Monitoring Bird Populations in Relation to Fuel Loads and Fuel Treatments in Riparian Woodlands with Tamarisk and Russian Olive Understories

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Abstract—*Over the past decade, wild fire events in riparian bosque (forested) areas along the Middle Rio Grande between Elephant Butte and Albuquerque have increased dramatically owing to flood suppression and accumulation of dead wood and exotic Tamarisk and Russian olive. This problem culminated in a large wild fire in July 1993 that resulted in the evacuation of hundreds of City of Albuquerque residents and captured the national media's attention. Prior to this event, the Rocky Mountain Research Station, in collaboration with the Middle Rio Grande Conservancy District, City of Albuquerque Open Space, and Bosque del Apache National Wildlife Refuge, designed a study in 1999 to compare effectiveness of three methods of fuel removal for reducing fire risk, preventing re-occurrence of exotics, and restoring native habitats, plants and animals. A goal of managers is to preserve cottonwoods while reducing or eliminating Tamarisk and Russian olive stems, so study sites were selected that had cottonwood overstories and Tamarisk and olive understories. As part of this study, the population and nesting responses of breeding bird species have been evaluated prior to and following fuel removal treatments. Our talk reports on 1) the numbers and kinds of bird species inhabiting bosque habitats with cottonwood overstories and varying amounts of Tamarisk and Russian olive, 2) nest substrate use and nesting success of selected bird species prior to treatment, and 3) preliminary results after the first year of mechanical treatments. In addition, we predict short-term and long-term responses of birds and plant communities following treatments.*

Introduction

Along the Middle Rio Grande in New Mexico, between Cochiti Dam and Elephant Butte Reservoir, exotic woody plants have proliferated since their original introductions, altering the structure and composition of riparian plant communities and greatly increasing the frequency and severity of wildfire. Dead and downed wood and exotic salt cedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*) are fuels that lead to high fire risk in the riparian woodland community of the Middle Rio Grande, referred to locally as the "bosque." Salt cedar plants possess many stems and have high rates of stem mortality, resulting in accumulations of dense, dry dead branches (Hart, 2002). When dense salt cedar stands burn, the fires are often intense and fast moving. Salt cedar's high flammability places native bosque flora and fauna at increased risk of mortality by fire. Native tree species inhabiting the middle Rio Grande, such as the Rio Grande cottonwood (*Populus deltoides* ssp. *wislizeni*) and Goodding's Willow (*Salix gooddingii*) are not fire-adapted, cannot resist fire damage and do not respond with regenerative resilience to fires (Busch, 1995).

Land managers are in need of effective methods for reducing fuel loads and controlling exotic woody plants that minimize negative impacts on native plants, wildlife, and soils. To assist in meeting this challenge, the Albuquerque Laboratory of the USDA Forest Service's Rocky Mountain Research Station agreed to monitor responses of various ecosystem components to fuel removal before and after application of treatments. Our interagency, collaborative project was initiated in 1999, with pre-treatment sampling occurring from 2000-2002. Treatments were initiated in 2003 and will continue through 2004. The study is designed to evaluate the effectiveness of three fuel reduction treatments and their effects on wildlife, soils, and hydrology, with the ultimate goal of providing land managers with information for designing and implementing future treatments. A

Memorandum of Understanding signed in 1999 documents participation and contributions of several partners other than the Rocky Mountain Research Station, including Bosque del Apache National Wildlife Refuge, Middle Rio Grande Conservancy District (MRGCD), City of Albuquerque Open Space (COA), Bureau of Land Management (BLM), New Mexico Department of Environment (NMDE), and NRCS Plant Materials Center (Los Lunas, NM).

Our study team is monitoring and evaluating the responses of groundwater, soils, vegetation, bird, bat, reptile, and amphibian populations to three fuel reduction treatments at 12 research sites. In this paper, we report on the status of treatments and describe some of the pre-treatment and early treatment findings as they pertain to the avifaunal component of the study.

Methods

Study Design

Site locations range from the southern portion of Albuquerque city limits to the Bosque del Apache National Wildlife Refuge (USFWS) 20 miles south of Socorro. We are using a randomized block statistical design with four sites (a control and three treatments) identified in each of three blocks. Randomized block designs are appropriate when a population of experimental units has recognizable structure, in this case riparian cottonwood galleries, and one can utilize that structure in assigning treatments (Williams et al., 2001). The three blocks are labeled North, Middle, and South. Sites are labeled from one to four in each block, for example, South 1 (SO1), South 2 (SO2), South 3 (SO3), and South 4 (SO4). Two exceptions, Middle 7, MO7 and North 7, NO7, are numbered in accordance with a broader study. Sites extend 129 km from southern edge of the city of Albuquerque south to the Bosque del Apache National Wildlife Refuge.

The Rocky Mountain Research Station worked with the several land managers; the MRGCD (Middle Rio Grande Conservancy District), COA (City of Albuquerque), USFWS (U.S. Fish and Wildlife Service), and the NMSP (New Mexico State Parks), to determine which sites along the river would be suitable research areas. The following criteria were used for research site selection: 1) sites had visibly-high fuel loads as identified by landowners and NM Environment Department (Wicklund and Najmi 1998); 2) the site had relatively homogenous vegetation, at least 20 hectares in size; 3) sites had a cottonwood overstory and an understory with exotic woody plants; 4) sites were accessible by road; 5) access and block design treatments were permitted by landowner; and 6) sites were relatively undisturbed by grazing, vehicles, and other uses. Each study site has an average size (n = 12 sites) of 20.4 hectares.

Each management agency is responsible for carrying out treatments on the land that they manage in accordance with the MOU. Treatment types were designed to decrease the risk of catastrophic fire by greatly reducing fuel levels. The primary fuels are comprised of dead and down wood and exotic woody plants. Ideally, fuels would be reduced at the selected sites to a range of 5-30 tons per acre, with an operational goal of 15 tons/acre. The following exotic / fuel removal treatments are being implemented in this study: 1) mechanical removal of dead and downed wood and exotic shrubs/trees followed by the application of herbicide (Garlan 3 and 4) to cut stumps, 2) partial mechanical removal of dead, down, and exotics followed by spot herbicide and light, prescribed fire, 3) mechanical removal of dead, downed, and exotics followed by spot herbicide and revegetation with native plants, and 4) control, no treatment. The research team and all cooperators agreed upon treatment types and goals prior to site selection. Treatment type at each site was selected using a random numbers table. Treatments by site are listed in our annual reports (Finch and others 2003, 2004). More information about prescriptions can be obtained in the Environmental Assessments on file with Bosque del Apache National Wildlife Refuge and Middle Rio Grande Conservancy District.

Vegetative Surveys

Vegetation surveys were analyzed at three levels: landscape-block, site-patch, and local-plot. Ecological classifications followed the scheme described in "Handbook of Wetland Vegetation Communities of New Mexico" (Muldavin et. al. 2000). More details about our vegetation data collection methods are described in Finch and others (2003).

At each site, two vegetation plot centers were established approximately 25 meters in each direction from each bird point count station using the diagonal azimuth (i.e., NW). Individual trees were counted by using the appropriate prism. A tree was counted if the displacement of the prism still touched the tree at approximately breast height. The selected tree was then identified to species, categorized as living or dead, and measured for DBH. In cases where a tree had more than one stem displaced by the prism, only the largest stem was counted. These measurements were entered into equations acquired from the Region 3 Stand Exam Program. This allowed for calculation of basal area, trees per acre and average diameter for each tree species. To measure crown closure, a densiometer reading was taken facing north and south by counting the number of closed points in each direction.

The two readings were then averaged and converted to a percentage to characterize canopy cover at the point. The average for each point was then used to determine canopy cover for the entire plot.

Four-meter radius circular plots were established at each bird count station to characterize understory and ground cover on each study site (James and Shugart 1970). Each plot area was 50.3 square meters or approximately 1/200 of a hectare. All native and exotic trees and shrubs were identified, counted, and measured for DBH. On all plots, woody plants with a DBH > 5 cm were characterized as alive or dead, identified to species, and measured for DBH. Only the largest stem was counted when a plant had more than one stem. All understory plants were identified and counted.

Fuel Inventory

The fuels targeted for treatment are grouped into dead and down, and live exotic trees. Fifty-foot transects were established at the center of each vegetation plot. Two transects were established at each bird point count station. Fuel data collection was based on sampling procedures for planar intercepts. Fuel pieces were counted by size class as they intercepted the transect line, following the procedure established in the attached document. Fuel pieces greater than three inches (diameter) were identified to species and measured to the nearest half-inch. The duff depth was measured twice on each transect. Fuel depth was measured three times along each transect. Resulting data were entered into the "Fuel Management Analyst Suite" (Fuels Management Analyst 2002). The Planar Intercept program was used to produce fuel load per type (tons/acre) and average duff and fuel bed depth (in.). With the exception of nest-vegetation data, pre-treatment vegetation and fuel load data were collected during the 2000-01 field seasons.

Exotic stems were counted at one fixed area plot per bird point station. Each exotic plant was identified to species and measured for DBH. Height and crown ratios for each species were calculated. The Crown Mass Inventory portion of the Fuel Management Analyst Suite was used to determine fuel loading by type (tons/acre).

Breeding Bird Point Counts

At each study site, we established generally eight point count stations along a north to south gradient based on global positioning system (GPS) coordinates. Only two sites do not have the standard number of point count stations: North 3 (7) and South 2 (5). All stations were positioned 150 meters apart and the majority is 75 meters from boundary edges. There is one point count station per 2.5 hectares.

Generally, our point count methods follow Bibby and others (1992). All points were sampled an average of five times per season, with each transect surveyed in a north-south direction, alternating direction each session. A round of counts for all sites was completed before beginning a new session. Point counts were performed every other week during each breeding season (05 May to 15 August, approximately). During each count, the observer at each point recorded all birds seen or heard for 8 minutes. Detection mode (heard, seen), sex, relative age of bird, and distance from point (m) were also recorded. Common and scientific names were based on the A.O.U Check List of North American Birds (American Ornithologists' Union, 1998) and its supplements. Species identification and distance estimations were checked across observers by informal testing throughout the sampling season. Each observer was trained to estimate and record distances to each bird. Each transect was surveyed by 3-5 different individuals over the course of each of the three pretreatment seasons to standardize observer bias (Verner, 1985). On mornings with low wind (<15 km/hr) and no precipitation, surveys were conducted within the first four hours after sunrise with the first count beginning within half an hour of sunrise. Analyses of wildlife abundance and possible responses to fuel removal will be evaluated after treatments.

Nest Monitoring

Each research site was searched for active nests on a regular and consistent basis from May through August each study year. At each nest, observers recorded a nest identification number, species identification, GPS location, directions to the nest (geographical and microscale), and a check of nest contents. Nest checks were repeated until young fledged (recorded as "success") or the nesting attempt failed ("failure") or ended with an undetermined fate ("unknown"). During nest checks, observers recorded monitoring dates, nesting stage, nest contents, and detailed notes about adult behavior, and evidence of cowbird parasitism, predation, and fledging. After the nesting season ended, additional measurements such as nest height, location of nest in plant, nest material, nest tree size and tree condition were collected at each nest site.

Results

Project Status

Data collection for this project began in the summer of 2000. This paper reports on project status through March 2004. Three complete years (200, 2001, and 2002) of pre-treatment bird data were collected. Mechanical removal and herbicide phases of treatments were implemented at 5 sites (NO2, NO4, SO2, SO3, and SO4) during the fall and winter of 2002-2003. Remaining sites other than controls are scheduled to be treated in the fall and winter of 2003-2004. Only one season of "post-treatment" data at five partially-treated sites has been collected up to the time of the writing of this paper. Because treatments have not been fully implemented and post-treatment sampling remains to be completed, only limited analyses of treatment effects can be reported.

Overstory Vegetation

The dominant species at all sites was Rio Grande Cottonwood (*Populus deltoids* ssp. *wislizeni*). Native trees such as Goodding's Willow (*Salix gooddingii*) and Box Elder (*Acer negundo*) were also important components of the overstory in the North and Middle blocks. Sites in the North block had higher canopy closures than those in other blocks. In the North block, the exotic trees, Siberian Elm (*Ulmus pumila*), Honey Locust (*Gleditsia triacanthos*) and White Mulberry (*Morus alba*), are present in the overstory as well as in the understory. Average canopy height for larger trees in the North block was approximately 19 m, and average DBH (diameter-at-breast-height) was 50 cm. Other sites and blocks had more trees per hectare, and trees were younger and/or stunted trees, averaging 12-15 m tall and 20-35 cm in diameter. Mean canopy closure decreased from North to South blocks of sites, ranging from 75.5 percent (+29.9 percent) at South 3 to 96.9 percent (+2.25) at North 2. Variation in canopy closure at South sites was much higher than North sites, as reflected by standard deviations that were about 5-7 times larger at South sites than North sites. A more comprehensive description of vegetation measurement results is given in Finch and others (2003).

Understory Vegetation

The understory layer at all study sites was dominated by exotic trees, the majority of which were Russian Olive and Salt Cedar. Exotic trees at North block sites were generally larger in size than those observed in other research blocks. The number of Russian Olive trees per site increased from North to South blocks, whereas the reverse was generally true for Salt Cedar. Also, the native New Mexico Olive (*Forestiera pubescens*), Seepwillow (*Baccharis salicifolia*) and native Pale Wolfberry (*Lycium pallidum*) were much more prevalent in the South block. The two native willows, Goodding's (*Salix gooddingii*) and Coyote (*Salix exigua*), were more abundant in the Middle block. Rio Grande Seepwillow (*Baccharis salicina*) and Golden Current (*Ribes aureum*) were most prevalent in the North block.

Fuel Loads

Fuel loads across all 12 study sites were comprised of exotic plants and dead and down wood. Total fuel loads prior to treatment varied from a low of 15.3 tons/acre at the South 2 site to a high of 51.0 tons/acre at the North 3 site. The North block of sites had an average fuel load of 42.1 tons/acre, the Middle block of sites had an average of 28.04 tons/acre, and the South sites had 32.1 tons/acre. The high fuel loads in the North sites are associated with high numbers of exotic trees as well as high amounts of dead and down (especially in the small size class). The average site contribution of dead and down in the 0.1-2.9" size class was 8.1 tons/acre/site, compared to 4.37 tons/acre contributed by the 3" size class. Exotic stems contributed an average of 21.6 tons/acre/site, which is about twice as much as the contribution by dead and down wood.

Breeding Bird Counts

Over 100 bird species have been detected across all study sites over the duration of the study. Bird count information is provided by species and year (2000-2003) in our annual reports, available by request. Table 1 gives bird detections/point averaged by site and year for the 20 most common species observed in the pre-treatment phase (2000-2002) and during the first year of the treatment period (2003). At this time, it is premature to evaluate statistically bird population responses to treatments because treatments are still in progress, and variations in bird populations among years and sites must be examined and factored out. We are simply reporting average detection numbers to illustrate the kinds of data we have collected during the pre-treatment phase and will continue to collect during and following treatments to determine treatment effects.

The most abundant species using our study sites during all sampled years was the Black-chinned Hummingbird (*Archilochus alexandri*) with detections in the pre-treatment phase ranging from an average low of 1.80 birds/point at our South 4 site to an average high of 27.99 birds/point at North 3 (NO3). Hummingbird detections in 2003 appeared slightly higher on all sites than site detections averaged across the pre-treatment phase. Annual variation in hummingbird numbers may be an important factor in explaining variation in bird numbers. Site to site variation in hummingbird numbers is also clearly evident in the pre-treatment phase. In particular, hummingbirds were most frequently detected at our northern sites and least frequently detected at our southern sites, suggesting

Table 1. Mean detections/count/site of common breeding bird species at 12 sites in the pre-treatment (a = 2000 – 2002 averaged by year) and treatment (b = 2003) phases of the middle Rio Grande fuel removal study.*

Research Site	NO1		NO2*		NO3		NO4*		MI1		MI2		MI3		MI4/7		SO1		SO2*		SO3*		SO4*	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Cooper's Hawk (*Accipiter cooperii*)	2.66	0.63	1.89	1.56	0.63	0.71	1.25	0.94	2.86	1.56	0.66	1.33	2.55	0.00	1.91	0.52	0.55	0.63	1.31	0.42	0.39	0.31	0.08	0.00
American Kestrel (*Falco sparverius*)	0.31	0.63	0.08	0.00	0.18	0.00	0.31	1.88	0.00	0.00	0.33	0.00	0.49	2.19	0.52	1.04	0.08	0.31	2.02	3.75	0.00	0.94	0.70	0.96
Mourning Dove (*Zenaida macroura*)	3.36	5.31	4.19	3.75	5.71	7.14	8.20	11.88	2.95	1.56	9.62	10.90	9.38	11.25	7.38	13.54	11.56	11.25	12.62	13.33	9.06	12.50	12.42	21.79
Yellow-billed Cuckoo (*Coccyzus americanus*)	0.08	0.00	0.49	0.00	0.18	0.00	0.08	0.00	0.09	0.00	0.00	0.27	0.16	0.00	0.43	0.26	0.31	0.00	0.36	1.67	1.88	2.19	1.09	0.64
Black-chinned Hummingbird (*Archilochus alexandri*)	23.05	32.81	26.97	27.19	27.99	34.29	24.45	33.75	24.55	25.94	26.81	31.65	16.94	16.25	18.32	30.73	10.63	10.31	11.31	11.67	6.41	5.31	1.80	1.28
Downy Woodpecker (*Picoides pubescens*)	3.05	2.81	1.32	1.56	1.09	1.43	3.20	2.19	2.59	0.63	2.63	1.60	1.48	1.56	1.04	0.26	1.25	1.56	0.71	1.67	0.94	0.63	0.78	1.92
Northern Flicker (*Colaptes auratus*)	2.11	2.19	3.04	3.44	5.34	2.14	1.48	2.81	2.50	0.63	3.70	0.00	3.70	3.44	2.69	4.43	1.56	1.56	5.71	3.33	0.78	1.25	4.45	0.96
Western Wood-Pewee (*Contopus sordidulus*)	1.95	0.63	0.99	3.75	7.70	5.36	5.86	13.44	1.07	0.63	2.63	2.66	4.36	4.06	1.39	2.60	8.28	5.00	4.05	4.17	1.48	2.50	2.66	4.17
Ash-throated Flycatcher (*Myiarchus cinerascens*)	5.08	10.94	3.62	7.50	3.89	5.36	4.61	5.94	5.00	7.81	17.60	17.02	6.41	6.56	7.03	15.10	16.33	15.94	11.55	6.25	8.91	15.63	17.81	19.87
Black-capped Chickadee (*Poecile atricapillus*)	6.41	8.75	4.19	3.13	5.43	8.57	2.81	1.25	7.59	9.69	8.14	9.84	2.80	2.19	2.34	7.81	1.09	3.13	0.00	0.00	0.08	0.63	0.00	0.00
White-breasted Nuthatch (*Sitta carolinensis*)	5.63	6.56	4.93	11.56	4.17	5.71	5.78	10.00	3.39	2.50	4.85	5.05	3.13	2.19	1.13	8.59	1.72	2.81	3.33	2.92	0.55	0.31	0.63	2.24
Bewick's Wren (*Thryomanes bewickii*)	8.75	12.19	10.94	7.81	9.33	11.43	13.13	12.81	5.00	11.25	5.35	7.71	4.52	13.44	3.73	13.28	5.23	14.06	11.67	14.58	8.05	8.44	19.45	22.76
Phainopepla (Phainopepla nitens)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.60	15.83	0.23	1.25	0.08	0.96
Yellow-breasted Chat (*Icteria virens*)	7.11	8.44	8.55	11.56	6.07	4.29	3.98	5.94	5.98	3.75	5.35	1.60	9.79	9.06	5.82	1.82	9.14	10.31	21.31	32.08	11.56	8.44	9.61	5.13
Summer Tanager (*Piranga rubra*)	4.14	8.75	4.61	4.38	5.16	9.64	6.33	11.56	5.36	3.13	6.25	5.85	4.19	5.94	6.34	5.47	6.33	8.13	8.81	6.67	6.88	7.50	8.67	10.26
Spotted Towhee (*Pipilo maculatus*)	10.86	12.81	18.09	14.69	16.21	20.71	17.19	12.19	13.39	15.31	17.11	12.50	11.68	11.56	16.06	16.41	14.45	10.63	21.79	18.75	13.67	5.00	13.67	12.82
Black-headed Grosbeak (*Pheucticus melanocephalus*)	10.94	15.63	16.28	18.13	15.13	19.64	20.31	14.69	18.84	7.50	14.64	11.44	12.42	9.06	13.54	18.75	20.47	15.94	10.60	15.83	9.45	8.44	6.25	2.56
Blue Grosbeak (*Passerina caerulea*)	5.70	4.38	4.03	2.81	4.44	4.29	2.81	4.06	4.02	6.25	6.00	3.72	7.73	6.25	9.46	2.08	11.88	12.50	10.48	12.50	7.81	9.38	5.47	3.21
Brown-headed Cowbird (*Molothrus ater*)	4.14	2.81	4.28	11.56	5.07	8.57	6.95	11.88	6.43	4.38	10.36	10.37	7.48	5.94	9.98	2.08	16.72	12.81	12.62	14.17	9.61	7.19	15.23	10.90
Lesser Goldfinch (*Carduelis psaltria*)	1.25	0.00	0.58	1.25	2.63	2.86	1.72	4.38	0.63	1.56	1.64	2.39	3.54	6.56	1.82	3.65	1.02	2.81	0.95	3.75	4.06	4.69	2.03	0.00

*shaded columns indicate sites treated between 2000-2003, and unshaded indicate untreated sites.

that factors that typically vary over space (for example, habitat suitability, air temperature) may explain variation in hummingbird numbers among study sites.

Spotted Towhees (*Pipilo maculatus*), Black-headed Grosbeaks (*Pheucticus melanocephalus*), and Bewick's Wrens (*Thryomanes bewickii*) were the next most commonly recorded species. Like the Black-chinned Hummingbird, most species showed site-to-site variation in numbers of detections during the pre-treatment phase (table 1). In particular, detection rates for Black-capped Chickadees and Black-headed Grosbeaks generally decreased from north to south sites whereas detection rates for Mourning Dove, Ash-throated Flycatcher, Yellow-breasted Chat, Phainopepla, and Brown-headed Cowbird were the reverse. Our annual reports demonstrate that annual variations in detections of many species were also noteworthy.

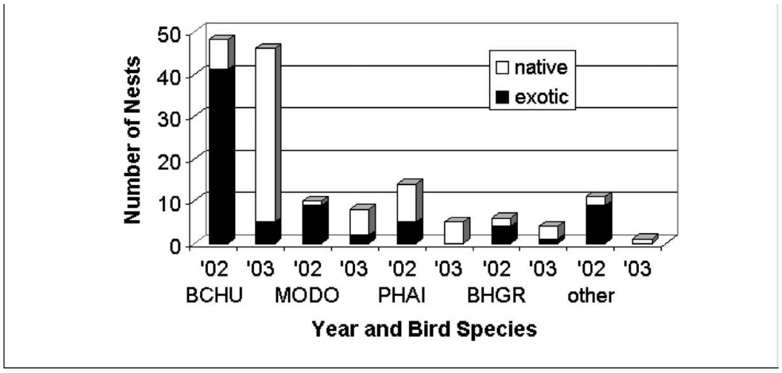
Bird Nests

A total of 580 nests, representing 33 species, were located on our 12 study sites during the pre-treatment phase (2000-2002). Nest fates, categorized as "success" or "failure," were determined for the most common riparian bird species (509 nests). We found more nests of Black-chinned Hummingbirds (253) than of any other species (table 2). This species had an overall nesting success rate of approximately 67.35 percent. Exotic trees (Russian olive, in particular) were used more often as nest substrates than native plants. Assessment of 2000-2001 data indicated that Black-chinned Hummingbird nesting success was not significantly related to use of exotic versus native plant substrates (chi-square, $p > 0.05$). Further monitoring will continue over the next several years.

Raptors, including as Cooper's Hawks (*Accipiter cooperii*) and American Kestrels (*Falco sparverius*), and cavity nesters displayed relatively high nesting success rates compared to the rates for cup-nesting species in the pre-treatment phase (table 2). In contrast, the Blue Grosbeak (*Passerina caerulea*), which nested more frequently in understory exotics than in native plants, appeared to have a fairly high rate of nest failure (70 percent) during the pre-treatment phase. Given that numbers of both Blue Grosbeaks and Brown-headed Cowbirds (*Molothrus ater*) varied together at some of the same sites, the high rate of Blue Grosbeak nest failure might be in part related to brood parasitism by cowbirds. How birds such as these respond to the removal of their preferred nesting plants will be one of the questions we will address by collecting and analyzing post-treatment data.

Table 2. Numbers of successful and failed nests by nest substrate (exotic or native plant) of common bird species during the pre-treatment phase (2000-2002) of the middle Rio Grande fuel model study.

Species	Native Plants					Exotic Plants				
Cup Nesters	Success	Failed	Unknown	Total	% Success	Success	Failed	Unknown	Total	% Success
Black-chinned Hummingbird	29	20	24	73	59.18	99	48	33	180	67.35
Phainopepla	6	6	9	21	50.00	4	2		6	66.67
Summer Tanager	3	4	5	12	42.86				0	
Black-headed Grosbeak	1	1	7	9	50.00	6	3	5	14	66.67
Blue Grosbeak	1			1	100.00	3	7	6	16	30.00
Totals	40	31	45	116	56.34	112	60	44	216	65.12
	Native Plants					Exotic Plants				
Cavity Nesters	Success	Failed	Unknown	Total	% Success	Success	Failed	Unknown	Total	% Success
American Kestrel	2		1	3	100.00				0	
Downy Woodpecker	18		10	28	100.00				0	
Northern Flicker		1	9	10	0.00				0	
Ash-throated Flycatcher	10		18	28	100.00				0	
Bewick's Wren	10	1	10	21	90.91	2			2	100.00
Totals	40	2	48	90	95.24	2	0	0	2	100.00
	Native Plants					Exotic Plants				
Stick Nesters	Success	Failed	Unknown	Total	% Success	Success	Failed	Unknown	Total	% Success
Cooper's Hawk	20		2	22	100.00				0	
Swainson's Hawk	6		1	7	100.00				0	
Mourning Dove	3	13	3	19	18.75	6	20	11	37	23.08
Totals	29	13	6	48	69.05	6	20	11	37	23.08



Legend:

BCHU = Black-chinned Hummingbird
MODO = Mourning Dove
BHGR = Black-headed Grosbeak
PHAI = Phainopepla
other = Northern Mockingbird, Yellow-breasted Chat, Blue Grosbeak, Lesser Goldfinch

native = Rio Grande Cottonwood, New Mexico Olive, Goodding's Willow, Screwbean Mesquite
exotic = Russian Olive, Salt Cedar, Tree of Heaven, Siberian Elm

Figure 1. Numbers of nests of common bird species at treated sites combined found in exotic and native plants in 2002, a pre-treatment year, and 2003, the first year of post-mechanical fuel removal.

Nest searches were conducted in the 2003 field season. This was a year when mechanical treatments were implemented at several sites. A total of 328 nests were found in 2003, the largest number recorded in any year of the Fuels Reduction study. Interestingly, of all sites surveyed, two partially-treated sites, North 4 (50) and South 2 (42), had the highest number of nests. Mechanical removal of exotics had been completed on both sites prior to collection of bird count and nest data. In the previous year, both sites were within the top three for most nests found and monitored per site. Thus, both North 4 and South 2 retained a high proportion of nesting birds in the first sampling season following mechanical removal of exotics and accompanying site disturbance.

Black-chinned Hummingbird nests accounted for almost half of all monitored nests (n = 152) in 2003. As in pre-treatment years, hummingbirds displayed a high nesting success rate (approx. 80 percent for 2003). The second most common nest found in 2003 belonged to Mourning Doves with a 50 percent success rate that paralleled dove nesting success rates from previous years.

As expected, due to the reduction of understory plants and potential nesting substrates, fewer nests (91) were found at the cut sites in 2003 than at uncut sites in 2002 (64 nests) despite 19.5 more hours of nest searching in 2003. In 2002, we found a total 68 nests of eight different species in exotic plants and only 21 nests in native plants on five sites scheduled for fuel removal. After treatment at these same sites, we only found 8 nests in exotic plants (at the periphery of the treated areas or in regenerated plants) but 56 nests in native plants. The two most predominant nesting species at pre-treatment sites in 2002, Black-chinned Hummingbirds and Mourning Doves, appeared to switch readily to native substrates when exotics were removed (fig. 1) at least in this first treatment year. The number of nests for both species only declined slightly. Excluding hummingbirds and doves, we found 31 nests in 2002 and only 10 nests in 2003. No nests of Blue Grosbeaks (*Passerina caerulea*) or Northern Mockingbirds (*Mimus polyglottos*) were found at any fuel reduction sites after cutting, and only 5 Phainopepla nests were found in 2003 compared to 14 nests in 2002.

Discussion

Treatments are scheduled to be completed by fall 2004, and the first year of post-treatment monitoring of vegetation, bird populations, and other variables is planned for the field season of 2005. Our quick evaluation of pre-treatment data revealed that numbers of exotic and native woody plants, canopy closure, and fuel loads varied by site. This variation is likely to affect bird numbers at each site. For example, decreases in observations of Black-chinned Hummingbirds from North to South sites paralleled declines in numbers of Russian Olive and Rio Grande Cottonwood stems and percentage of canopy closure from North to South. During the treatment-analysis phase, we will need to factor in natural variation in vegetation across sites and consequent effects on bird populations. Bird populations also varied by year, another factor to be accounted for when interpreting treatment effects. Annual variation in bird numbers is linked to yearly differences in adult and juvenile mortality and productivity which can vary by species.

More nests were found over all sites in 2003 than in any previous year, even though fewer nests were found at the five mechanically-cut sites than in 2002. Prior to treatment, shrub-nesting birds, especially Black-chinned Hummingbirds and Mourning Doves, frequently nested in exotic plants and experienced comparable nesting success as those nesting in native plants. Cavity-nesters rarely used exotic plants as nest substrates, and hawk nests were never found in exotics. After treatment, the abundant Black-chinned Hummingbird and Mourning Dove adapted to loss of exotic plants at cut sites by switching their nests to native plants. Further analyses and interpretations of bird population and nesting responses to treatments will be conducted after treatments are completed and post-treatment data have been collected.

Fuel loads are comprised of dead and down wood and exotic plants. Some bird species such as Northern flicker and Bewick's Wren forage for insects in dead and down wood. Cavity-nesters build their nests in live and dead snags, some of which will be removed during the treatment phase. Some cup-nesting species appear to have an affinity for exotic woody plants as nest, cover, or foraging substrates. We predict that at least some cavity-nesters, litter-foragers, and shrub nesters will experience population declines at the local site level during the first 1-3 years following treatments. If treatments are successful in restoring native understory shrubs, however, bird species that require shrubs to nest in may experience resurgence in their numbers as native shrubs mature, reproduce, and spread. Although the short-term population responses of canopy-nesters such as Summer Tanager and Yellow-billed Cuckoo are hard to predict, the long-term consequences of restoring native trees (such as Rio Grande Cottonwood and Goodding's Willow) by removing exotic plant competitors are likely to be beneficial for canopy-nesters.

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