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Impacts of Non-native Plant Removal on Vertebrates along the Middle Rio Grande (New Mexico)

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The Middle Rio Grande and its riparian forest in central New Mexico are the focus of restoration activities to reverse or lessen negative anthropogenic impacts. The riparian forest is the largest gallery cottonwood (*Populus deltoides*) forest in the Southwest (Hink and Ohmart 1984). Historically, the river was free to meander across the floodplain, creating a dynamic system in which riparian vegetation establishment on riverbanks alternated with periods of scouring floods (Crawford et al. 1993). The establishment of non-native invasive plants has compounded the impacts of an altered hydrology, which has been changed through channelization and water diversion. Non-native saltcedar (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*) and the accumulation of woody debris along the river have increased the risk of wildfire and suppressed native seed germination (Howe and Knopf 1991, Busch and Smith 1995).

Fires in the riparian forest increase the risk of losing native habitat that has not historically experienced fire. Land managers have a suite of techniques available to reduce the risk of fire by removing non-native plants and fuels in the riparian forest. Biologists are interested in understanding how these management activities can impact other components of the Middle Rio Grande riparian ecosystem, such as native flora and fauna.

In 2000 the USDA Forest Service Rocky Mountain Research Station began monitoring amphibians, reptiles, birds, and bats in riparian forests dominated by Rio Grande cottonwood (*Populus deltoides wislizenii*) and a non-native plant midstory (Figure 1a) to investigate the impacts of restoration treatments on vertebrate species. We established three control and nine experimental 20-ha sites along 140 km of riparian forest. Treatments to remove non-native plants and fuels began in 2003 and were completed in 2005 (Figure 1b). In all three treatments, non-native plants were removed by chainsaw and Garlon (triclopyr) herbicide was applied to stumps. In the second treatment, burning slash piles followed plant removal. In the third treatment, planting native tree and shrub seedlings (247 per hectare) followed plant removal. The cottonwood overstory remained unchanged after treatments, whereas midcanopy cover decreased in experimental sites when non-native plants were removed.

For seven years at each site we gathered data on herpetofauna, birds, and bats. We utilized arrays of drift fences and pitfall and funnel traps to capture and release amphibians and reptiles (Bateman et al. 2008). We followed nomenclature from Crother (2008) for herpetofauna names. We recorded bird species, and distance from observer, at point count stations and monitored nests during the breeding season (Finch and Hawksworth 2006). Ultrasonic detection systems (Anabat detectors, Titley Corporation, Australia) recorded bat echolocation activity once a week during the summer (Chung-MacCoubrey and Bateman 2006).

Restoration treatments appear to be beneficial or nondamaging to lizard species and may have a positive effect on bat foraging. Treatments appear to negatively affect densities of some bird species that nest in midstory vegetation. We did not detect changes in response to restoration treatments in relative abundances or densities of other taxa, such as toads (*Anaxyrus* spp.), snakes, or other avian nesting guilds.

Two lizard species, New Mexico whiptails (*Aspidoscelis neomexicana*) and prairie lizards (*Sceloporus consobrinus*), increased after experimental treatments. Chihuahuan spotted whiptails (*A. exsanguis*), desert grassland whiptails (*A. uniparens*), and side-blotched lizards (*Uta stansburiana*) were either positively associated with the posttreatment forest or negatively associated with the pretreatment forest (Bateman et al. 2008). Lizard abundance may have increased after treatments because the more open midstory may provide more basking opportunities as greater light penetrates to the understory.

Birds nesting in the lower two-thirds of vegetation decreased after treatments for the midstory nesters, black-chinned hummingbird (*Archilochus alexandri*), mourning dove (*Zenaida macroura*), and black-headed grosbeak (*Pheucticus melanocephalus*), and one ground shrub nester,

Figure 1. Middle Rio Grande cottonwood (*Populus deltoides wislizenii*) forest: a) non-native saltcedar (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*) and heaps of woody debris dominate the understory and midstory; b) after non-native plants and fuels were removed the cottonwood overstory remained unchanged. Over time all experimental and control sites had more grass and weed cover. Photos by Heather Bateman

spotted towhee (*Pipilo maculatus*) (Finch and Hawksworth 2006). Treatments likely reduced the availability of nesting and foraging substrate for these species. In some riparian habitats, native plants may take a decade or more to reestablish the midstory layer (Queheillalt and Morrison 2006).

Bat activity increased to a greater degree at treated sites than at the control sites. An analysis of habitat structure before treatment indicated that bat activity was greater at sites with lower midstory canopy cover (Chung-MacCoubrey and Bateman 2006). Non-native tree removal may explain the greater bat activity; greater forest openness may improve accessibility to bat species with a wider variety of flight styles.

During the study period we also had an opportunity to record some interesting observations, which although not the main thrust of our study, offered unexpected insights into other taxa of the Middle Rio Grande ecosystem. First, in 2005 we recorded the responses of toads to a spring flood event at two study sites in terms of groundwater elevation and other hydrologic variables (Bateman et al. forthcoming). Compared to other sites that did not flood, we documented more total captures and more captures of young-of-the-year toads, which we interpreted as toads using flooded sites for breeding habitat.

Second, compared to historical reports, four herpetofaunal species closely tied to aquatic and semiaquatic habitats were either not present or rare in our study. Tiger salamanders (*Ambystoma tigrinum*), boreal chorus frogs (*Pseudacris maculata*), northern leopard frogs (*Lithobates pipiens*), and black-necked garter snakes (*Thamnophis cyrtopsis*) were rarely captured or not captured at all (Bateman et al. forthcoming, Bateman et al. unpub. data). These species were present or even common along the Middle Rio Grande 20 years ago (Hink and Ohmart 1984). Reduction in wetlands (Roelle and Hagenbuck 1995) and loss of flood pulses (Molles et al. 1998) may have contributed to declines in habitat used by amphibians and semiaquatic snakes along the Middle Rio Grande.

Third, there is little published information about the natural history of desert shrews (*Notiosorex crawfordi*) in the Southwest. We found that desert shrews were abundant in the riparian forest and surprising numbers were captured in herpetofaunal pitfall traps. Capture rates of shrews varied by month, but did not appear to be affected by removal treatments (Chung-MacCoubrey et al. unpub. data).

A comprehensive monitoring scheme is both necessary and valuable, particularly when management must address potentially conflicting goals. It is important to consider multiple taxa, to include control and experimental sites,

and to cover large temporal and spatial scales in order to evaluate impacts of restoration activities. This comprehensive approach, including species typically overlooked, may provide unexpected results. Our monitoring design allowed us to account for annual and site variability, provide insights that can help managers weigh potential tradeoffs, and discover additional ecological patterns that were not connected to the experimental design.

Removal of non-native plants and excessive fuels is critical to slowing the loss of Middle Rio Grande riparian habitat to wildfire. We were able to draw conclusions about how treatments could impact a variety of habitat types (surface, thermal environment for lizards; structural, breeding habitat for birds; and aerial foraging habitat for bats). It may be important to conduct treatments in phases over time to minimize impacts on birds and other organisms utilizing midstory vegetation, so that these species can access adjacent untreated areas until planted native vegetation regrows.

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Influence of Floristic Diversity on Songbird Nesting Preferences in a Suite of Adjacent Reconstructed Grasslands (Wisconsin)

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Roughly 37 million U.S. acres are enrolled in the Conservation Reserve Program (CRP) with much of this acreage planted to native grasslands (EPA Federal Register 2001). Many CRP-type installations are planted with a mixture of native warm-season grasses and minor amounts of a few native forbs. These planting recipes tend to create communities that climax as solid stands of grass, dominated by only a few species. As these grass-dominated