Vegetation and Habitat along the Gila River in Southwestern New Mexico

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Abstract
As part of a biodiversity study, 49 riparian sites along the Gila River in southwestern New Mexico were sampled to document the presence and abundance of many rare birds, reptiles, and amphibians and to specifically examine their vegetation and habitats, which are the topic of this paper. During the summer of 2006, a team of researchers recorded all the plant species, their percent cover, and the number of woody species from three 0.1-hectare plots at each of the 49 sites. Data from this project demonstrate that upstream vegetation (from sites in the vicinity of Gila Hot Springs) is different from vegetation downstream (from sites near the towns of Gila and Cliff and below Redrock). Upstream sites have more species/plot, less bare ground, more total plant cover and more wetland species. These data are important for providing a baseline data set for studying possible in-stream flow alterations, natural habitat changes, or climate change, which may influence both hydrological changes and vegetation.

Introduction

This project was undertaken to document the presence and abundance of many rare species and their habitats along the upper reaches of the Gila River in southwest New Mexico. One of the rarest birds, the federally endangered willow flycatcher, *Empidonax trailii*, has been documented to have the largest number of territories along this stretch of the Gila River (U.S. Fish and Wildlife Service 2002). However, the status of most other species of concern and their habitat along the Gila River is not well documented.

This paper discusses the vegetation and habitat data collected during the summer of 2006, the first year of the two-year study. Collection of these data is urgently needed to provide baseline documentation of wildlife habitat and species composition before potential changes to the river occur. Such changes include in-stream flow alteration and climatic changes. Baseline documentation can provide necessary information for management opportunities to restore and potentially improve habitat. Sound data are essential for public discourse and sound management practices. The lack of such current data documenting the biota of the Gila River is a problem that this research project can help resolve, to benefit the conservation of these bird, reptile, and amphibian species and the potential conservation and restoration of their habitat.

Forty-nine sites along the Gila River were established with Global Positioning System (GPS) coordinates so that they can be resampled in the future to determine longer-term trends and also to facilitate future data analysis that can be used to evaluate change in conservation status of these species in the event that conservation, restoration, or hydrological changes are made to these habitats.

Methods

Study Area

Fieldwork for this study of the habitats of birds, amphibians, and reptiles along the Gila River took place in Grant and Catron Counties, NM, from near the towns of Redrock, Gila, and Cliff upstream to the town of Gila Hot Springs and up the Middle and West Forks beyond the Gila Cliff Dwellings National Monument lands (fig. 1).

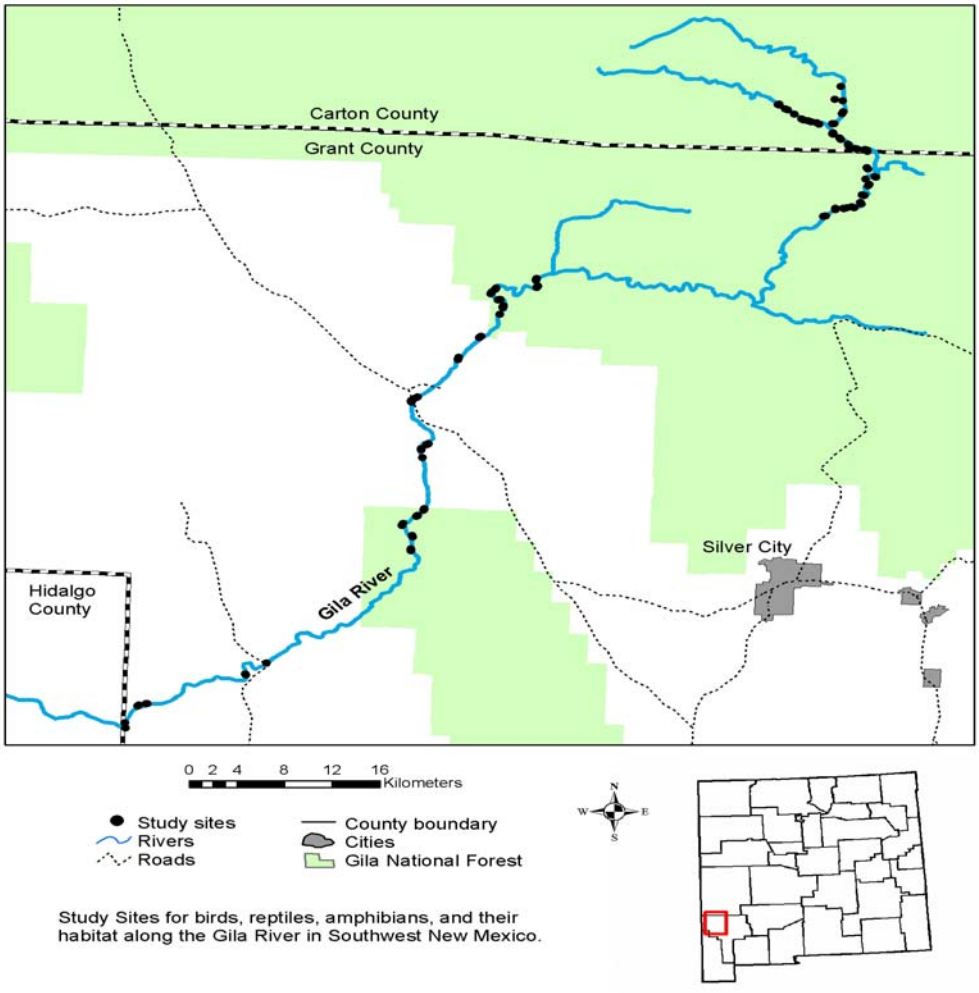

Fig. 1. Study sites along the Gila River

Methodology

Based on results from similar large-scale projects (Kindscher et al. 1998; Debinski, Kindscher, and Jakubauskas 1999; Norris and Farrar 2001; Saveraid et al. 2001), a robust methodology was established for this project in the Gila watershed. The primary focus was on two categories of sites: upstream sites (higher elevation sites from 5,000 to 6,000 feet, located nearer the town of Gila Hot Springs and the Gila Cliff Dwellings National Monument), and downstream sites (lower elevation sites from 4,000 to 5,000 feet, located nearer to the towns of Gila and Cliff and downstream to and below Redrock, NM; fig. 1). Lands in the study area are owned and managed by the federal government (Gila National Forest, Gila Cliff Dwellings National Monument, and the Bureau of Land Management), the State of New Mexico, the Nature Conservancy, and private property owners. All sites were selected within riparian areas and were separated by at least ½ mile to ensure independence.

Each site was characterized by three circular plots with an 18 m radius area (0.1 ha in size) and was sampled for all overstory and understory plant species. Cover values were determined for all plant species, and voucher specimens will be collected during the second year of fieldwork and deposited in the Dale A. Zimmerman Herbarium (SNM) at Western New Mexico University and in the Ronald L. McGregor Herbarium (KAN) at the University of Kansas.

Data were recorded in every plot for the following habitat attributes (modified from Rice, Anderson, and Ohmart 1984): the diameter at breast height (dbh) of the four largest trees, the foliage density of the ground layer (density of the foliage from the ground to 0.6 m), foliage density of the understory (1.5 m–3.0 m), the foliage density

of the overstory (from 3.0 m to the canopy), the foliage height diversity, and the number of trees in the plot with dbh > 2 in.). All data were collected on a fieldwork form, copied, and entered into an Excel spreadsheet at the University of Kansas. Data were summarized by species and plots were divided into upstream and downstream locations. All species names are from the State of New Mexico checklist at the Range Science Herbarium at New Mexico State University (Allred 2007).

Results

For the 49 sites (147 plots) along the river, a total of 399 plant species were found. The riparian area contains forests dominated by Fremont's cottonwood (*Populus fremontii* S. Wats.), narrowleaf cottonwood (*Populus angustifolia* James), Goodding's willow (*Salix goodingii* Ball), and rabbitbrush (*Ericamera nauseosa* {Pallas ex Pursh} Nesom & Baird) (tables 1 and 2). In addition there are open areas of grassland and savanna and other areas of sand and gravel bars. Significant differences were found between bare ground and dominant species upstream and downstream. Upstream areas had more species (47.3 per plot) compared to downstream sites (only 32.1 species per plot). Upstream sites had less bare ground with total plant cover, including canopy overlap, of 99.8% compared to downstream sites with 62.8%. Vegetation differences were illustrated by the fact that bare ground had the highest cover class of any plant or category at downstream sites. Also, more wetland species (classified as wetland obligate species by the U.S. Fish and Wildlife Service, 2007) were found in upstream plots.

Non-native species are of concern in riparian habitats in the Southwest. Salt cedar or tamarisk (*Tamarix chinensis* Loureiro) has become a species of concern in the southwestern United States as this exotic species tends to use considerable amounts of water in riparian areas and crowds other species out. Whiteman (2006) found salt cedar along much of the Gila River and mapped its locations. The data from our Gila River project indicate that only 14 of the 72 (19%) downstream plots had tamarisk cover, with the highest percentage being only 2% of the cover of any individual plot and most other plots having no cover or only a trace. In the upstream plots (those above Turkey Creek and greater than 5,000 feet in elevation), only 4 of the 75 plots (5%) had tamarisk, also with the cover less than 2% in all plots. So overall, only 12% of the plots had tamarisk cover and the greatest percentage was 2% in any of these plots. A higher percentage of cover (but still less than 1% per plot) was found for the exotic sweet clover (*Melilotus officianalis* {L.} Pallas), which made extensive stands along middle portions of the river.

Table 1. Summary of species with greatest cover and bare ground percent cover for upstream plots taken along the Gila River in July 2006. Species cover summed from 75 plots at 25 sites, located from 3 miles below the Grapevine Campground at the Forks of the Gila (the junction of the East and West forks) upstream to along the Middle and West forks above the Gila Cliff Dwellings National Monument. All plots were between 5,000 and 6,000 feet. The symbol * designates a non-native species.

Species with Authorities and Bare Ground	Common Name	Percent Cover
Bare Ground	Bare Ground	23.9
Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird	rubber rabbitbrush	8.9
Populus angustifolia James	narrowleaf cottonwood	8.5
Salix irrorata Andersson	bluestem willow	6.1
Alnus incana (L.) Moench	mountain alder	4.0
Artemisia carruthii Wood ex Carruth	Carruth's sagebrush	3.6
Acer negundo L.	boxelder	3.4
**Melilotus albus* Medik.	white sweet clover	2.7
Populus x acuminata Rydberg	lanceleaf cottonwood	2.6
Platanus wrightii S. Watson	Arizona sycamore	2.5
Populus fremontii S. Watson	Fremont cottonwood	1.6
Pinus ponderosa Lawson	ponderosa pine	1.2
Vitis arizonica Engelmann	canyon grape	1.2
Juniperus scopulorum Sarg.	Rocky Mountain juniper	1.1
Mirabilis longiflora L.	sweet four o'clock	1.0
Juniperus monosperma (Engelm.) Sarg.	oneseed juniper	1.0
Sporobolus contractus A. S. Hitchcock	spike dropseed	1.0
Brickellia floribunda Gray	Chihuahuan brickellbush	0.9

Parthenocissus vitacea (Knerr) A.S. Hitchcock	thicket creeper	0.9
Juniperus deppeana Steud.	alligator juniper	0.9
Bouteloua gracilis (Willd. ex Kunth) Lagasca ex Griffiths	blue grama	0.8

Table 2. Summary of species with the greatest cover and bare ground percent cover for downstream plots taken along the Gila River in July 2006. Species cover summed from 72 plots at 24 sites, located from the Turkey Creek confluence to below Redrock, NM. All plots were between 4,000 and 5,000 feet. The symbol * designates a non-native species.

Species with Authorities, Bare Ground and Water	**Common Name**	**Percent Cover**
Bare Ground	Bare Ground	40.4
Populus fremontii S. Watson	Fremont cottonwood	12.6
Salix gooddingii Ball	Gooddings willow	6.8
Baccharis salicifolia (Ruiz & Pavon) Persoon	mules fat	3.0
Salix exigua Nutt.	sandbar willow	2.0
Platanus wrightii S. Watson	Arizona sycamore	2.0
Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird	rubber rabbitbrush	1.5
Ambrosia monogyra (Torrey & Gray ex Gray) Strother & Baldwin	burrobrush	1.5
Salix irrorata Andersson	bluestem willow	1.3
Water	Water	0.9
**Melilotus albus* Medik.	white sweet clover	0.7
Acer negundo L.	boxelder	0.5
Sporobolus contractus A. S. Hitchcock	spike dropseed	0.5
**Rumex crispus* L.	curly dock	0.4
Aristida divaricata Humboldt & Bonpland ex Willdenow	poverty threeawn	0.4
**Salsola tragus* L.	prickly Russian thistle	0.4
**Cynodon dactylon* (L.) Persoon	Bermuda grass	0.4
Prosopis glandulosa Torrey	honey mesquite	0.4
Artemisia carruthii Wood ex Carruth	Carruth's sagebrush	0.3
Amaranthus palmeri S. Watson	pigweed	0.3
Boerhavia erecta L.	erect spiderling	0.3

Discussion

The Gila River in southwest New Mexico is still a free-flowing river and is dominated by stands of native riparian species. Although there are some patches of exotic species, such as sweet clover and salt cedar, for the most part, the cover is overwhelmingly dominated by native species and is in relatively good condition. There were no rare or state or federally-listed plant species found in the plots, but this is not surprising as riparian areas typically have few rare plant species as these habitats are greatly affected by flooding disturbance.

This project's data will be archived and will be useful for conservation work, planning for restoration, and management of the river's vegetation, and will be important baseline data for any proposed actions that will change the hydrology of the river through proposed water-development projects. In addition, these data can be important for documenting and studying the habitat of rare and common species of plants, birds, and other animals, and also for the management of exotic species. Because there are differences along the river in the vegetation due to the hydrology, geology and past land-management practices, more data will be collected and the interpretations will be available for review and discussion. The final data will be available to other researchers and the public through the author's Web site: http://www.kbs.ku.edu/people/kindscher.htm

Acknowledgments

I would like to thank Quinn Long, Maggie Riggs, Hillary Loring, Bernadette Kuhn, and Sarah March for help in the field data collection and species identification, Jessica Dean and Bernadette Kuhn for data entry, Craig Freeman and

Caleb Morse for botanical identifications of specimens, and William Norris, Randy Jennings, and Roland Shook for collaborating on the project. Jack Carter and William Norris provided useful editorial comments. In addition, I would like to thank the New Mexico Department of Game and Fish for funding, and most importantly, the property owners—Gila National Forest, Gila Cliff Dwellings National Monument, the State of New Mexico, Bureau of Land Management, the Nature Conservancy, and private property owners—for giving us permission to collect these data on their respective land holdings.

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