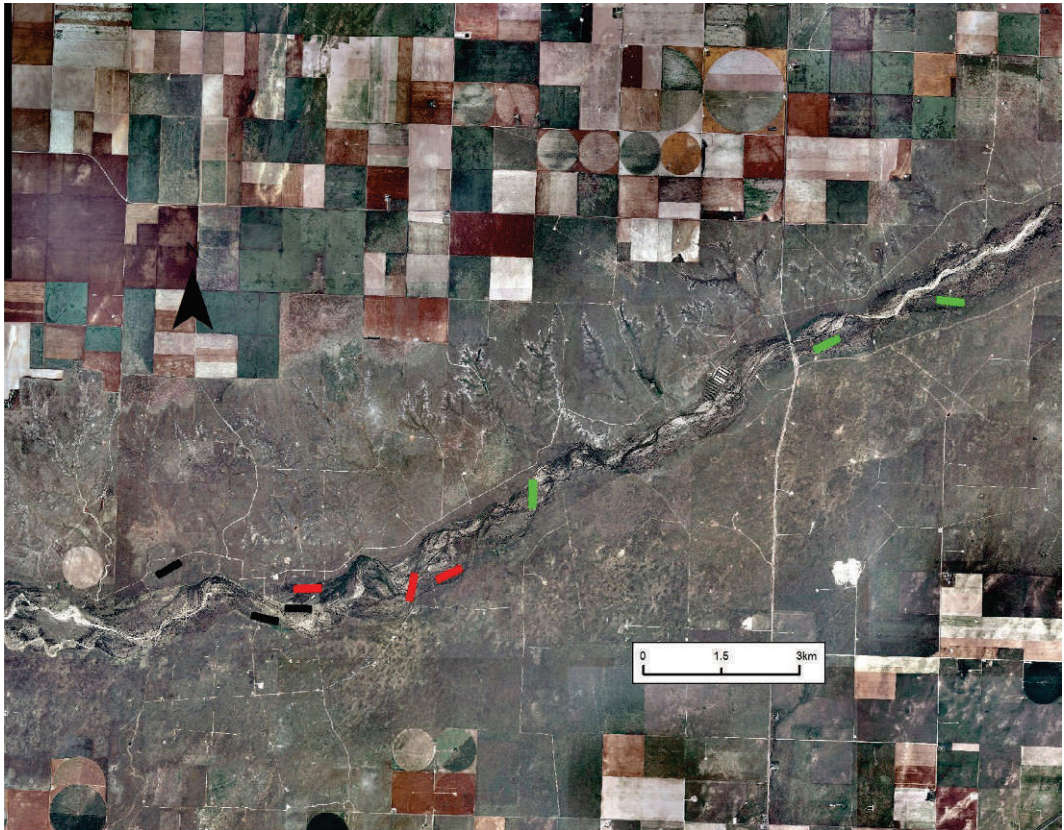


Figure 1. Locations of the nine transects used in this study. Black indicates transects in areas of treated saltcedar. Red indicates locations of transects in untreated stands of saltcedar. Green indicates transects in areas dominated by cottonwood.

flooded. Sites where saltcedar had been removed were vegetated by switchgrass (*Panicum virgatum*), western wheatgrass (*Pascopyrum smithii*), tall dropseed (*Sporobolus asper*), and numerous forbs. Soils were a combination of Happyditch loamy fine sand, occasionally flooded, and Happyditch sand, frequently flooded. In the understory of areas dominated by cottonwood were scattered willow (*Salix* sp.), willow baccharis (*Baccharis salicina*), and various grasses and forbs. All the soils are classified as sandy lowland ecological sites on 0 to 2% slopes and average forage production of 3080 kg/ha in normal years (Soil Survey Staff, NRCS-USDA, 2013).

In consultation with USFS personnel, nine 500-m transects were established at locations along the riparian zone of the Cimarron River

(Fig. 1). Three were located in areas dominated by saltcedar, three were in treated areas where saltcedar had been killed, and three were in areas dominated by cottonwood (*Populus deltoides*). It is important to note that the three habitat types surveyed in this study were not homogeneous. The cottonwood woodlands had open areas similar to the treated areas and had occasional saltcedar plants growing among the cottonwoods. Likewise, scattered cottonwood trees grew in both the treated and untreated saltcedar areas, providing perches and nest sites for birds not associated with saltcedar or grassy areas where saltcedar had been removed. No large homogenous tracks of woody plants exist on the CNG, so the birds counted along transects represent the real field situation of a mosaic of small habitat patches and blurred habitat distinctions in the riparian

zone along the Cimarron River. Transects through the cottonwood stands were intended to provide a basis for comparison of birds in native riparian woodland with areas dominated by saltcedar and treated areas.

For four consecutive years (2006–2009), each of the nine transects was walked twice during the breeding season. Over the 4 years, the two sampling periods were scheduled strategically throughout the breeding season to capture early and late nesters with sampling dates ranging from 22 May to 5 July. Three transects, one from each habitat type, were walked each day during each 3-day sampling period. The surveys began at sunrise and the sequence of transects was rotated by habitat type among visits to control for time of day over the course of the study. The number of individuals for each bird species seen or heard within 50 m of each 500-m transect line was recorded. We believe that due to the relatively open habitats, particularly in the treated and cottonwood areas, and the narrow transect sampling area that differences in detectability were not significant.

RESULTS AND DISCUSSION

General Species Richness and Abundance in the Riparian Zone. A total of 1,701 individuals representing 46 bird species were recorded in the study area. The four most common species seen along the nine transects in order of abundance were Mourning Dove (*Zenaida macroura*) (483), Bullock's Oriole (*Icterus bullockii*) (220), Western Kingbird (*Tyrannus verticalis*) (238), and Northern Mockingbird (*Mimus polyglottos*) (181). Abundances of other species were considerably lower. The next most common species was Orchard Oriole (*Icterus spurius*), with only 68 detections over the four-year period.

Comparisons between Treated, Untreated, and Natural Areas. Although as previously noted the vegetation type and structure along transects were not homogeneous, several bird

species were found only in one of the three general habitat categories. Table 1 lists the bird species found exclusively in one of the three habitat types. The saltcedar habitat contributed only four unique species to the riparian study area, whereas the cottonwood and treated areas contributed 14 and 7 unique species, respectively.

Treated Saltcedar. In areas that had been treated to eradicate saltcedar, 359 individuals of 25 bird species were found. An average of 7.3 species and 15.5 individuals were found per transect in these areas where saltcedar had been cut and sprayed. Seven species of birds were found exclusively in the treated areas. The Ring-necked Pheasant (*Phasianus colchicus*), Killdeer (*Charadrius vociferus*), Dickcissel (*Spiza americana*), and Western Meadowlark (*Sturnella neglecta*) were found along the treated transects and are expected in open habitats lacking woody vegetation. The Cassin's Sparrow (*Peucaea cassinii*) probably wandered into the treated areas from adjacent sand-sage prairie areas. Swainson's Hawks (*Buteo swainsoni*) and American Kestrels (*Falco sparverius*) did not nest along transects in the treated areas, but they used these open areas for hunting. Efforts to remove saltcedar may benefit these species.

Untreated Saltcedar. Untreated saltcedar areas and treated areas had similar species richness. In areas of mature saltcedar that had not been treated, 569 individuals of 27 species were detected. An average of 9.1 bird species and 24.3 individuals per transect were found in these areas of dense saltcedar. More individuals were observed in the untreated areas than in treated areas, possibly due to the more complex vegetation structure, which offers more cover, food resources, and nesting sites. As mentioned above, scattered cottonwoods exist throughout both the treated and untreated saltcedar areas, so in both habitats species occurred that would not be found in a pure stand of saltcedar or an area entirely devoid of woody vegetation.

Table 1. Bird species found exclusively in each of the three habitat types on the Cimarron National Grassland, Kansas.

Treated areas (saltcedar mostly eradicated)	Untreated areas (dense stands of saltcedar)	Cottonwood areas (open riparian woodlands)
Ring-necked Pheasant (<i>Phasianus colchicus</i>)	Western Screech-Owl (<i>Megascops kennicottii</i>)	Mississippi Kite (<i>Ictinia mississippiensis</i>)
Swainson's Hawk (<i>Buteo swainsoni</i>)	Yellow-breasted Chat (<i>Icteria virens</i>)	Great Horned Owl (<i>Bubo virginianus</i>)
American Kestrel (<i>Falco sparverius</i>)	Field Sparrow (<i>Spizella pusilla</i>)	Red-headed Woodpecker (<i>Melanerpes erthrocephalus</i>)
Killdeer (<i>Charadrius vociferus</i>)	Indigo Bunting (<i>Passerina cyanea</i>)	Downy Woodpecker (<i>Picoides pubescens</i>)
Cassin's Sparrow (<i>Peucaea cassinii</i>)		Hairy Woodpecker (<i>Picoides villosus</i>)
Dickcissel (<i>Spiza americana</i>)		Western Wood-Pewee (<i>Contopus sordidulus</i>)
Western Meadowlark (<i>Sturnella neglecta</i>)		Ash-throated Flycatcher (<i>Myiarchus cinerascens</i>)
		Great Crested Flycatcher (<i>Myiarchus crinitus</i>)
		Warbling Vireo (<i>Vireo gilvus</i>)
		Blue Jay (<i>Cyanocitta cristata</i>)
		White-breasted Nuthatch (<i>Sitta carolinensis</i>)
		Eastern Bluebird (<i>Sialia sialis</i>)
		American Robin (<i>Turdus migratorius</i>)
		Black-headed Grosbeak (<i>Pheucticus melanocephalus</i>)

Four species were found only in stands of saltcedar. Yellow-breasted Chat (*Icteria virens*), Field Sparrow (*Spizella pusilla*), Indigo Bunting (*Passerina cyanea*), and Western Screech-Owl (*Megascops kennicottii*) were not found in the other two habitat types studied. The Western Screech-Owl is known to occupy nearby cottonwood groves and it nests in cavities in mature trees and is not typically associated with saltcedar or other shrub habitat (Cable and Seltman, 2011). The owl flushed from the ground in an open area among the saltcedar and flew into a nearby

cottonwood tree; it may have been using the isolated cottonwood tree as a hunting perch and may have dropped to the ground to catch prey. Because the owl is known to exist in the cottonwood habitat along the Cimarron River (Cable and Seltman 2011), we did not consider it unique to the saltcedar habitat even though it was found only there. Removal of the saltcedar may negatively affect local populations of Yellow-breasted Chat, Indigo Bunting, and Field Sparrow, species found exclusively in that habitat in this study.

Although use of saltcedar by migrants was beyond the scope of this study, it is important to recognize that migrants use it (Ellis, 1995). If saltcedar is removed without being replaced by other woody vegetation, migrants could be negatively affected.

Cottonwoods. Just as Shanahan et al. (2011) found greater avian species richness in cottonwoods due to their support of canopy species, our study also found that cottonwood areas had the greatest species richness, abundance of birds, and the most species found exclusively in that habitat when compared with saltcedar and treated areas. In total, 773 individuals of 36 species were found along the three transects in this habitat. An average of 9.2 bird species and 33.6 individuals were found per transect. Unlike the saltcedar and treated habitats, the mature cottonwoods provide cavities as potential nest sites. Several species found exclusively in cottonwood areas were cavity nesters, including three species of woodpecker, Eastern Bluebird (*Sialia sialis*), Ash-throated Flycatcher (*Myiarchus cinerascens*), and White-breasted Nuthatch (*Sitta carolinensis*). These open woodland patches also provide habitat for birds that prefer shrubs and even a few grassland species, so it is not surprising that the highest species richness and abundance was found in this habitat. USFS personnel hope to maintain and re-establish this habitat along the Cimarron River. To this end, USFS land managers have planted cottonwood seedlings in the riparian zone.

Sogge, Sferra and Paxton (2008) noted that although bird abundance and diversity is less in saltcedar habitats than in natural vegetation, many species find saltcedar stands to be suitable habitat and warn, "the removal of *Tamarix* without the guaranteed establishment of native habitat could produce negative impacts." This warning seems to be appropriate on the CNG for Yellow-breasted

Chat, Field Sparrow, and Indigo Bunting populations, because these species were found only in saltcedar and would require similar dense, shrubby vegetation if the saltcedar were eradicated. Although Yellow Warblers (*Dendroica petechia*) occasionally were found in the cottonwood areas (four detections), they were most common in saltcedar areas (27 detections), and their populations also might be negatively affected if the saltcedar were removed and not replaced with other woody vegetation.

CONCLUSIONS

The USFS saltcedar eradication efforts do not seem to affect overall species richness or avian abundance on the Cimarron National Grassland; however, as with any land management practice, some species benefit whereas others are affected negatively. These efforts to eradicate *Tamarix* would seem to benefit grassland birds such as Killdeer, Ring-necked Pheasant, Dickcissel, and Western Meadowlark, whereas the removal of this woody vegetation likely will negatively affect the local nesting populations of some of the 27 species of birds found in saltcedar areas, particularly Yellow-breasted Chat, Field Sparrow, Indigo Bunting, and possibly Yellow Warbler. If successful, the current efforts of the USFS to establish and maintain cottonwood forest along the Cimarron River likely will result in significantly increased avian species richness and abundance.

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