Herpetological Communities of the Middle Rio Grande Bosque: What Do We Know, What Should We Know, and Why?

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Abstract—*Amphibians and reptiles (herpetofauna) play important roles within ecosystems. Similar to many birds and mammals, they are major consumers of terrestrial arthropods. However, amphibians and reptiles are more efficient at converting food into biomass and are a higher quality food source for predators. Recent declines in some herpetofaunal populations have stimulated a greater overall interest in the monitoring of these populations. Although studies have examined the use of exotic plant-invaded ecosystems by birds and mammals, few have focused on the herpetofaunal community. Specifically, there is little information on the ecology and management of reptiles and amphibians within riparian cottonwood forest (bosque) along the Middle Rio Grande in New Mexico. Invasion by exotic plant species and accumulation of woody debris have led to high fuel loadings and thus the risk of catastrophic fire in the bosque. Thus, land managers are interested in removing exotics and reducing fuels by various techniques. To effectively manage habitat and make sound decisions, managers must understand how various fuels reduction treatments affect wildlife communities, including the distribution, abundance, and ecology of amphibian and reptile populations. In 1999, the U.S. Forest Service- Rocky Mountain Research Station initiated a study to monitor and evaluate the response of vegetation and wildlife to three fuel reduction treatments in the Middle Rio Grande bosque. This component of the study will evaluate the impact of treatments on herpetofauna. Using pre- and post-treatment capture data from pitfall and funnel traps, we will analyze species-specific and community level responses to the treatments. Specifically, we will address how these treatments affect survivorship, species richness, abundance, diversity, reproduction, and community energy flow.*

Importance of Herpetofauna Within Ecosystems

Amphibians and reptiles, which we will refer to as herpetofauna, play important roles within ecosystems. Many consume insects, serve as food for birds, mammals, and other predators, and may be indicators of environmental health. Compared to birds and mammals, amphibians and reptiles are less mobile, have smaller home ranges, and thus may be affected to a greater degree by alterations to their habitat (Burton and Likens 1975). Yet, herpetofauna have long been overlooked by managers, biologists, and researchers.

Herpetofauna as Consumers, Predators, and Prey

Amphibians and reptiles eat a wide variety of foods, including plants, arthropods, birds, and small mammals. Many feed solely on arthropods. Whiptail lizards are active foragers and eat mostly moths and moth larva (Lepidoptera), beetles (Coleoptera), crickets and grasshoppers (Orthoptera), and termites (Isoptera, Medica 1967, Degenhardt and others 1996). Amphibian species such as toads eat bees and ants (Hymenoptera), beetles, insect larvae (Hemiptera), and spiders (Arachnida, Degenhardt and others 1996).

Relative to birds and mammals, amphibians and reptiles are more efficient at transferring energy up the food chain and thus retaining energy within ecosystems. Because they are ectotherms, amphibians and reptiles expend little energy toward metabolic thermoregulation (using 7 to 10 times less energy per unit body mass than endotherms) and are more efficient at converting food into new tissue. This conversion efficiency is approximately 50 percent in ectotherms and only 2 percent in endotherms (Pough and others 2001). In a New Hampshire forest, salamanders collectively consumed less food than birds and mammals, but produced more animal mass per year than the birds and mammals combined (Burton and Likens 1975). Consuming smaller invertebrates on the forest floor, salamanders harvested energy unavailable to birds and mammals and returned it to the food chain as salamander biomass. Salamanders were also a higher-quality food source because they contained a greater percentage of protein than birds and mammals (Burton and Likens 1975).

Herpetofauna as Indicators

Amphibians and reptiles also serve another valuable role as indicator species of environmental and ecosystem health. Since the 1980s, herpetologists have reported worldwide declines in amphibian populations and species extinctions (Collins and Storfer 2003). These declines have prompted extensive investigations by government agencies to identify the causes of these abnormalities and if there is any potential risks to human health (Van der Schalie and others 1999). Hypotheses to explain these global amphibian declines include exotic species invasions, habitat alteration, exploitation, global climate change, and disease (Collins and Storfer 2003). Recent population declines have focused more attention on amphibians and reptiles, which have historically been overlooked. Managers and biologists are more concerned and aware of the potential effects of human activities on amphibian and reptile populations and their habitats. This paper focuses on effects of human activities on herpetofauna in the Middle Rio Grande bosque, a highly managed and altered southwestern riparian forest ecosystem.

The Middle Rio Grande Bosque Ecosystem

The Middle Rio Grande supports the most extensive, remaining gallery of cottonwood forest (*Populus deltoides* subspecies *wislizeni*) in the southwest (Hink and Ohmart 1984). This forest, or bosque, hosts a rich assemblage of vertebrates, particularly birds (Hink and Ohmart 1984). In the past century, humans have dramatically altered the vegetative structure and composition of the bosque through damming, channelization, irrigation, urbanization, and restoration. Much of the previous extent of the bosque has been converted for agricultural or urban use, and the remaining bosque primarily exists between levee roads paralleling the river (Hink and Ohmart 1984, fig. 1). In the 20th century, engineers dammed and channelized the river to reduce the frequency and severity of flooding and to facilitate agriculture and water management. As a result, many natural processes in the bosque ecosystem have been disrupted or altered. For example, spring floods historically scoured forests of woody

Figure 1. Cottonwood forests of the Middle Rio Grande bosque are largely confined to areas immediately adjacent the river. Surrounding floodplains have been converted for agricultural or urban use.

debris and deposited new sediments on which cottonwood seedlings germinated (Howe and Knopf 1991, Taylor and others 1999). The absence of spring flood events has reduced recruitment in cottonwood populations and allowed invading plants, such as saltcedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*), to establish on sites formerly available to cottonwood (Howe and Knopf 1991). The quantities of woody debris in many areas of the bosque have also increased substantially due the lack of scouring floods (Ellis and others 1999). Accumulation of these woody debris, combined with dense stands of saltcedar and Russian olive in the understory, lead to fuel loadings capable of supporting catastrophic wildfires (Stuever 1997).

To reduce fire risk, restore cottonwood dominance, and increase groundwater availability, land managers have used herbicide, prescribed fire, chaining, ripping, and other mechanical manipulations to remove saltcedar and other invasive woody plants (Taylor and McDaniel 1998, Taylor and others 1999, Dello Russo and Najmi, this proceedings). Vegetative structure and composition affect food, shelter, cover, and other resources available to wildlife. Thus, anthropogenic changes in the bosque have likely altered wildlife communities of these forests (for example, species composition, abundance, and interactions). Managers must understand the effects of various restoration treatments on wildlife communities and individual wildlife species to make sound decisions that balance management objectives (for example, reducing fire risk) with other considerations such as the Endangered Species Act, recreational use, aesthetic value, and ecosystem integrity.

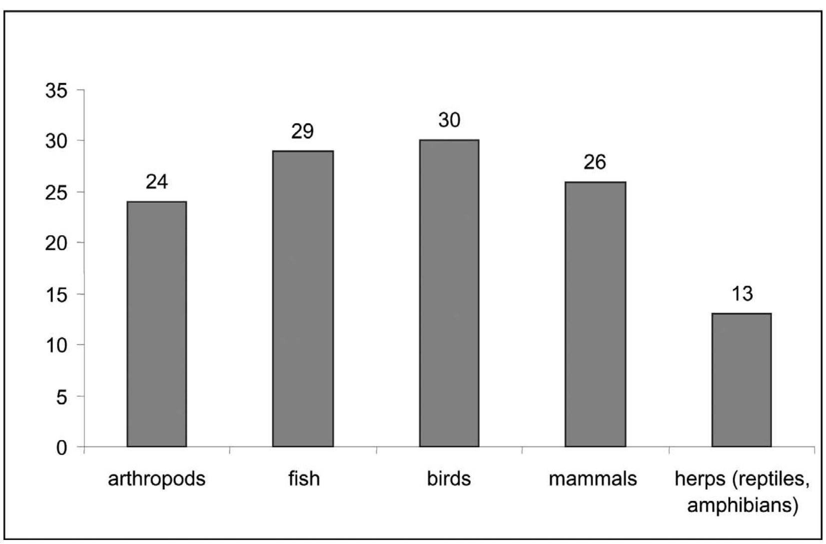

Figure 2. Results of a literature search of the BIOSIS Database (1969-2004) for studies of vertebrates and arthropods that occurred along the Rio Grande in New Mexico.

What Do We Know About Herpetofauna in the Bosque?

Information on the herpetofaunal community of the Middle Rio Grande bosque is limited. A literature search of the BIOSIS Database revealed that only 10 percent of studies published on animals associated with the Rio Grande in New Mexico have focused on herpetofauna (fig. 2). Most studies focused on fish, birds, arthropods, or mammals. Because there are no studies of amphibians and reptiles in the bosque prior to channelization and damming of the river, it is difficult to characterize the herpetofaunal community of native, undisturbed cottonwood forest.

A list of expected species may be assembled from recent studies, historic and museum records, and habitat associations from Degenhardt and others (1996). More recently, Hink and Ohmart (1984) characterized herpetofauna associated with riparian vegetation of the Middle Rio Grande based on results of their pitfall surveys, museum records, and other field observations. Stuart and others (1995) reported herpetofauna captured at two sites within the Bosque del Apache National Wildlife Refuge (BDANWR) near Socorro, NM. Several studies have examined the lizard communities of desert riparian areas in Arizona. However, data from these studies are not comparable to Middle Rio Grande bosque because mesquite (*Prosopis velutina*) was the major overstory tree/shrub in the Arizona study areas, and cottonwood (*Populus fremontii*) and willow (*Salix gooddingii*) had only a scattered or occasional presence (Vitt and others 1981, Jakle and Gatz 1985, Jones and Glinski 1985, Szaro and Belfit 1986).

Based on available literature, cottonwood forests and associated habitats of the Middle Rio Grande (including ditches, canals, ponds, sandbars, and drier peripheral riparian habitats) are used by at least 50 reptile and amphibian species. Species that were captured (Hink and Ohmart 1984, Stuart and others 1995) and species with other types of records in the Middle Rio Grande bosque (Hink and Ohmart 1984, Degenhardt and others 1996, Bailey and others 2001) are listed in table 1. The Eastern Fence Lizard (*Sceloporus undulatus*), New Mexico Whiptail (*Aspidoscelis neomexicana*, formerly genus *Cnemidophorus* from Reeder and others 2002), and Woodhouse's Toad (*Bufo woodhousii*) were frequently captured from Española to Socorro, NM (Hink and Ohmart 1984). Fifteen other species of lizards, snakes, amphibians, and

Table 1. Species list of herpetofauna observed or captured in the Middle Rio Grande bosque and associated habitats (including ditches, canals, ponds, sandbars, and drier peripheral riparian habitat). Reference codes are as follows: HC = captures by Hink and Ohmart (1984), HM = museum records and other observations reported in Hink and Ohmart (1984) Appendix 2, D = habitat associations from Degenhardt and others (1996), B = Bailey and others (2001), S = captures by Stuart and others at BDANWR (1995).

Taxa	Scientific Name	Common Name	Reference
Amphibians	*Ambystoma tigrinum*	Tiger Salamander	HC, D, B, S
	Bufo cognatus	Great Plains Toad	HC, D, B
	Bufo punctatus	Red-spotted Toad	HM
	Bufo woodhousii	Woodhouse's Toad	HC, D, B, S
	Pseudacris triseriata	Western Chorus Frog	HC, D, B
	Rana blairi	Plains Leopard Frog	B
	Rana catesbeiana	American Bullfrog	HC, D
	Rana pipiens	Northern Leopard Frog	HM, D, B
	Scaphiopus couchii	Couch's Spadefoot	HM, D, B
	Spea bombifrons	Plains Spadefoot	HC, B
	Spea multiplicata stagnalis	New Mexico Spadefoot	HM, D, B
Turtles	*Apalone spinifera*	Spiny Softshell Turtle	HC, D, B
	Chelydra serpentina serpentina	Eastern Snapping Turtle	D
	Chrysemys picta	Painted Turtle	HM, D, B
	Terrapene ornata	Ornate Box Turtle	HM, D, B
	Trachemys gaigeae gaigeae	Big Bend Slider	D, B
	Trachemys scripta elegans	Red-eared Slider	D
Lizards	*Aspidoscelis exsanguis*	Chihuahuan Spotted Whiptail	HC, D, S
	Aspidoscelis inornata	Little Striped Whiptail	HC, D, S
	Aspidoscelis neomexicana	New Mexico Whiptail	HC, D
	Aspidoscelis tesselata	Common Checkered Whiptail	HM, D
	Aspidoscelis tigris	Tiger Whiptail	HM
	Aspidoscelis uniparens	Desert Grassland Whiptail	HM, D, S
	Aspidoscelis velox	Plateau Striped Whiptail	HC
	Cophosaurus texanus	Greater Earless Lizard	D
	Crotaphytus collaris	Eastern Collared Lizard	D
	Eumeces obsoletus	Great Plains Skink	HC, D, B
	Holbrookia maculata	Common Lesser Earless Lizard	HC
	Phrynosoma hernandesi	Greater Short-horned Lizard	HM
	Phrynosoma modestum	Round-tailed Horned Lizard	HC, D
	Sceloporus magister	Desert Spiny Lizard	HM, D, B
	Sceloporus undulatus	Eastern Fence Lizard	HC, D, S
	Urosaurus ornatus	Ornate Tree Lizard	D
	Uta stansburiana	Common Side-blotched Lizard	HC, D
Snakes	*Arizona elegans*	Glossy Snake	HC
	Coluber constrictor	Eastern Racer	HM, D, B
	Crotalus atrox	Western Diamond-backed Rattlesnake	HM, B
	Crotalus viridis	Prairie Rattlesnake	HM, B
	Heterodon nasicus	Western Hog-nosed Snake	HM
	Lampropeltis getula	Common Kingsnake	HM, D, B, S
	Leptotyphlops dissectus	New Mexico Threadsnake	D, B
	Masticophis flagellum	Coachwhip	HM, B
	Pituophis catenifer	Gophersnake	HM, D, B
	Rhinocheilus lecontei	Long-nosed Snake	HM
	Sistrurus catenatus	Massasauga	HM
	Tantilla nigriceps	Plains Black-headed Snake	HM, B, S
	Thamnophis cyrtopsis	Black-necked Gartersnake	HM, D, B
	Thamnophis elegans	Terrestrial Gartersnake	D, B
	Thamnophis marcianus	Checkered Gartersnake	HM, D, B
	Thamnophis sirtalis	Common Gartersnake	HC, D, B

turtles were captured infrequently, at a limited number of locations, or both (Hink and Ohmart 1984, table 1). An additional 23 species of reptiles and amphibians were occasionally sighted or otherwise documented in the Middle Rio Grande Valley (Hink and Ohmart 1984, table 1). In two mixed stands of mature cottonwood and saltcedar at BDANWR, Stuart and others (1995) detected eight amphibian and reptile species (table 1).

Most of the species captured are typically associated with upland habitats (for example, desert grasslands, shrublands, and arroyos) rather than mesic riparian forest (Degenhardt and others 1996). Hence, capture rates were highest in open vegetation types with sandy soils and sparse ground cover and lowest in stands with dense understories (Hink and Ohmart 1984). Species captured more frequently in open, sandy habitats with sparse vegetation (for example, open stands of intermediate aged cottonwoods) included Eastern Fence Lizards, New Mexico Whiptails, Chihuahuan Spotted Whiptails (*A. exsanguis*), Woodhouse's Toads, Great Plains Toads (*Bufo cognatus*), and Plains Spadefoots (*Spea bombifrons*, Hink and Ohmart 1984). However, Great Plains Skinks (*Eumeces obsoletus*) were captured frequently in stands with densely vegetated understories.

Species associated with wetter habitats within the bosque (for example, near permanent water) included Gartersnakes (*Thamnophis* spp.), Spiny Softshell Turtles (*Apalone spinifera*), Tiger Salamanders (*Ambystoma tigrinum*), Western Chorus Frogs (*Pseudacris triseriata*), and American Bullfrogs (*Rana catesbeiana*, Hink and Ohmart 1984). Although once abundant in the bosque, Northern Leopard Frogs (*Rana pipiens*) were rarely captured by Hink and Ohmart (1984) and are considered extirpated from Bernalillo, Socorro, and Sierra counties (Applegarth 1983, Bailey and others 2001). The absence or low numbers of these species captured likely reflect the loss of suitable wetland habitat along the river. From 1935 to 1989, surface area covered by wet meadows, marshes, and ponds declined by 73 percent along 250 miles of Middle Rio Grande floodplain (Roelle and Hagenbuck 1995).

What Should We Know and Why?

Cottonwood forests of the bosque exist in a variety of states (for example, minimally-invaded, highly-invaded, or 'restored') as a result of initial alterations (for example, dams and channelization), subsequent changes (for example, invasive plants and accumulation of debris), and restoration efforts (for example, removal of invasive plants, herbicide application, and prescribed fire). Amphibian and reptile populations respond to changes in abiotic factors, such as structural heterogeneity and substrate moisture (Cunningham and others 2002, James and M'Closkey 2003), as well as biotic factors such as insect availability and predation (Sabo and Power 2002). Simply detecting changes in herpetofaunal populations is not adequate for guiding management activities. Rather, understanding the causes of observed population changes is necessary to design appropriate management responses (Gibbs and others 1999). Thus, questions arise regarding how changes in forest structure and composition have affected herpetofaunal diversity, community ecology, and species distributions, abundances, and interactions.

What Can We Learn From Other Taxa?

Answers to these questions are difficult due to the lack of information on amphibians and reptiles in native bosque prior to recent anthropogenic changes. Although there is no published literature on the effects of these changes on herpetofaunal communities, researchers have compared arthropod, bird, and rodent communities in cottonwood and saltcedar habitats, and results of these studies may provide insight into herpetofaunal community responses.

Ellis and others (2000) described arthropod richness, abundance, and composition in cottonwood and saltcedar sites at BDANWR. Cottonwood sites had a greater abundance of abundance of exotic isopods (Isopoda), which are leaf macrodetritivores. Spider richness and abundance were greater in saltcedar sites. The abundance of other insect taxa was similar or greater in saltcedar sites than cottonwood sites. Thus, although saltcedar has altered riparian ecosystems, it does support a varied and abundant surface-dwelling arthropod community which in turn, support amphibians, reptiles and other vertebrates.

The bosque hosts a rich assemblage of birds in both cottonwood and saltcedar habitats (Hink and Ohmart 1984). Cottonwood and saltcedar habitats were similar in number of species during spring, summer, and fall, although species composition differed seasonally (Hunter 1985, Ellis 1995). During the spring breeding season, more neotropical migrant species were found in cottonwood habitats than saltcedar (Hunter 1985, Ellis 1995).

Ellis and others (1997) described rodent communities in cottonwood and saltcedar sites. White-footed mice (*Peromyscus leucopus*) were the most abundant species in the bosque. Whitethroat woodrats (*Neotoma albigula*) occurred only in cottonwood sites. Overall, rodent species richness was greater in saltcedar sites than cottonwood sites. Similar to the herpetofaunal community, most rodents were upland and grassland species, not riparian specialists.

Effects of Habitat Loss

Damming, channelization, and water diversion have resulted in the loss of wetlands and meadow habitats along the Middle Rio Grande (Hink and Ohmart 1984, D. McDonnell, University of New Mexico, personal communication 2004). Biologists and managers must understand how the loss of these unique habitats has impacted amphibians and other aquatic-associated species in the bosque and whether urban areas, agricultural fields, and irrigation canals provide alternative, quality habitats for these species.

Effects of Fuels Reduction Treatments

Treatments to decrease fuel loadings in the bosque are needed to reduce the risk of catastrophic wildfire to people, their homes, and businesses in surrounding urban and rural areas (Taylor 2001). Information is needed on the impacts of various treatments on herpetofaunal species and communities and opportunities for mitigating adverse effects. For example, in pinyon-juniper woodlands of western Colorado, spiny lizards (genus *Sceloporus*) prefer standing dead trees for shelter, perching, foraging, and other activities. Loss of these trees through fuels reduction treatments would reduce habitat for spiny lizards (James and M'Closkey 2003). However, these negative effects may be mitigated by leaving a percentage of dead standing trees after treatment. Information on the life history and specific habitat requirements of amphibian and reptile species within the bosque is required to answer these questions as they pertain to fuels management along the Middle Rio Grande. Species adapted for open environments may respond favorably to fuels reduction, whereas species requiring more cover or moist habitats may be negatively affected. The challenge facing managers, researchers, and biologists is to identify treatment alternatives that will achieve as many management objectives as possible (for example, fuels reduction, control of exotic plant species, endangered species habitat improvement, improved water management and delivery, restoration of native plant species, biodiversity, and positive or neutral effects on wildlife).

Other Considerations

Many management decisions are often weighed by their impacts on biodiversity, and a high species richness is often favored. However, community productivity and desired species composition are also important considerations when evaluating management activities. The number of animals supported in an area depends on the amount of energy available, and amount of energy available is determined by plant primary productivity (Damuth 1987). Will removal of exotic plant biomass temporarily decrease energy available and thus the number of insects, birds, mammals, amphibians, and reptiles supported on treated sites?

Ernest and Brown (2001) found that abundance, biomass, and energy use mirror fluctuations in primary production, whereas species composition may not follow the same pattern. For example, two sites may have the same number of species, but could differ in the size, abundance, and density of those animals, which is measured by population-level energy use. Therefore, by tracking changes in population-level energy use rather than solely species composition or diversity, we can assess fluctuations in ecosystem function, or resource supply, caused by fuels reduction treatments.

Managers may also be required to make value judgments as to whether changes in species composition and abundance are favorable or unfavorable. All-female, or parthenogenic, lizard species are common in marginal, ecotonal, or disturbed habitats and consequently, have been called 'weedy species' (Wright and Lowe 1968). Parthenogenic species such as the New Mexico Whiptail, Desert Grassland Whiptail (*A. uniparens*), and the Chihuahuan Spotted Whiptail are the most frequently captured whiptails in the Middle Rio Grande bosque (Hink and Ohmart 1984, Stuart and others 1995). However, populations of the Little Striped Whiptail (*A. inornata*), a nonparthenogenic species, were found in the bosque of BDANWR (Stuart and others 1995). Would it be considered a negative consequence if management activities fostered populations of this bisexual, nonparthenogenic grassland species at the cost of other parthenogenic whiptail species and a decline in species diversity? Are managers interested in maximizing biodiversity, restoring native species to bosque, or enhancing habitat for declining species? Research cannot answer these questions, but it can provide information helpful to making decisions.

The Fuels Reduction Project

In 1999, scientists with the U.S. Forest Service Rocky Mountain Research Station initiated an interagency, collaborative project to evaluate the effectiveness of three fuel reduction treatments at sites in the Middle Rio Grande bosque and monitor their effects on groundwater, vegetation, soils, and wildlife. Cooperators on this project include Middle Rio Grande Conservancy District, BDANWR, City of Albuquerque Open Space Division, Bureau of Land Management, New Mexico Department of Environment, Texas Agriculture Experiment Station, and the NRCS Plants Material Center. This project attempts to identify the most effective fuels reduction and exotic plant removal method that will preserve native plants, reduce fire risk, and have a positive or least-negative impact on native wildlife species (Finch and others 2002).

Project Area

The project area encompasses approximately 129 km of riverside bosque from Albuquerque to the BDANWR.

Twelve sites were selected along this stretch of the river, each with relatively homogeneous vegetation, approximately 20 hectares in size, and composed of a mature cottonwood overstory and an exotic woody understory (specifically, saltcedar and Russian olive). To achieve a randomized block design, the 12 sites were subdivided into three blocks of four sites each, and each of the four sites was randomly assigned a treatment type. Treatment 1 consists of mechanical removal of dead and down wood and exotic trees and shrubs followed by spot application of herbicide to cut stumps. Treatment 2 consists of procedures in treatment 1 followed by a light, prescribed fire. Treatment 3 consists of procedures in treatment 1 followed by revegetation with native shrubs. Treatment 4 is the control and consists of no treatment.

Monitoring

To evaluate effects of treatments on herpetofaunal communities, we are monitoring populations (primarily lizards and amphibians) via drift fence arrays, pitfalls, and funnel traps. Drift fences, pitfalls, and funnel traps are being used simultaneously because multiple techniques result in a more complete sampling of amphibian and reptile communities (Jorgensen and others 1998, Crosswhite and others 1999). Each of the 12 sites has three arrays. Each array consists of six pitfalls and six funnel traps positioned along a set of fences. There are a total of 216 pitfalls and 216 funnel traps at the 12 study sites. Each year, traps are open continuously from the first week of June to mid September and are checked three times per week from 0600 and 1400 hrs. Snout-to-vent length, tail length, age (hatchling or adult) and weight of all animals are recorded. Individuals of all lizard species and Woodhouse's Toads are uniquely identified via toe clipping for mark-recapture analysis. Other amphibians and snakes are not captured in sufficient numbers to warrant marking.

Herpetofaunal Research Questions

Habitat Relations

Using pre- and post-treatment trapping results and associated vegetation data (such as vegetation structure, plant species composition, density, canopy cover, litter depth, and woody debris), we will address several of the questions posed. Data from this study will provide insight into the natural history of many species, some of which are little studied to date. For species that are more commonly found in upland habitats, these data will provide specific information regarding their habitat use in riparian cottonwood forests. For example, parthenogenic whiptail species have been studied in upland and riparian habitats of the Lower Rio Grande in Texas and Mexico (Walker 1987, Walker and others 1990), but little is known about their behavior and habitat use along the Middle Rio Grande. Our study will help describe how these populations respond to habitat disturbance and the degree to which they overlap with sexual whiptail species.

Species-specific Responses

Pre- and post-treatment information collected on animals and vegetation will allow us to describe how treatments impact amphibians and reptiles at different life stages and whether new species colonize after different treatments. In particular, we will address species-specific responses to treatments, how populations of parthenogenic species respond to treatment-related habitat changes, and how populations of aquatic or mesic-associated species respond to treatments.

Species Diversity

Avian and lizard diversity are typically greater in complex, heterogeneous environments (MacArthur 1958, Pianka 1967, Farley and others 1994). We will describe diversity with rank-abundance curves and examine whether differences in spatial heterogeneity among or within sites are associated with changes in herpetofaunal diversity.

Ecosystem Function

We are interested in linking species and population-level responses to changes in the ecosystem. To assess energy availability for each site, we will evaluate population-level energy use (Ernest and Brown 2001) by amphibians and reptiles in sites before and after treatment. Population-level energy use is calculated from species density, species-specific metabolic rate, and body mass. This will estimate the amount of energy in the herpetofaunal community.

Project Status

Although data collection for this project began in summer 2000, initial phases of treatments have only recently been completed. Mechanical removal and herbicide phases of treatments occurred at five sites during fall and winter of 2002-2003 and at three sites during fall and winter of 2003-2004. Mechanical removal will occur at the remaining site in fall 2004, and final phases of treatments (prescribed fire and revegetation) will completed by spring 2004. The first season of post-treatment data was collected this summer 2004 at 11 of the 12 sites.

Table 2. Species list of herpetofauna captured in the Middle Rio Grande bosque during the RMRS fuels reduction project (2000 to 2003), ordered within taxa by total number of captures.

Taxa	Scientific Name	Common Name	Number
Amphibians	*Bufo woodhousii*	Woodhouse's Toad	617
	Bufo cognatus	Great Plains Toad	58
	Scaphiopus couchii	Couch's Spadefoot	40
	Spea multiplicata stagnalis	New Mexico Spadefoot	13
	Ambystoma tigrinum	Tiger Salamander	2
	Rana catesbeiana	American Bullfrog	2
	Spea bombifrons	Plains Spadefoot	2
	Pseudacris triseriata	Western Chorus Frog	1
Turtles	*Apalone spinifera*	Spiny Softshell Turtle	1
Lizards	*Sceloporus undulatus*	Eastern Fence Lizard	2755
	Aspidoscelis neomexicana	New Mexico Whiptail	2569
	Aspidoscelis exsanguis	Chihuahuan Spotted Whiptail	2034
	Aspidoscelis uniparens	Desert Grassland Whiptail	1139
	Eumeces obsoletus	Great Plains Skink	397
	Sceloporus magister	Desert Spiny Lizard	73
	Uta stansburiana	Common Side-blotched Lizard	35
	Aspidoscelis tigris	Tiger Whiptail	29
	Aspidoscelis tesselata	Common Checkered Whiptail	12
	Aspidoscelis inornata	Little Striped Whiptail	1
	Phrynosoma cornutum	Texas Horned Lizard	1
Snakes	*Lampropeltis getula*	Common Kingsnake	24
	Pituophis catenifer	Gophersnake	15
	Heterodon nasicus	Western Hog-nosed Snake	9
	Thamnophis sirtalis	Common Gartersnake	8
	Tantilla nigriceps	Plains Black-headed Snake	7
	Thamnophis marcianus	Checkered Gartersnake	4
	Masticophis flagellum	Coachwhip	3
	Thamnophis elegans	Terrestrial Gartersnake	2
	Arizona elegans	Glossy Snake	1
	Crotalus viridis	Prairie Rattlesnake	1
	Leptotyphlops dissectus	New Mexico Threadsnake	1
	Rhinocheilus lecontei	Long-nosed Snake	1
	Crotalus atrox	Western Diamond-backed Rattlesnake	0[a]

[a] Observed at study site, but not captured.

Preliminary Results

A total of 9,857 individuals of 32 species (8 amphibians, 11 lizards, 12 snakes, and 1 turtle) have been captured during the 2000 through 2003 seasons (table 2). Because the arrays are less effective at capturing amphibians and snakes, the majority of individuals captured were lizards. Four species, including the Eastern Fence Lizard, New Mexico Whiptail, Chihuahuan Spotted Whiptail, and Great Plains Skink, were present at most or all sites (11 or 12 sites). Fewer aquatic or moist habitat species are represented. Similar to previous studies, the majority of species captured were upland species. For example, the New Mexico Whiptail is typically associated with open, sparse vegetation (Christiansen and others 1971). The large number of captures of this and other species is surprising considering the high degree of canopy cover, and therefore shading, at our sites (x = 83.3 + 3.3 percent S.E.). At least 3 years of posttreatment data (2004-2006) will be collected at all sites, and data analysis will begin at the close of the field season in mid September 2004.

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