Birds, Reptiles, Amphibians, Vascular Plants, and Habitat in the Gila River Riparian Zone in Southwestern New Mexico

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Cover Photo: The Gila River in New Mexico. Photo by Kelly Kindscher, September 2006.

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Abstract

During 2006 and 2007 our research crews collected data on plants, vegetation, birds, reptiles, and amphibians at 49 sites along the Gila River in southwest New Mexico from upstream of the Gila Cliff Dwellings on the Middle and West Forks of the Gila to sites below the town of Red Rock, New Mexico. For the vegetation work, three plots were established at each site and a total of 476 species were identified in the plots. For bird work, more than 70 birds were identified at both the lower and upper Gila River sites, including the federal and state-listed southwestern Willow Flycatcher, Bell's Vireo, Gila Woodpecker, Abert's Towhee, and Common Black Hawk. And surveys in and adjacent to the river at these sites found five amphibians species, eight snake species and 28 other reptile species. Data from these surveys provide an important census of species that are present and provide a baseline data set for future study and comparison.

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Introduction

The purpose of this study, conducted over a two-year period (2006-2007), was to identify and collect data on species of concern (federal and state) and their habitats along the Gila River in southwest New Mexico. This project also provided the opportunity for the four principal investigators to conduct comprehensive inventories of birds, reptiles, amphibians, and vascular plants of habitats adjacent to the Gila River. One of the rarest birds in the southwestern United States, the federally endangered Willow Flycatcher, *Empidonax traillii*, 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.

Figure 1. The study included 49 sites in the riparian areas, including this site, along the west fork of the Gila River.

Collection of these data has been 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 and for habitat restoration and potential habitat improvement. Decisions based on sound baseline data, which document the biota of the Gila River, are essential for public discourse and sound management practices. The lack of such current data 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 study sites along the Gila River (Example in Figure 1) were established for this research with Global Positioning System (GPS) coordinates so that they can be re-sampled in the future to determine long-term trends and to facilitate future data analysis. This information can be used to evaluate change in conservation status of these species in the event that restoration, hydrological, or climate changes occur in these habitats.

Methodology and Study Area

Based on results from similar large-scale projects (Kindscher et al. 1998, Norris and Farrar 2001, Saveraid et al. 2001, Debinski et al. 1999), 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 Dwelling National Monument, Figure 2), 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 Red Rock, New Mexico; Figure 2). 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. Study sites were 300 by 50 m and established within riparian areas and were separated by at least 300 km to ensure independence.

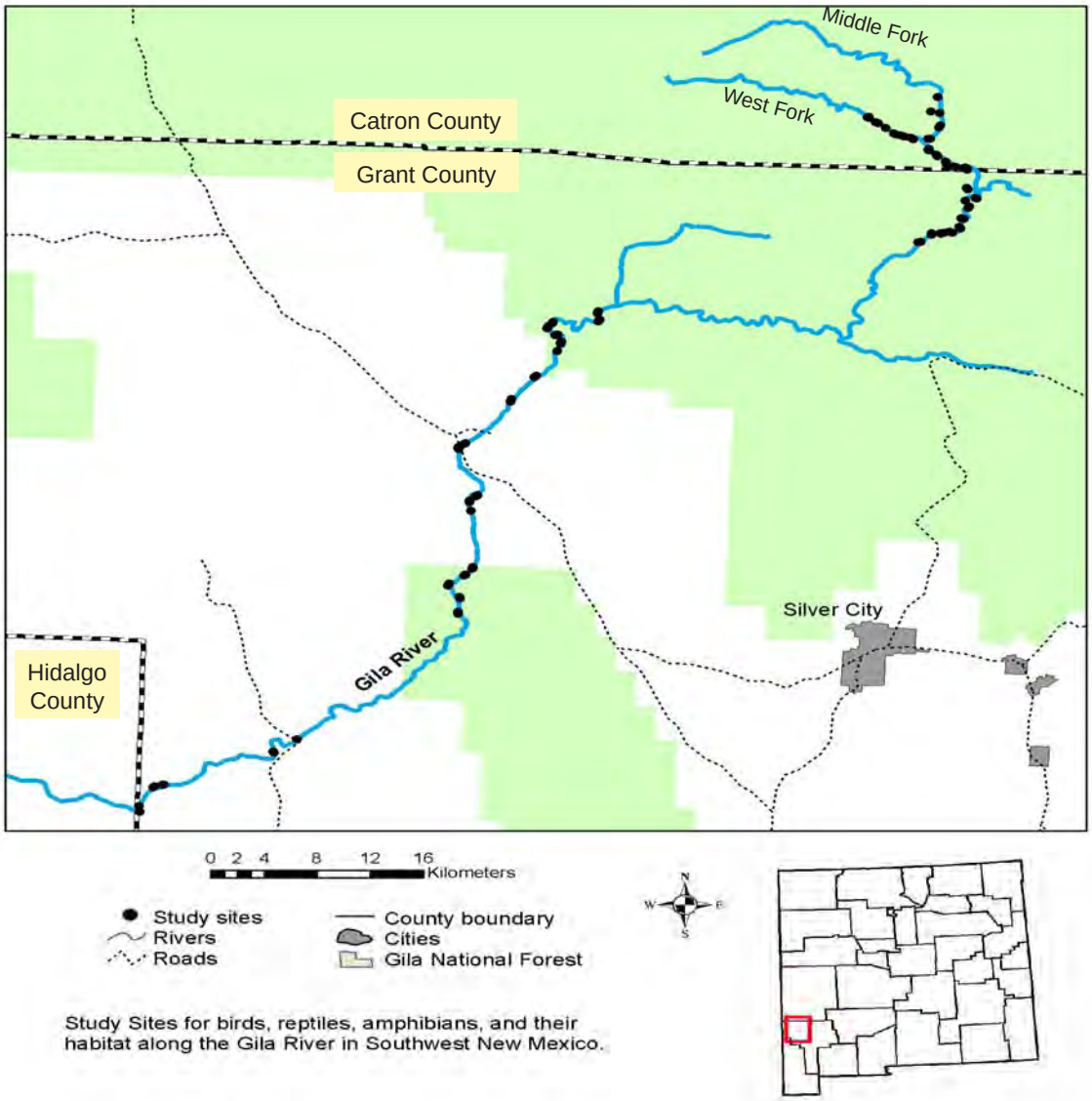

Figure 2. Study sites along the Gila River are marked with black dots. Upstream sites numbered 25 and were clustered around the West Fork and Middle Fork of the Gila in Catron County and along the main stem of the Gila in northern Grant County. Upstream sites were at higher elevations ranging from 5,000 to 6,000 feet. Downstream sites numbered 24 and were distributed along the Gila River in Grant County; they were at lower elevations ranging from 4,000 to 5,000 feet.

Section 1. Gila River Survey for Vegetation and Habitat Data

By Kelly Kindscher

Introduction

The vegetation and plant species of each site were characterized to establish baseline data of both individual species and also to determine the habitats that were used by other species. The vegetation was highly variable due to flooding and hydrology, substrates of rocks, sand, and soil, and past land uses.

Methods

Three circular plots were established at each site, separated from each other by about 100 m. Each plot had an 18 m-radius area (0.1 ha in size) and was sampled for all overstory and understory plant species. Percent cover values were determined for all plant species at each plot using Daubenmire's (1959, 1968) sampling protocol. Voucher specimens of plant species found in plots were collected, labeled, and deposited in the Dale A. Zimmerman Herbarium (SNM) at Western New Mexico University and 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 et al. 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); lower understory (0.6 to 1.5 m); upper understory (1.5 m–3.0 m); overstory (from 3.0 m to 8.0 m); and canopy (>8.0 m). We also recorded 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 categorized as either upstream or downstream. All species names are from the State of New Mexico checklist at the Range Science Herbarium at New Mexico State University (Allred 2007). Statistical analysis using t-tests (in SPSS version 16.0) were conducted to compare upstream versus downstream locations for number of species per plot and for a wetland index.

Figure 3. The author measures the diameter of a large sycamore growing on the edge of a deep river scour.

Results

For the 49 sites (147 plots) along the river, a total of 476 plant species were found. (Examples of some wildflowers are in Figures 13-18.) The riparian area for both upstream and downstream plots contains forests dominated by Fremont's cottonwood (*Populus fremontii* S. Wats.), narrow leaf cottonwood (*Populus angustifolia* James), Goodding's willow (*Salix gooddingii* Ball), and Carruth's

sagewort (*Artemisia carruthii* Alph. Wood ex Carruth). (See Figures 4-12.) Tables 1 and 2 provide both the most dominant downstream and upstream species and their cover. Habitats included forested and open areas of grasslands and savanna and other areas of sand and gravel bars.

In comparisons of upstream and downstream plots, significant differences were found for bare ground cover and total number of species per plot for 2007 data (Table 3). Specifically for 2007, upstream areas had more species (47.3 per plot) compared to downstream sites (only 41.1 species per plot). In addition, upstream sites had significantly 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 within sampled plots of any plant or category at downstream sites. Note that data for 2006 and 2007 were very similar, so 2007 data and analysis are provided here.

All species are classified as to their relationship to wetlands (U.S. Fish and Wildlife Service, 2007, Kindscher et al. 1998), with most species being upland species, almost never found in wetlands. The other four classes of wetland species in order of greater affinity to wetland habitats are: facultative upland plant species, facultative species (about half the time found in wetlands), facultative wetland species, and obligate wetland species. There was more cover by all groups of wetland indicating species in upstream plots, with facultative wetland species, facultative species, facultative upland species, and

Figure 4. Rabbit brush, willows, and cottonwoods on the upper Gila River near Gila Hot Springs National Monument.

Figure 5. Some study sites were on gravel bars.

Figure 6. Other study sites were in areas of grasses, cottonwoods and sedges on the river's edge






Figures 7 through 12. Additional views of the Gila River. First column, top to bottom: Gila Lower Box; gravel bar with willows and cottonwoods; the deeper and drier canyon near Red Rock. Second column, top to bottom: Arizona sycamore and alder in shaded habitat near Gila Hot Springs; a rocky riparian flat with rabbit brush, willows, and Ponderosa pine above; sedges and willows along the West Fork.

and upland species, all having significantly higher cover upstream than downstream (Table 3). Only obligate wetland species, which had only a small amount of cover, were similar in cover between upstream and downstream locations.

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) observed tamarisk at several locations along the Gila River in our study area and mapped their locations. Our data indicate that it is not very common as only seven of the 72 (<10%) downstream plots had tamarisk cover, with the highest percentage being 2% of the cover of any individual plot and most other plots having no cover or only a trace. For the upstream plots (those above Turkey Creek and greater than 5,000 feet in elevation), only five of the 75 plots (7%) had tamarisk, also with the cover no more than 1% 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 was found for the exotic sweet clover (*Melilotus albus* {L.} Pallas), which made extensive stands along both upper and lower portions of the river (20 percent cover of some plots) and being found in 126 of all 147 plots (86%).

Table 1. Upstream plot summary, species with greatest cover and wetland status for plots sampled along the Gila River in July 2007. Average species cover 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.

Species	Common Name	Percent Cover	Wetland Status
Populus angustifolia	Narrow-leaved cottonwood	13.23	FACWetland
Artemisia carruthii	Carruth's sagewort	12.39	Upland
Ericameria nauseosa	Rabbitbrush	11.58	Upland
Salix irrorata	Bluestem willow	9.84	FACWetland
Alnus incana	Gray alder	5.93	Not Included
Acer negundo	Box elder	4.73	FACWetland
Platanus wrightii	Arizona sycamore	3.67	FACUpland
Populus fremontii	Fremont's cottonwood	3.42	FACWetland
Populus X acuminata	Lance-leaved cottonwood	3.11	FACWetland
Vitis arizonica	Canyon grape	2.76	FACultative
Bromus carinatus	California brome	2.35	Upland
Pinus ponderosa	Ponderosa pine	1.97	FACUpland

Table 2. Downstream plot summary, species with the greatest cover and wetland status for plots sampled along the Gila River in July 2007. Average species cover summed from 72 plots at 24 sites, located from the Turkey Creek confluence north of Cliff, NM, to below Red Rocks, NM. All plots were between 4,000 and 5,000 feet. The symbol * designates a non-native species.

Species	Common Name	Percent Cover	Wetland Status
Populus fremontii	Fremont's cottonwood	17.03	FACWetland
Salix gooddingii	Goodding's willow	8.61	Obligate
Baccharis salicifolia	Mule's fat	4.86	FACWetland
Salix exigua	Coyote willow	3.60	Obligate
Platanus wrightii	Arizona sycamore	3.13	FACWetland
*Salsola tragus**	Russian thistle	2.99	FACUpland
*Melilotus albus**	White sweet clover	1.93	FACUpland
Sporobolus contractus	Spike dropseed	1.45	Upland
Acer negundo	Box elder	1.40	FACWetland
Ericameria nauseosa	Rabbitbrush	1.31	Upland
Aristida ternipes	Threeawn	1.28	Upland
Chenopodium neomexicanum	New Mesico goosefoot	1.26	Not included

*** signifies exotic species**

Table 3. Comparisons of bare ground, wetland groups of plants and number of species between upstream and downstream Gila River riparian sites using 2007 plot data.

Category	Upper Gila Cover	Lower Gila Cover	T-test statistics
Bare ground	20.9%	39.7%	t= 4.3, df=124, p=0.000
Upland Species	26.2%	15.2%	t= 9.6, df=138, p=0.000
Facultative Upland Species	7.3%	5.7%	t= 4.4, df=144, p=0.000
Facultative Species	7.1%	3.7%	t=-8.2, df=141, p=0.000
Facultative Wetland Species	8.5%	6.8%	t=-2.6, df=144, p=0.011
Obligate Wetland Species	1.8%	1.8%	t=-.07, df=138, p=0.944
Number of species	**47.3**	**41.1**	**t=8.4, df=144, p=0.000**

Figures 13-18. Wildflowers found in our riparian plots were an important component of the 476 species recorded. First column, top to bottom: golden crownbeard (*Verbesina enceloides*) with red morning glory (*Ipomoea cristulata*), four o'clock (*Mirabilis multiflora*), and white sandmat (*Chamaesyce albomarginata*). Second column: prickly poppy (*Argemone pleiacantha*), bee spiderplant (*Cleome serrulata*), and Hooker's evening primrose (*Oenothera elata*).

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, especially sweet clover, vegetative cover is overwhelmingly dominated by native species and is in relatively good condition. One rare plant, Mimbres figwort (*Scrophularia macrantha* Greene ex Stiefelhagen), was found along both West Fork and Middle Fork sites of the Gila. This plant is not listed, but it is a species of concern for the U.S. Fish and Wildlife Service and the State of New Mexico and a Sensitive species on U.S. Forest Service lands (New Mexico Rare Plant Technical Council 1999). This is a range extension as it had not been found before in Catron County or along the Gila River. It was found along moist and sheltered locations along both forks of the Gila River.

The data collected during this project 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 their interpretation 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

Figure 19. Morning light striking cottonwoods and burro brush across riparian area of Gila River near Red Rock, NM.

Section 2. Gila River Survey for Bird Data

By William Norris and Roland Shook

Introduction

New Mexico bird records published in *Birds of New Mexico* by Florence M. Bailey Bailey (1928), the *Revised Check-list of the Birds of New Mexico* by John P. Hubbard (1978), the New Mexico Ornithological Society's *Field Notes* (1962 – 2007), the National Audubon Society's *Audubon Field Notes* (1953 – 2007) and successive publications were recently analyzed as to their distribution from the Arizona border to the upper reaches of the West, Middle and East Forks of the Gila River. Of the 7,847 records identified, 529 (7%) were from the Lower Gila Valley (below Redrock), 4,661 (59%) were from the Cliff/Gila Valley, 500 (6%) were from the Upper Gila Valley (above Grapevine Campground), 1,669 were from the Glenwood area (21%), and 488 (6%) were unidentified as to exact location. This analysis revealed the need to collect information on the avifauna in the Gila River valley in a more uniform manner.

In this paper, we describe the results of a comprehensive bird inventory conducted at 49 different study sites on the Gila River and its major tributaries (West, Middle and East Forks) in New Mexico in 2006 and 2007. The primary goal of this project was to identify occurrences of federal and state listed bird species, and to characterize their habitats along the river. Analysis of data collected during this project has also allowed us to characterize the avifauna of the Gila River basin in a more uniform manner than has been previously possible, and in particular has revealed major differences in the avifaunas of the "upstream" and "downstream" regions of the Gila River (as defined in the Introduction to this report and shown in Figure 2).

Figure 20. *Falco peregrinus*, Peregrine Falcon.
http://www.flickr.com/photos/80835774@N00/2139159555/

Methods

Bird censuses were conducted using point counts (Ralph et al. 1995) at each of the 49 study sites established along the Gila River in both 2006 and 2007 (three times each year between mid-May and early July). These censuses were conducted in the morning within 15 minutes of sun-up and no later than 9:30 a.m. Each point count lasted ten minutes, and was conducted by either co-principal investigators William Norris or Roland Shook. The occurrence of all birds seen or heard during the census was recorded on a census form as occurring either inside or outside of a 25 m radius circle tangent to the river. Each bird observation was characterized as occurring during the first three minutes, between minutes three through five, and/or during the last five minutes of the census. The nature of the vocalization (auditory, vocal, both, flyover) was also recorded for each bird observation. Typically, four to five bird censuses were conducted in a given morning. The beginning time of each bird census at a given study site was varied throughout each season when logistically feasible. Also,

Norris and Shook rotated the census of birds at each site when possible to reduce observer bias.

Data were summarized to allow for a comparison of the Gila River avifauna on upstream (25) versus downstream (24) sites. For each of these two general regions, common species were determined for a given year as those bird species detected (inside or outside of the 25m circle) in at least 75% of the study sites. Frequent species were determined for each region and for each year as those species which occurred in between 50% and 74% of the study sites. Infrequent species for a given region and year were defined as those occurring in between 25% and 49% of sites, and rare species were defined as species occurring in less than 25% of sites for a given region and year.

We compared the avifaunas of the upstream and downstream Gila River sites with respect to the following characteristics: total bird species richness, similarity/dissimilarity of common species, in each region, species with > 50% difference in frequency between upstream and downstream regions, and the occurrence of federally/state endangered and threatened species. Bird nomenclature used in this report (Table 4) follows the Checklist of the American Ornithological Union (accessed April 2008).

Results

Common Species

In the 25 upstream Gila sites, a total of 71 bird species were detected in both 2006 and 2007, respectively (Table 2). The following species were common during both years in the upstream Gila and its tributaries: Western Wood Pewee, Violet-Green Swallow, Spotted Towhee, Mourning Dove, Black-Headed Grosbeak, and American Robin. Three species were common for one year in the upper Gila sites: Warbling Vireo (2006), Yellow Breasted Chat (2007) and Blue Grosbeak (2007).

A total of 75 and 64 bird species were detected in the downstream Gila sites in 2006 and 2007, respectively. In this region, six bird species were common during both years: Mourning Dove, Yellow Warbler, Yellow-Breasted Chat, Brown-Headed Cowbird, House Finch and Cassin's Kingbird. Five species were common during one of the two years in the downstream Gila sites: Western Wood Pewee (2007), Summer Tanager (2006), Blue Grosbeak (2007), Bewick's Wren (2007) and Brown-Crested Flycatcher (2007).

Comparison of the Upper and Lower Gila Avifaunas

Different bird species predominated the avifauna of the upstream and downstream Gila River valleys, with only four of the above listed bird species (Western Wood Pewee, Mourning Dove, Yellow-Breasted Chat, Blue Grosbeak) being common in both regions for at least one year (see previous paragraph). Many species have great differences in frequency of site occurrences between these two regions. For example, the following bird species were present in at least 50% more upstream than downstream Gila River sites for at least one year: American Robin (2006, 2007), Violet-Green Swallow (2006, 2007), Black-Headed Grosbeak (2006, 2007), and Warbling Vireo (2006). In contrast, Summer Tanager (2006), House Finch (2007) and Brown-Crested Flycatcher (2006, 2007) were present in at least 50% more of the downstream versus upstream Gila sites during this study.

Rare Species

Rare species are defined by us as those detected in fewer than 25% of sites. In the upstream Gila sites, more than half of species in both 2006 (44, 62%) and 2007 (40, 56%) were rare. These include many Southwest specialties typical of forest habitat, including Painted Redstart, Hepatic Tanager, Virginia's Warbler and Grace's Warbler. They also include observations of two New Mexico state threatened birds: Common Black Hawk (2006, 2007) and Peregrine Falcon (2007).

In the downstream Gila sites, more than half of bird species detected were rare in both 2006 (42, 56%) and 2007 (35, 55%). During both 2006 and 2007, we detected the federally and New Mexico state endangered Southwestern Willow Flycatcher as well as four New Mexico state threatened species: Bell's Vireo, Gila Woodpecker, Abert's Towhee and Common Black Hawk.

Discussion

It is clear that the avifaunas of the upstream and downstream regions of the Gila River have similarities and dissimilarities (see Results). Interestingly, the more forested tributaries and upper reaches of the Gila River are home to numerous songbirds endemic to the Southwest; none of these, however, are listed as threatened or endangered by any state or federal agency. Both listed species of the upper Gila are raptors: Peregrine Falcon and Common Black Hawk. In contrast, the downstream Gila River is home to four listed songbird species, as well as a state threatened woodpecker and raptor. Clearly, the data collected during this study support the great importance of the downstream Gila River region as habitat for birds of conservation concern from a purely legal standpoint.

Figure 21. *Melanerpes uropygialis* , Gila Woodpecker.
http://www.flickr.com/photos/modean987/227650312/sizes/o/

Our original intention was to analyze habitat relationships of both individual species and subsets of birds (e.g., migratory status, feeding guild, nest substrate, etc.) using vegetation data collected by Kindscher during concurrent vegetation surveys of our study sites. Such analyses are usually conducted using bird data collected within the circle established for a point count census, so that direct comparisons between vegetation and bird utilization can be analyzed. However, the very low frequency of bird detections recorded within the 25 m circle used during this study greatly diminish the power of standard statistical tests to detect such relationships.

Future study of the Gila River avifauna should investigate modifications of the point count protocol used in this investigation to allow for greater detection of birds within a predetermined radius of the observer, or consider alternative census methods currently employed for analysis of bird communities along riparian habitats. Future studies might also consider an extension of bird censuses into July to enhance detection of bird species which are more conspicuous at mid-summer (e.g., Lesser Goldfinch, Yellow-Billed Cuckoo, personal observation of Norris and Shook). Furthermore, studies of nest productivity of selected bird species would be desirable for evaluating the importance of Gila River habitats to bird population dynamics on a regional scale. Nonetheless, the data summarized in this report (Table 2) provide a baseline of bird distribution that clearly establish similar and unique features of bird communities at different locations along the Gila River in New Mexico. Finally, these data provide a baseline for future studies focused on long-term change in bird community composition along the Gila River.

Table 4. Summarized bird census data collected during point-counts conducted at 49 total study sites along the Gila River in New Mexico (2006, 2007). Frequency = number of sites at which a given bird species was detected within upstream or downstream Gila River sites. Percent = percent of total sites out of 25 (upstream sites) or 24 (downstream sites) at which a given bird species was detected during a given year. Bird abbreviations follow AOU Checklist of North American Birds (2008).

Bird Species	Upstream Site Frequency (2006)	Upstream Site Percent (2006)	Downstream Site Frequency (2006)	Downstream Site Percent (2006)	Upstream Site Frequency (2007)	Upstream Site Percent (2007)	Downstream Site Frequency (2007)	Downstream Site Percent (2007)
Abert's Towhee		0	2	8.3		0	5	21
Acorn Woodpecker	3	12		0.0	1	4		0
American Crow		0	4	16.7		0	4	17
American Dipper		0		0.0	1	4		0
American Kestrel	1	4	2	8.3		0	1	4
American Robin	23	92	3	12.5	19	76		0
Ash-Throated Flycatcher	11	44	4	16.7	10	40	5	21
Barn Swallow		0	1	4.2		0		0
Brown-Crested Flycatcher		0	15	62.5		0	18	75
Black-chinned Hummingbird		0		0.0	1	4	1	4
Bell's Vireo		0	6	25.0		0	8	33
Bewick's Wren	14	56	17	70.8	18	72	19	79
Brown-Headed Cowbird	16	64	18	75.0	15	60	18	75
Black-Headed Grosbeak	24	96	5	20.8	23	92	4	17
Blue Grosbeak	13	52	15	62.5	21	84	21	88
Black Phoebe	7	28	11	45.8	12	48	8	33
Bronzed Cowbird		0		0.0			2	8
Bridled Titmouse	4	16	5	20.8	4	16	1	4
Broad Tailed Hummingbird	2	8		0.0	11	44		0
Black-Throated Gray Warbler	3	12		0.0	3	12		0
Bullock's Oriole	10	40	9	37.5	10	40	6	25
Bushtit	7	28	3	12.5	9	36	2	8
Cassin's Kingbird	12	48	20	83.3	10	40	21	88
Canyon Wren	6	24	4	16.7	13	52	2	8
Canyon Towhee	2	8		0.0	3	12		0
Common Black Hawk	3	12	3	12.5	3	12	3	13
Chipping Sparrow	2	8		0.0	1	4		0
Cliff Swallow	2	8	2	8.3	2	8	2	8
Cordilleran Flycatcher	2	8		0.0	4	16		0
Cooper's Hawk	1	4		0.0		0		0
Common Merganser	1	4	4	16.7	2	8	1	4
Common Nighthawk		0	1	4.2		0	1	4
Common Raven	12	48	8	33.3	12	48	5	21
Common Yellowthroat	14	56	6	25.0	11	44	6	25
Eurasian Collared Dove		0	2	8.3		0	1	4
European Starling		0	2	8.3		0	2	8
Gambel's Quail		0	13	54.2	1	4	15	63
Great Blue Heron	1	4	3	12.5	3	12	6	25
Great Horned Owl		0	1	4.2		0		0
Gila Woodpecker		0	8	33.3			6	25
Grace's Warbler	2	8		0.0		0		0
Great-tailed Grackle		0	1	4.2		0		0
Green-tailed Towhee	2	8	1	4.2		0		0
Hairy Woodpecker	7	28		0.0	4	16	1	4

Bird Species	Upstream Site Frequency (2006)	Upstream Site Percent (2006)	Downstream Site Frequency (2006)	Downstream Site Percent (2006)	Upstream Site Frequency (2007)	Upstream Site Percent (2007)	Downstream Site Frequency (2007)	Downstream Site Percent (2007)
Hepatic Tanager	4	16		0.0	5	20		0
House Finch	10	40	19	79.2	5	20	19	79
Hooded Oriole		0	2	8.3		0	1	4
House Wren	18	72	1	4.2	16	64		0
Indigo Bunting		0	4	16.7	4	16	7	29
Killdeer		0	10	41.7	1	4	6	25
Lazuli Bunting	1	4		0.0		0		0
Lark Sparrow		0	1	4.2		0		0
Ladder-Backed Woodpecker		0	8	33.3		0	8	33
Lesser Goldfinch	6	24	6	25.0	9	36	9	38
Lesser Nighthawk		0	1	4.2		0		0
Lincoln Sparrow	1	4		0.0		0		0
Lucy's Warbler		0	14	58.3	1	4	13	54
Magnificent Hummingbird		0		0.0	1	4		0
Mallard	6	24	8	33.3		0	2	8
Mexican Jay	3	12	2	8.3	2	8	2	8
MacGillivray's Warbler	1	4	2	8.3	1	4		0
Mountain Chickadee	1	4		0.0		0		0
Mourning Dove	20	80	22	91.7	20	80	22	92
Montezuma Quail		0		0.0			1	4
Northern Cardinal		0	16	66.7		0	14	58
Northern Flicker	13	52	10	41.7	16	64	8	33
Northern Mockingbird	2	8	2	8.3		0	2	8
Northern Rough Winged Swallow	4	16	7	29.2	1	4	5	21
Orange-Crowned Warbler	4	16		0.0	4	16		0
Osprey		0		0.0	1	4		0
Painted Redstart	10	40		0.0	11	44		0
Pied-billed Grebe	1	4	1	4.2		0		0
Peregrine Falcon		0		0.0	3	12		0
Phainopepla		0	1	4.2		0	3	13
Pinyon Jay	3	12	1	4.2	8	32		0
Plumbeous Vireo	10	40	7	29.2	16	64	3	13
Pyrrhuloxia	1	4		0.0		0		0
Rufous-crowned Sparrow		0		0.0	1	4		0
Red Crossbill		0		0.0	1	4		0
Red-Naped Sapsucker	2	8		0.0	2	8		0
Rock Wren	2	8	1	4.2	4	16	1	4
Red-tailed Hawk	1	4	1	4.2		0	2	8
Red-Winged Blackbird	1	4	2	8.3	2	8	2	8
Say's Phoebe	2	8		0.0	7	28		0
Song Sparrow	1	4		0.0		0		0
Spotted Sandpiper		0	2	8.3	1	4		0
Spotted Towhee	25	100	12	50.0	25	100	9	38
Stellar's Jay	11	44		0.0	9	36		0
Summer Tanager	6	24	21	87.5	5	20	15	63
Turkey Vulture	4	16	4	16.7	5	20	3	13
Vermilion Flycatcher		0	11	45.8		0	6	25
Verdin		0	1	4.2		0		0
Violet-Green Swallow	19	76	5	20.8	21	84	5	21
Virginia's Warbler	11	44		0.0	4	16		0

Bird Species	Upstream Site Frequency (2006)	Upstream Site Percent (2006)	Downstream Site Frequency (2006)	Downstream Site Percent (2006)	Upstream Site Frequency (2007)	Upstream Site Percent (2007)	Downstream Site Frequency (2007)	Downstream Site Percent (2007)
Warbling Vireo	21	84	3	12.5	17	68		0
White-Breasted Nuthatch	6	24	7	29.2	10	40	7	29
White Crowned Sparrow	3	12		0.0		0		0
Western Bluebird		0		0.0	1	4		0
Western Kingbird		0	10	41.7		0	3	13
Western Meadowlark		0	1	4.2		0		0
Western Scrub Jay		0		0.0	2			0
Western Tanager	2	8		0.0	15	60		0
Western Wood Pewee	22	88	18	75.0	25	100	16	67
Willow Flycatcher		0	4	16.7		0	2	8
Wild Turkey		0		0.0	2			0
Wilson's Warbler	5	20	4	16.7	1	4		0
White-Throated Swift	4	16		0.0	4	16	1	4
White-Winged Dove		0	11	45.8	3	12	5	21
Yellow-Breasted Chat	18	72	21	87.5	20	80	24	100
Yellow-Billed Cuckoo	1	4	6	25.0	1	4	7	29
Yellow Warbler	18	72	23	95.8	15	60	22	92

Section 3: Gila River Survey for Amphibians and Reptiles

By Randy Jennings

Introduction

Historically, 73 species of amphibians (14 species) and reptiles (59 species) have been documented from the Gila River in New Mexico (Painter 1985, Degenhardt et al. 1996). For reference 130 (26 amphibians and 104 reptiles) and 137 (28 amphibians and 110 reptiles) species have been documented in the states of New Mexico and Arizona, respectively (Stebbins 2003). A total of 29 species of amphibians (4 species) and reptiles (25 species) were found during surveys of the Gila River associated with this study during 2006 (Table 5). During 2007 one additional species of amphibians and three additional species of reptiles were identified: a total of 5 amphibians and 28 reptiles were found during all surveys.

Of the 73 species of amphibians and reptiles documented from the Gila River in New Mexico, six amphibian and 18 reptile species exhibit widespread distributions along the river (Degenhardt et al. 1996). Two amphibian species are restricted to higher elevation, upper reaches of the Gila River watershed, while six species are restricted to low elevation habitats of the lower Gila River drainage. As might be expected, a majority of reptile species (35) are restricted to warmer, lower elevation sites, while only three species each have ranges restricted to middle and upper reaches of the river.

Methods

We conducted visual encounter surveys (VESs), searches using dip nets, and investigation of cover objects at each of the 49 study sites along the Gila River to detect amphibians and reptiles. At each site 300 m of stream formed the long axis of the site, while the width of the stream plus a 15 m swath on each side of the stream formed the width of each herpetological study area. The stream was sampled using visual encounter surveys, and dip nets. The 15 m borders on each side of the stream were sampled visually by two observers walking slowly along the length of one shore of the river. Observers also flipped inviting cover object that may hide amphibians and reptiles. Both sides of the river were sampled in this manner. During surveys, we monitored ambient environmental conditions (air temperature, water temperature, water pH, water conductivity, wind, and weather). We identified species of amphibians and reptiles visually using binoculars or when possible by hand capture. Each of the 49 sites was sampled in this manner once each year from May through July during 2006 and 2007. Voucher specimens were retained at WNMU in the Gila Center for Natural History collections.

Figure 22. *Bufo woodhousei*, Woodhouse's toad.

Results

The five species of amphibians found during these surveys included *Hyla arenicolor* (canyon treefrog), *Rana catesbeiana* (American bullfrog), *Bufo cognatus* (Great Plains toad), *Bufo*

microscaphus (southwestern toad), and *Bufo woodhousei* (Woodhouses's toad, Fig. 22). While *Hyla arenicolor* is known from throughout the Gila River basin, it was found only in a single site in the northern half of the study area. *Rana catesberiana* was numerous and found throughout sites surveyed, but was much more common in lower elevation, downstream sites. *Bufo wodhousei* and *B. cognatus* were found only in the downstream Gila River sites, while *Bufo microscaphus* was much more common in the upstream Gila River sites.

Notable amphibian absences included *Ambystoma tigrinum* (tiger salamander), *Rana yavapaiensis* (lowland leopard frog), and *Rana chiricahuensis* (Chiricahua leopard frog). All of these species have been found along the river or in near-stream aquatic habitats (Degenhardt et al. 1996). The absence of *A. tigrinum* may be understood by its preference for still water habitats; most of those surveyed along the river were lotic. The absence of the two leopard frog species was expected since neither has been observed along the portions of the Gila River surveyed during this study since the 1970s (Jennings 1987, Jennings 1991). *R. chiricahuensis*, a federally threatened species, and *R. yavapiensis*, a state threatened species, have suffered from the presence of *R. catesbeiana* and crayfish species which are non-native predators and competitors of these and other native amphibians and reptiles. Additionally, both leopard frogs are known to be adversely affected by a Chytridiomycetes fungus, *Batrachochytrium dendrobatidis*, that specializes in the breakdown of amphibian α-keratin.

Twenty-eight species of reptiles observed during surveys included two turtle species, 16 lizard species, and 10 snake species (Table 5). The two species of turtle observed were *Kinosternon sonoriense*, a native and well-documented component of the Gila River herpetofauna (Degenhardt et al. 1996). The other turtle encountered was the non-native, spiny softshell turtle, *Apalone spinifera*. *Apalone spinifera* is an aquatic turtle that was observed in the downstream, warmer reaches of the Gila River. The only other turtle likely to be encountered would be western box turtle, *Terrapene ornate*, which is a relatively common species in grasslands adjacent to the Gila River, but this habitat was not surveyed..

The most common species seen during these surveys were lizards (Table 5). The phrynosomatid lizards (spiny, earless, tree, and horned lizards, 9 species), and whiptail lizards (Family Teiidae, 5 species) constituted most species and individuals seen. A single species of skink, the Great Plains skink (*Eumeces obsoletus*, Family Scincidae), and a single species of alligator lizard, the Madrean alligator lizard (*Elgaria kingi*, Family Anguidae) completed the list of lizards observed. The greater number of lizard species observed when compared to other groups of amphibians and reptiles probably reflects the conspicuousness of many lizard species as much as their relative abundance. Visual encounter surveys (VESs) are probably a more effective survey technique for lizard than for other groups.

The most common lizard species seen in downstream Gila River sites were *Aspidoscelis sonorae* (55 individuals), *Aspidoscelis uniparens* (43), *Cophosaurus texanus* (41), *Aspidoscelis flagellicauda* (33), *Urosaurus ornatus* (31), *Sceloporus cowlesi* (25) and *Sceloporus clarki* (16). At upstream sites, *U. ornatus* (111), *S. cowlesi* (68), *Aspidoscelis exsanguis* (58), *A. sonorae* (40), and *Sceloporus poinsettii* (6) were most common species. *A. sonorae*, *U. ornatus*, and *S. cowlesi* were common in upstream and downstream sites, while other common species exhibited a more restricted distribution. Distribution of all lizard species is found in Figures 25 through 41.

Many lizards observed were individuals of the five species of whiptail lizards, genus *Aspidoscelis*. These lizards possess interesting biology in that there are both bisexual species (species with both male and female individuals; *A. tigris* and *A. inornata*), as well as parthenogenetic species (species with just females individuals; *A. exsanguis*, *A. flagellicauda*, *A. neomexicana*, *A. sonorae*, and *A. uniparens*) known form the portions of the Gila River surveyed. Whiptails also exhibit a high degree of morphological similarity, and probably use similar resources (Degenhardt et al. 1996). *Aspidoscelis*

tigris (Fig. 10), *A. uniparens* and *A. flagellicauda* were found only (former two species) or were primarily found (later species) in the downstream sites. *Aspidoscelis exsanguis* (Fig. 11) was found primarily in the upstream sites, while *A. sonorae* was found commonly throughout both areas. Other than through elevation, it was difficult to further partition stream-side habitats along the river among these species of whiptails. All species encountered seemed to be found along the edges of stream-side vegetation including cottonwoods, *Populus* spp., willows, *Salix* spp., and seep willow *Bacharris* spp. The lack of detection during these surveys of *A. inornata* and *A. neomexicana* may reflect the decline or preference of habitats further from the river of these two species (Degenhardt et al. 1996). Some studies suggest that *A. inornata* is sensitive to overgrazing of grassland habitats where it is found (Jones 1981).

Of phrynosomatid lizards observed the members of the genus *Sceloporus* were common. *Sceloporus cowlesi* (formerly *S. undulatus*) was found throughout the study area, but was more common in the upstream area. *Sceloporus poinsetti* was found only in the supstream sites, as was *Sceloporus jarrovi* (Fig. 12), which was found for the first time along the Gila River during these surveys. *Uta stansburiana* (Fig 13), *Cophosaurus. texanus*, and *Holbrookia maculata* were found only in downstream Gila River sites.

Only eight species of snakes were observed during Gila River surveys (Table 5). Three of those were garter snakes [*Thamnophis cyrtopsis* (Fig. 14), *Thamnophis elegans*, and *Thamnophis rufipunctatus* (Fig. 15)] which have a strong affinity for water (Degenhardt et al. 1996). All three of these species are known from upper and lower reaches of the Gila River. However, numbers of *T. rufipunctatus* detected during this survey (5 individuals) are lower than expected based on historical abundances of this species along the Gila River (Degenhardt et al.1996). Declines of populations of *T. rufipunctatus* have been noted in much of this species range in Arizona and New Mexico (Holycross et al. 2006).

Other snakes species with more than a single sighting included the black-tailed rattlesnake, *Crotalus molossus* (15 individuals), the striped whipsnake, *Masticophis taeniatus* (5) individuals, and the ring-necked snake, *Diadophis punctatus* (2 individuals). *Crotalus molossus* (Fig. 16) was found in both upstream and downstream Gila River sites, while the single individual of *Crotalus atrox* seen in the lower Gila River probably reflects the greater affinity of this species for lower elevation sites. *Masticophis taeniatus* and *D. punctatus* were also seen in upstream and downstream sites. All other species of snakes detected during these surveys, *Trimorphodon biscutatus*, *Pituophis catenifer*, and *Lampropeltis pyromelana*, were represented by a single individual. The bullsnake, *P. catenifer*, is a relatively common snake in New Mexico (Degenhardt et al. 1996), and the dearth of its sightings was unexpected. Its scarcity may be explained in part by the proximity of survey site to water. More individuals might be encountered farther from the river.

Figure 23. *Thamnophis rufipunctatus*, narrow-headed garter snake.

Discussion

Certainly the number of species and individuals of snakes observed during these surveys does not adequately represent the diversity or abundance of this important group of reptiles. While visual encounter surveys might be appropriate for some groups of snakes, such as water and garter snakes, most snake populations cannot be sampled effectively using this approach.

Other approaches such as pitfall trapping along the Gila River (see Painter 1985) would likely yield a higher snake richness and diversity.

Species that would be expected during these surveys but that were not encountered, or species that were observed in lower numbers than expected include the Chiricahua leopard frog, *R. chiricahuensis*, the lowland leopard frog, *R. yavapaiensis*, and the narrow-headed garter snake, *T. rufipunctatus*. All three species are state or federally protected, and are aquatic species. Interestingly, the only non-native species found along the Gila River, the American bullfrog, *R. catesbeiana*, and the spiny softshell, *A. spinifera*, are also aquatic species. In addition to these non-native amphibians and reptile, the Gila River is plagued by non-native crayfish (Fig. 17), *Orconectes* spp. and a non-native Chytridiomycetes fungus, *Batrachochytrium dendrobatidis*, that are widely dispersed in aquatic habitats along the Gila River. Crayfish and *R. catesbeiana* are aggressive competitors and predators (Degenhardt et al. 1996), and prey upon and compete with native species of amphibians and reptiles, especially those tied to aquatic habitats. *Batrachochytrium dendrobatidis* specializes in the digestion of the α keratin found in amphibian skin which allows them to obviate the special immunological defenses of amphibian integument. This fungus has been implicated in declines of amphibians around the world and in the Southwest.

Figure 24. *Crotalus molossus*, black-tailed rattlesnake.

Table 5. Amphibians and reptiles documented during visual encountered surveys of the Gila River in New Mexico during 2006 and 2007. Species with zeros for both years have previously been observed in the study area.

Anura – Frogs and Toads (5 of 13 spp.)

	2006	2007
Family Pelobatidae		
Scaphiopus couchii	0	0
Spea bombifrons	0	0
Spea multiplicata	0	0
Family Bufonidae		
Bufo cognatus	0	1
Bufo microscaphus	>44,000	>250,000
Bufo punctatus	0	0
Bufo woodhousii	96	>7800
Family Hylidae		
Hyla arenicolor	1	1
Hyla wrightorum	0	0
Pseudacris maculata	0	0
Family Ranidae		
Rana catesbeiana	>101,000	>12,000
Rana chiricahuensis	0	0
Rana yavapaiensis	0	0

Caudata – Salamanders (0 of 1 sp.)

Family Ambystomatidae		
Ambystoma tigrinum	0	0

Testudines – Turtles (2 of 3 spp.)

Family Emydidae		
Terrapene ornata	0	0
Family Kinosternidae		
Kinosternon sonoriense	2	3
Family Trionychidae		
Apalone spinifera	0	3

Table 5. continued.

Squamata – Lizards and Snakes / Sauria – Lizards (16 of 25 spp.)

	2006	2007
Family Crotaphytidae		
Crotaphytus collaris	0	0
Gambelia wislizenii	0	0
Family Phrynosomatidae		
Cophosaurus texanus	18	23
Holbrookia maculata	1	0
Phrynosoma cornutum	0	0
Phrynosoma hernandesi	2	1
Phrynosoma modestum	0	0
Sceloporus clarkii	10	17
Sceloporus cowlesi	54	39
Sceloporus jarrovii	3	2
Sceloporus magister	0	0
Sceloporus poinsetti	4	2
Urosaurus ornatus	66	76
Uta stansburiana	3	6
Family Gekkonidae		
Coleonyx variegatus	0	0
Family Teiidae		
Aspidoscelis exsanguis	32	50
Aspidoscelis flagellicauda	23	11
Aspidoscelis inornata	0	0
Aspidoscelis neomexicana	0	0
Aspidoscelis sonorae	55	40
Aspidoscelis tigris	14	3
Aspidoscelis uniparens	22	21
Family Scincidae		
Eumeces obsoletus	3	1
Family Anguidae		
Elgaria kingii	1	6
Family Helodermatidae		
Heloderma suspectum	0	0

Table 5. continued.

Squamata – Lizards and Snakes / Serpentes – Snakes (10 of 31 spp.)

	2006	2007
Family Leptotyphlopidae		
Leptotyphlops dissectus	0	0
Leptotyphlops humilis	0	0
Family Colubridae		
Arizona elegans	0	0
Diadophis punctatus	1	1
Gyalopion canum	0	0
Heterodon nasicus	0	0
Hypsiglena torquata	0	0
Lampropeltis getula	0	0
Lampropeltis pyromelana	1	0
Lampropeltis triangulum	0	0
Masticophis flagellum	0	0
Masticophis taeniatus	2	3
Pituophis catenifer	0	1
Family Colubridae		
Rhinocheilus lecontei	0	0
Salvadora grahamiae	0	0
Salvadora hexalepis	0	0
Tantilla hobartsmithi	0	0
Tantilla nigriceps	0	0
Thamnophis cyrtopsis	12	11
Thamnophis elegans	5	2
Thamnophis eques	0	0
Thamnophis marcianus	0	0
Thamnophis rufipunctatus	1	4
Trimorphodon biscutatus	0	1
Family Elapidae		
Micruroides euryxanthus	0	0
Family Viperidae		
Crotalus atrox	1	0
Crotalus lepidus	0	0
Crotalus molossus	8	7
Crotalus oreganos cerberus	0	0
Crotalus scutulatus	0	0
Crotalus viridis	0	0

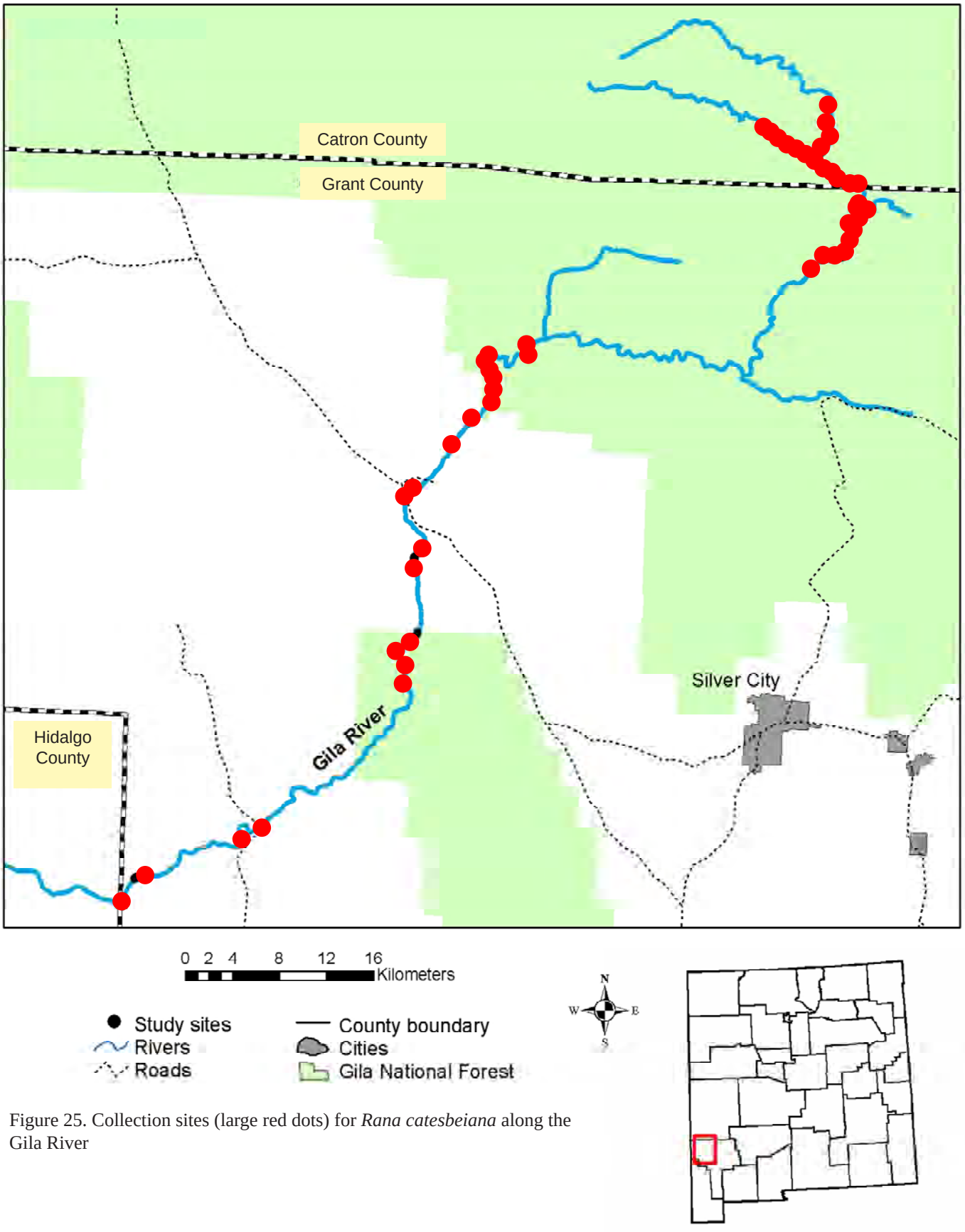

Figure 25. Collection sites (large red dots) for *Rana catesbeiana* along the Gila River

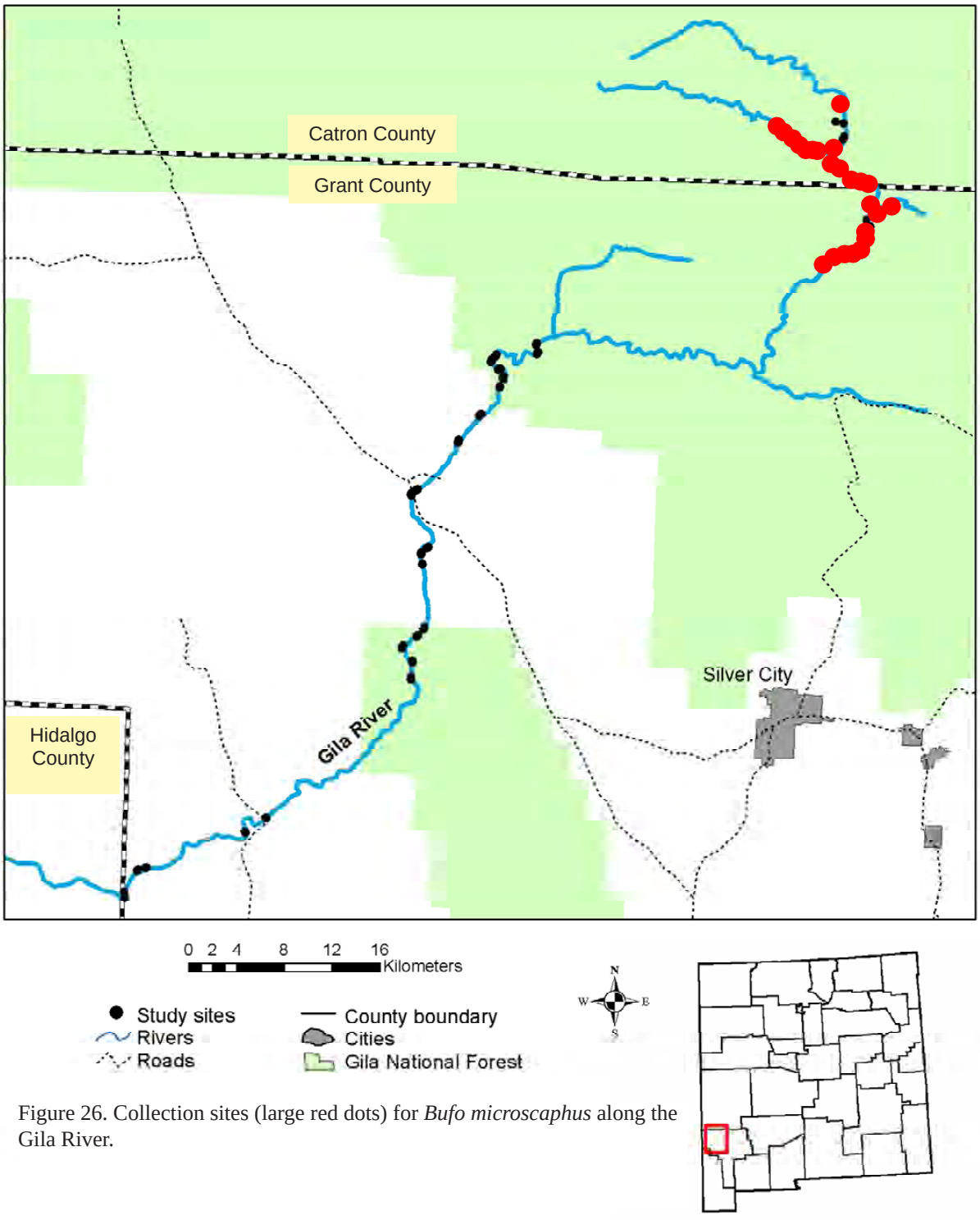

Figure 26. Collection sites (large red dots) for *Bufo microscaphus* along the Gila River.

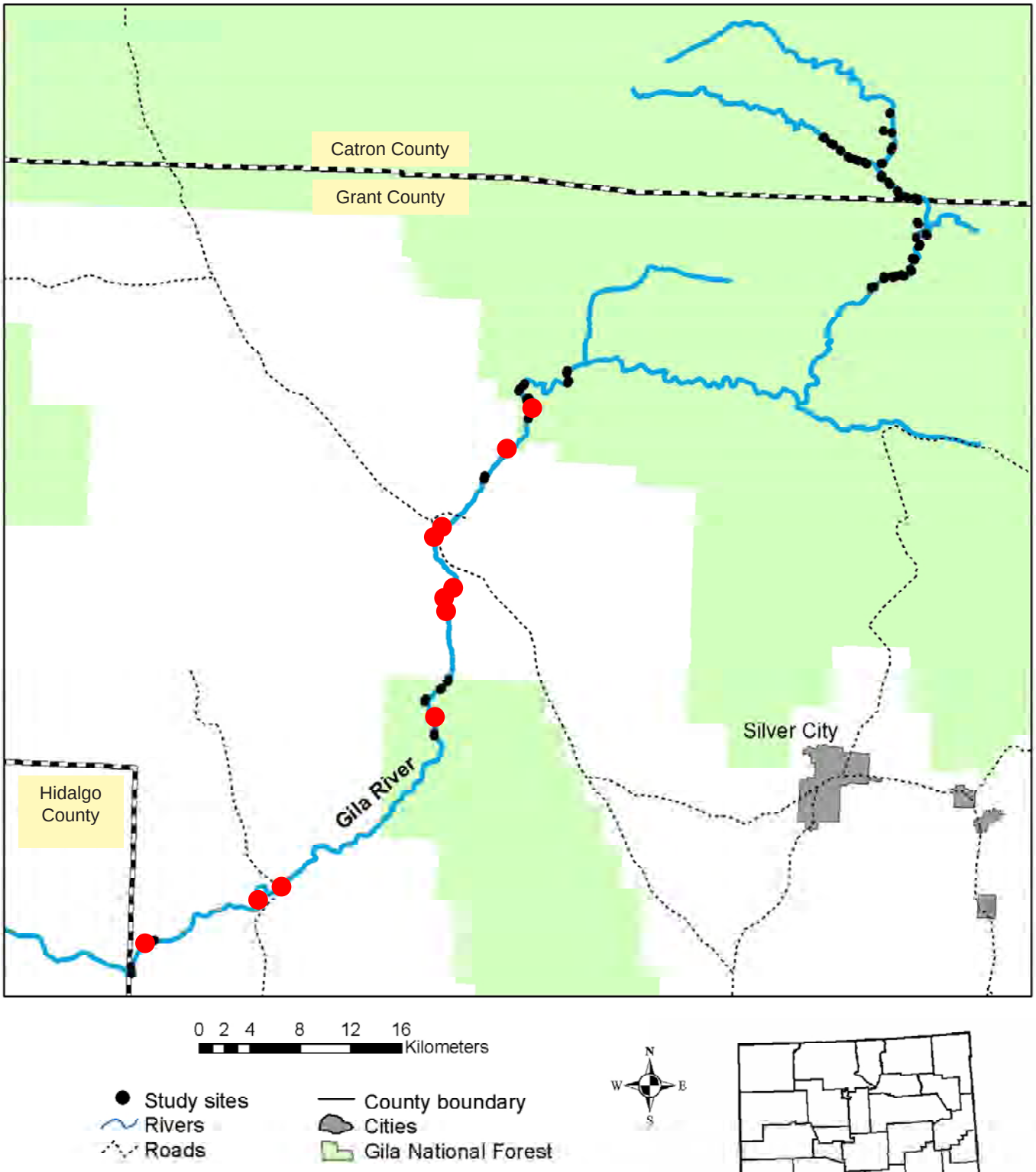

Figure 27. Collection sites (large red dots) for *Bufo woodhousii* along the Gila River.

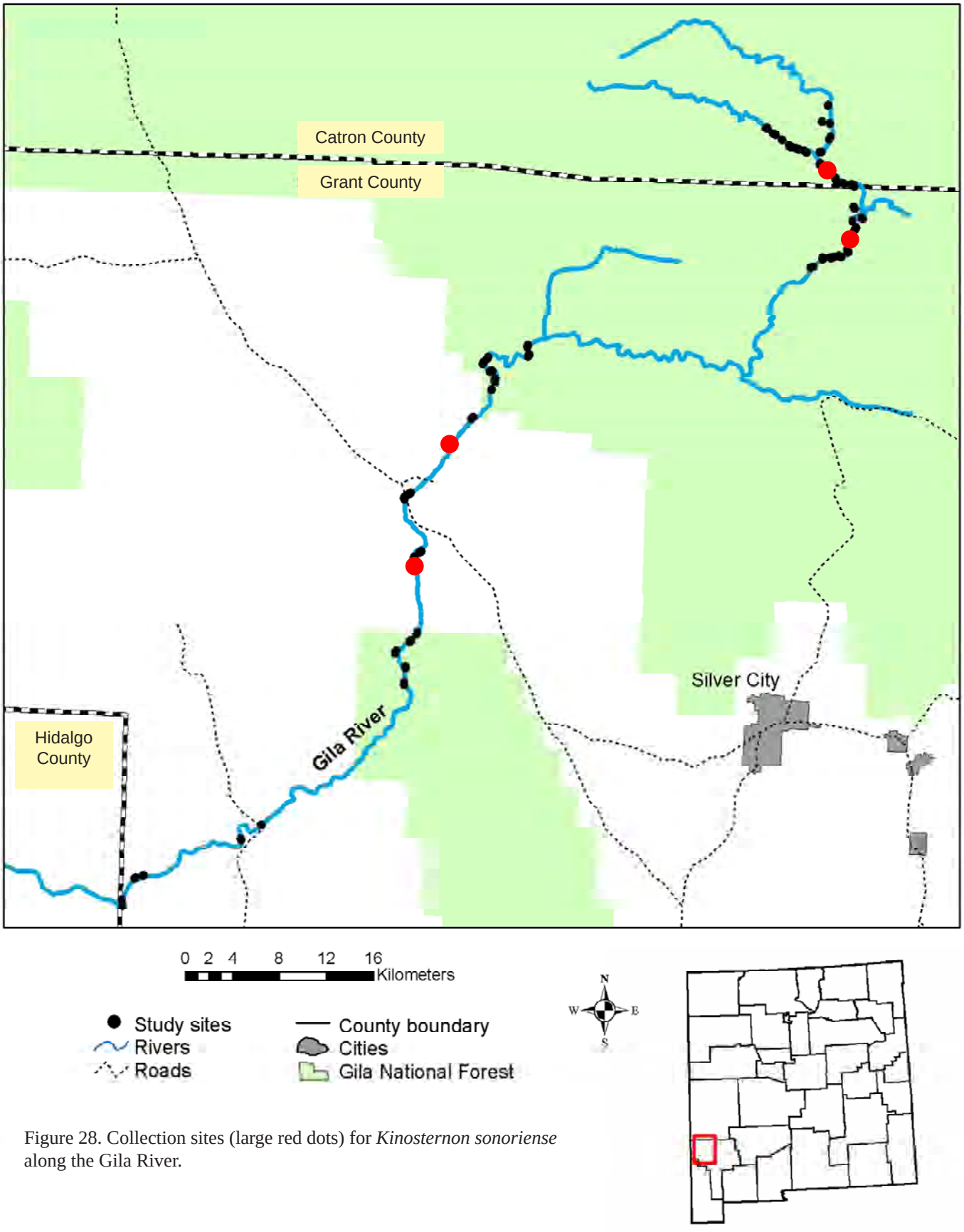

Figure 28. Collection sites (large red dots) for *Kinosternon sonoriense* along the Gila River.

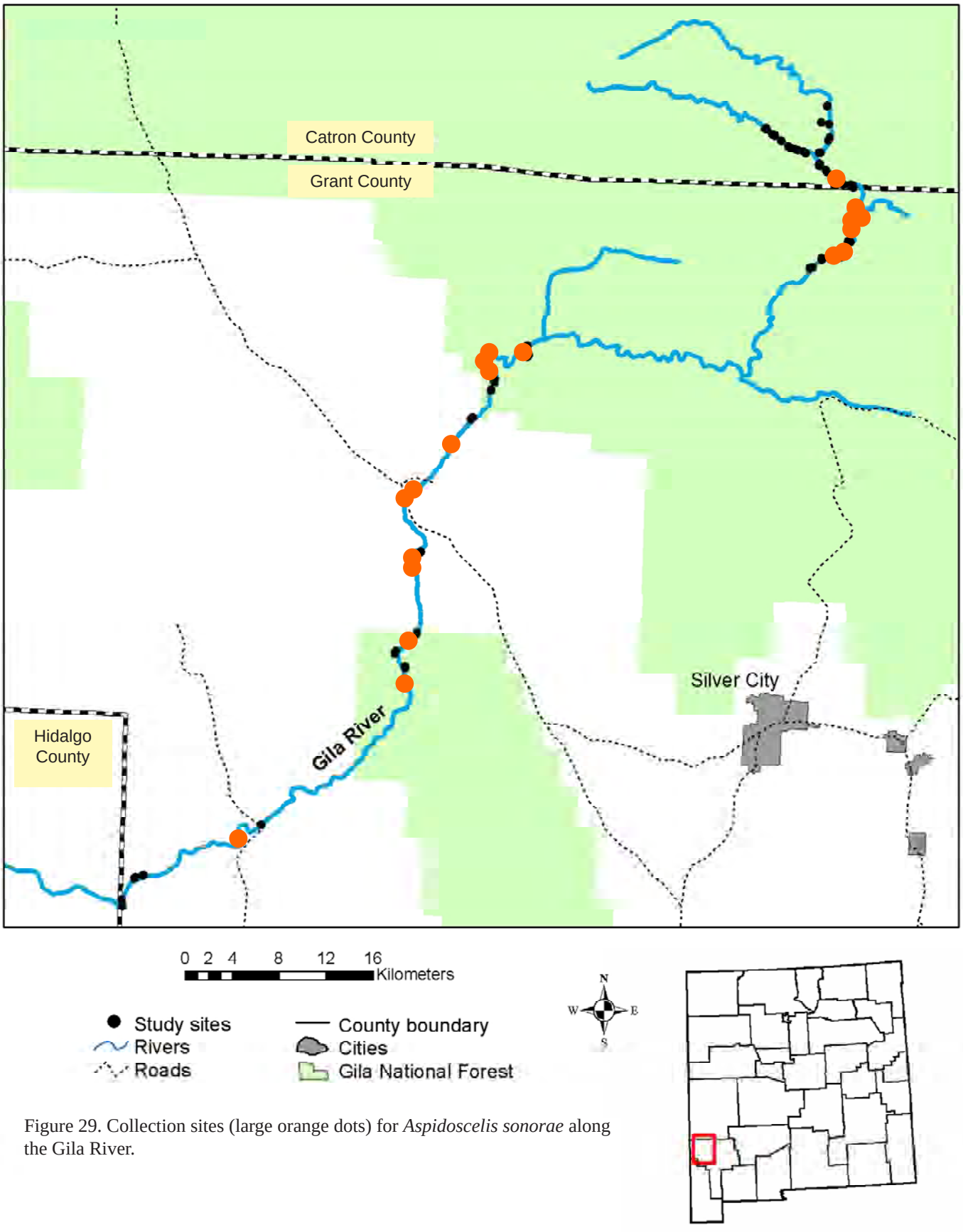

Figure 29. Collection sites (large orange dots) for *Aspidoscelis sonorae* along the Gila River.

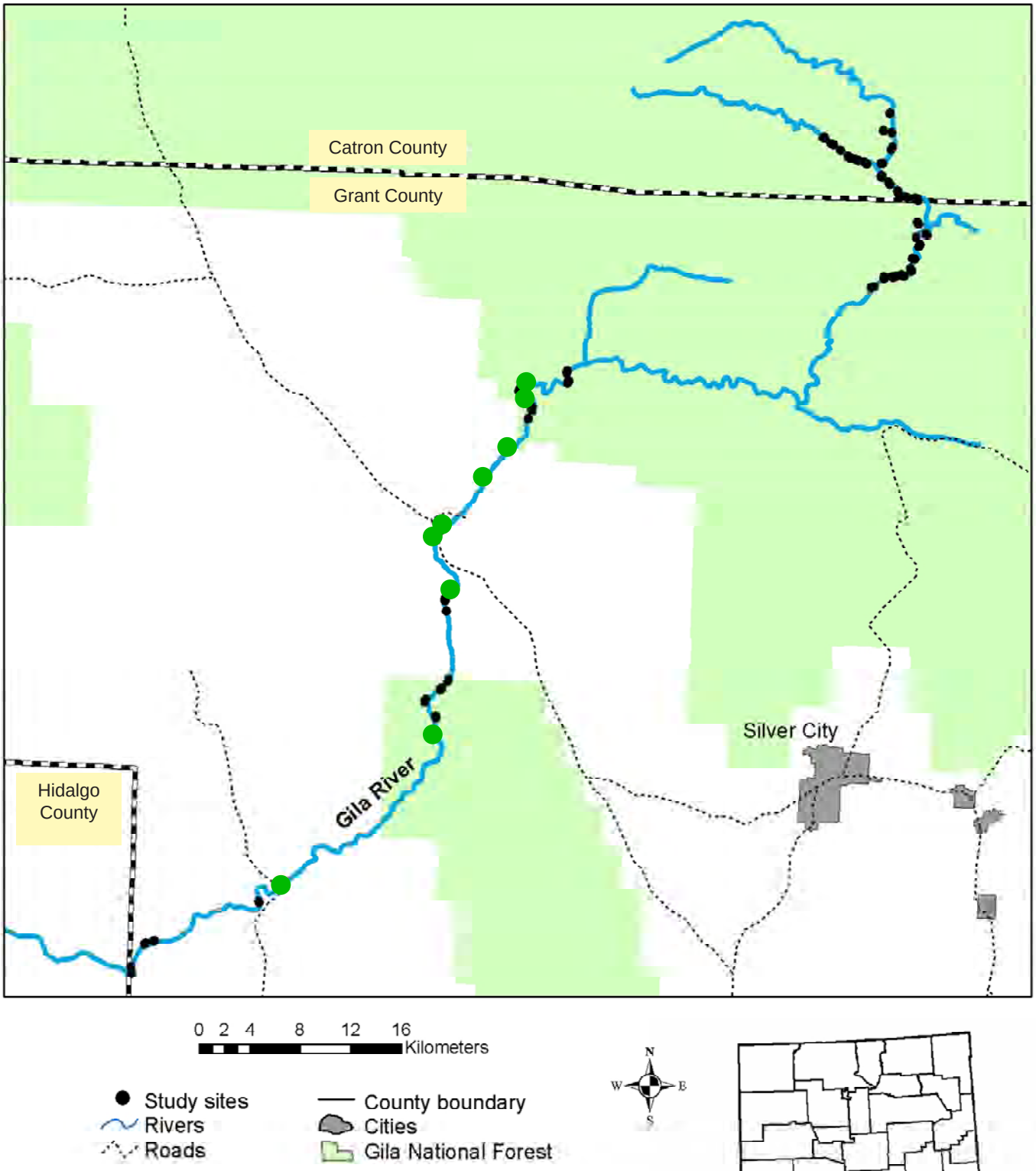

Figure 30. Collection sites (large green dots) for *Aspidoscelis uniparens* along the Gila River.

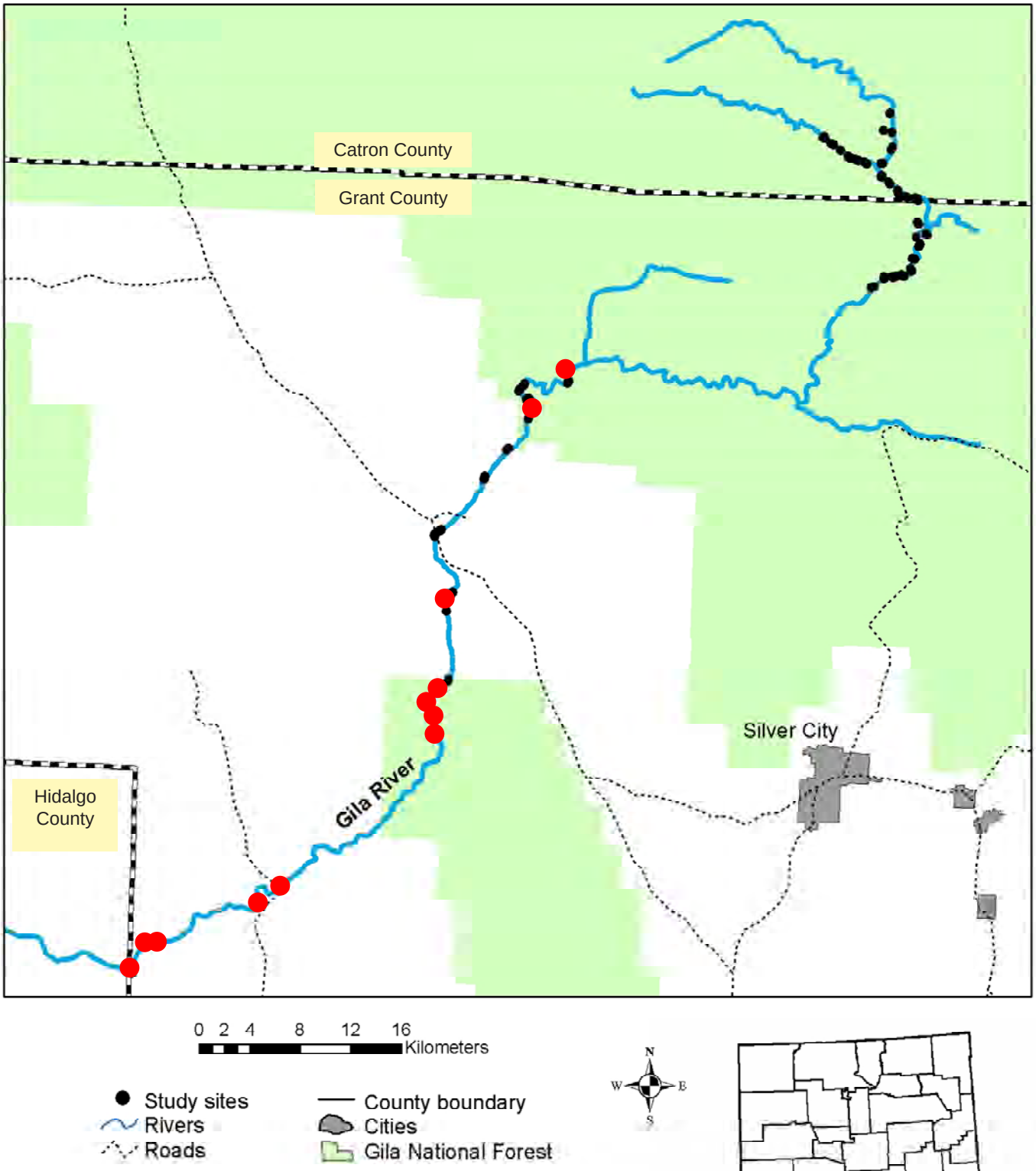

Figure 31. Collection sites (large red dots) for *Cophosaurus texanus* along the Gila River.

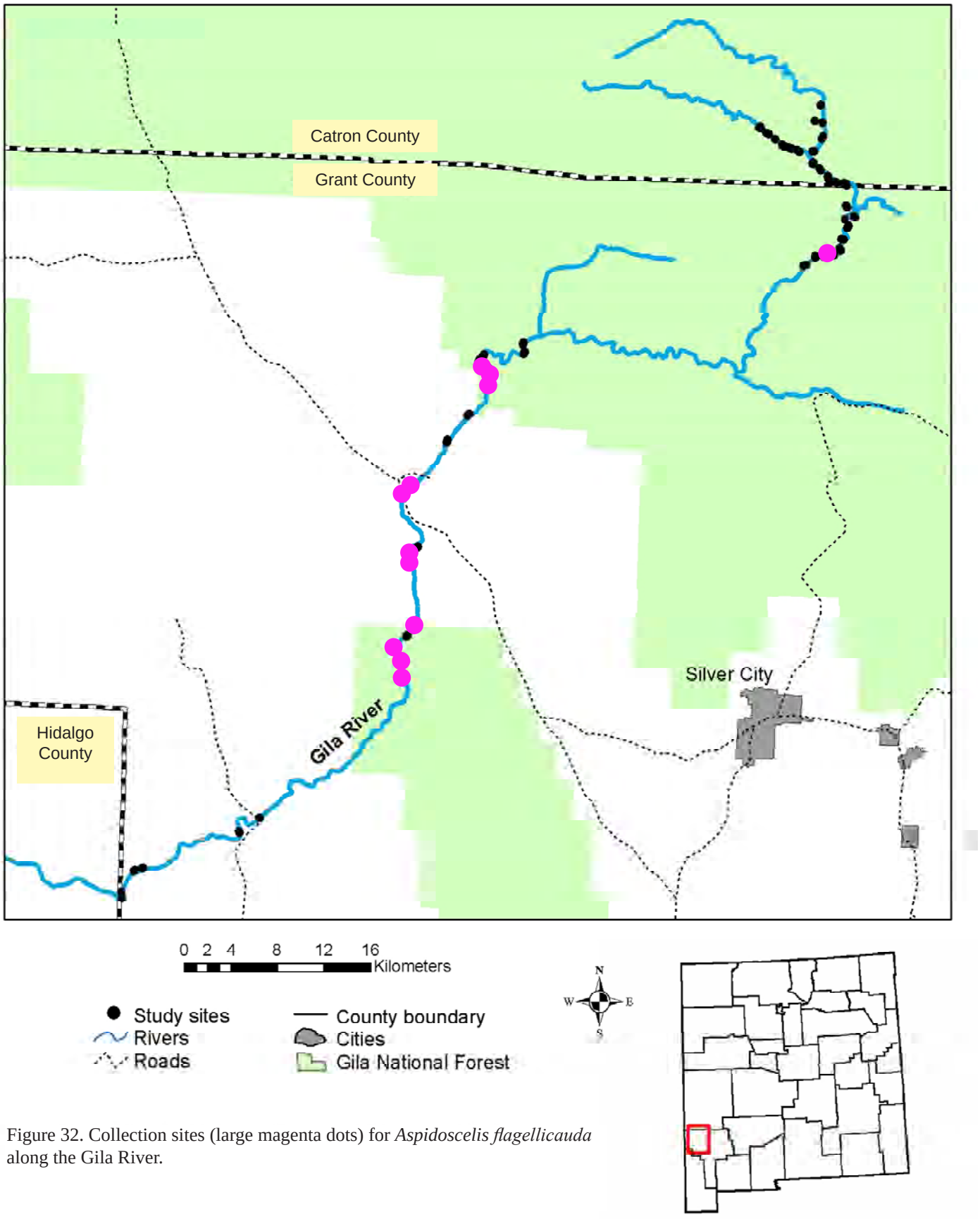

Figure 32. Collection sites (large magenta dots) for *Aspidoscelis flagellicauda* along the Gila River.

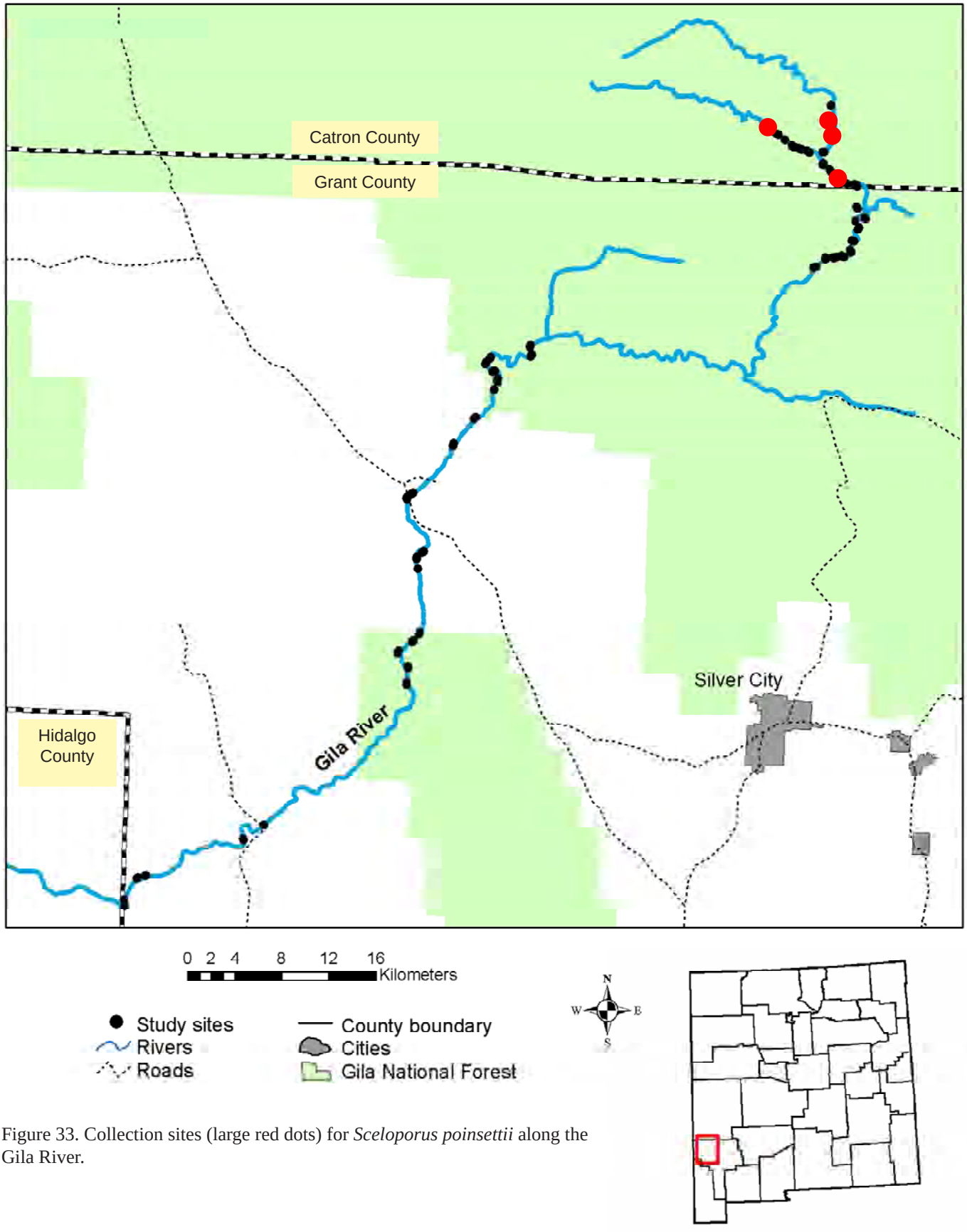

Figure 33. Collection sites (large red dots) for *Sceloporus poinsettii* along the Gila River.

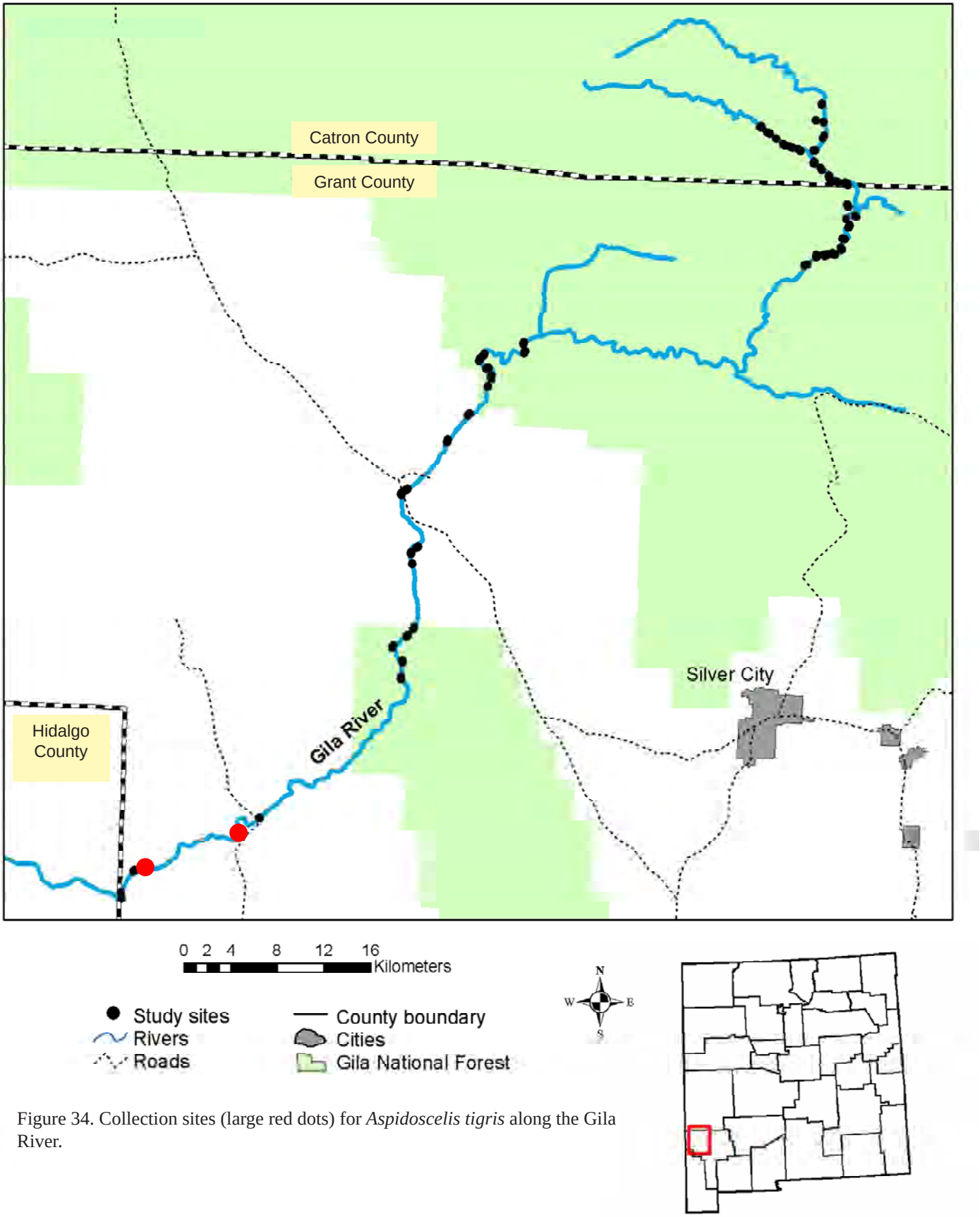

Figure 34. Collection sites (large red dots) for *Aspidoscelis tigris* along the Gila River.

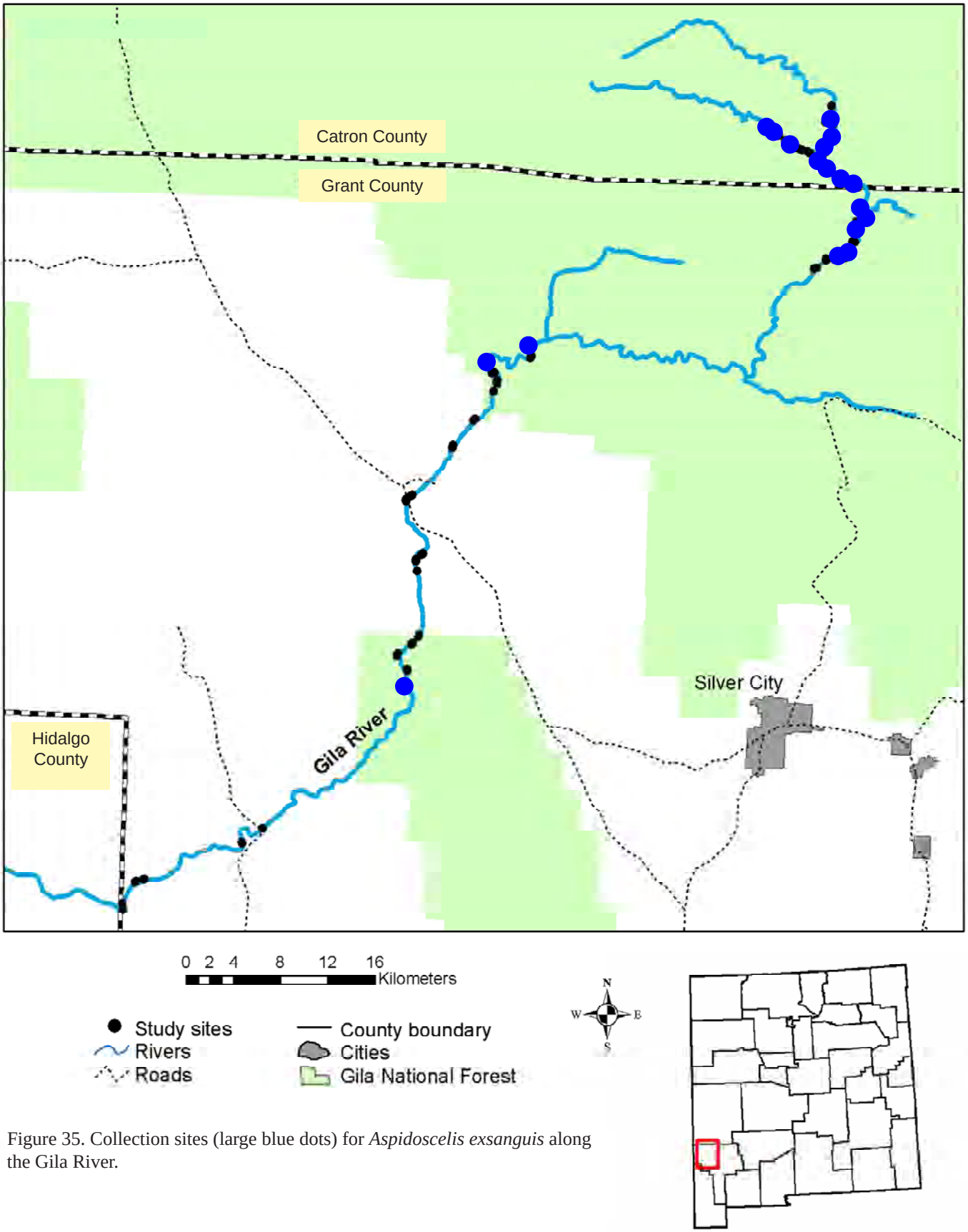

Figure 35. Collection sites (large blue dots) for *Aspidoscelis exsanguis* along the Gila River.

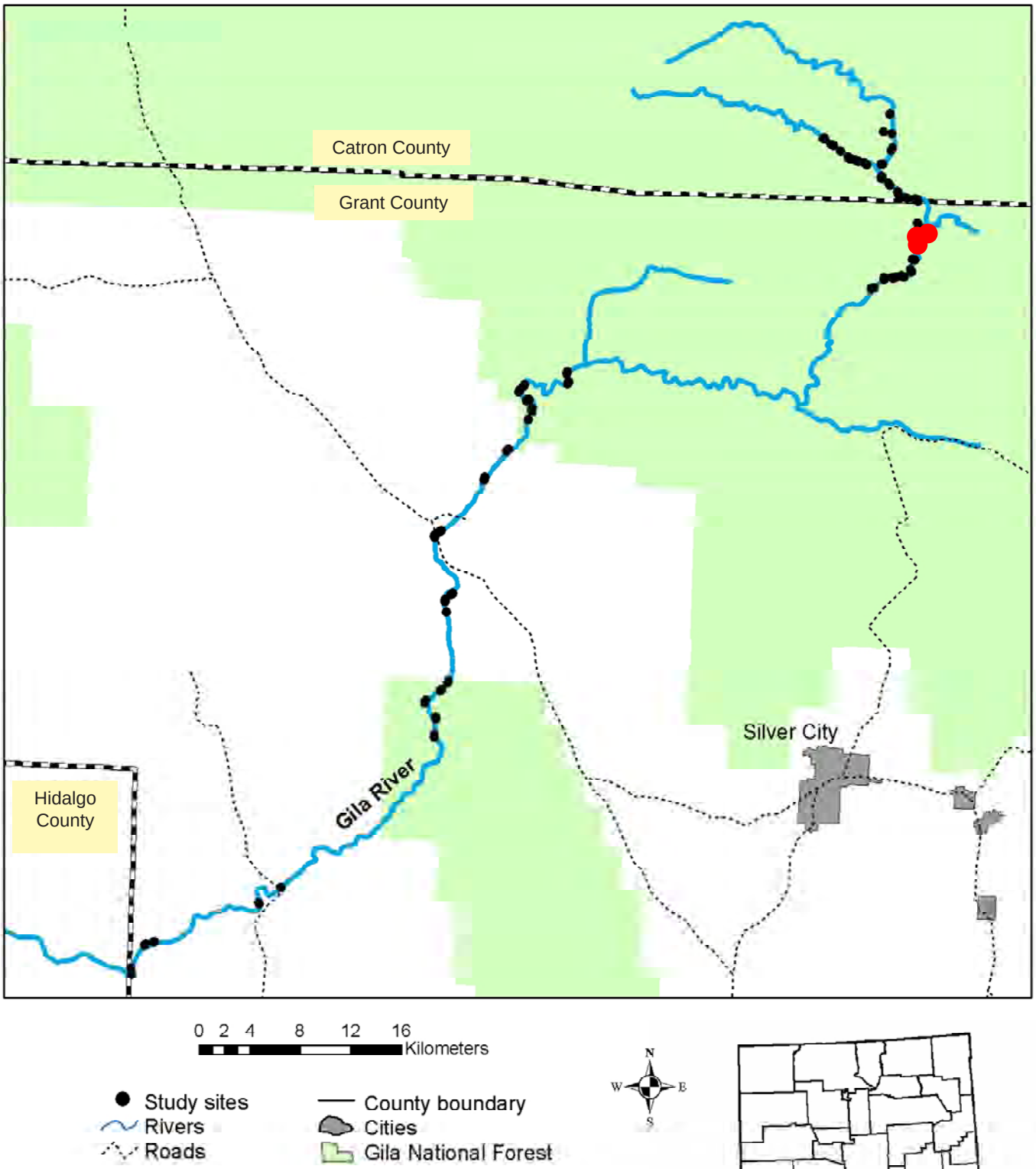

Figure 36. Collection sites (large red dots) for *Sceloporus jarrovii* along the Gila River.

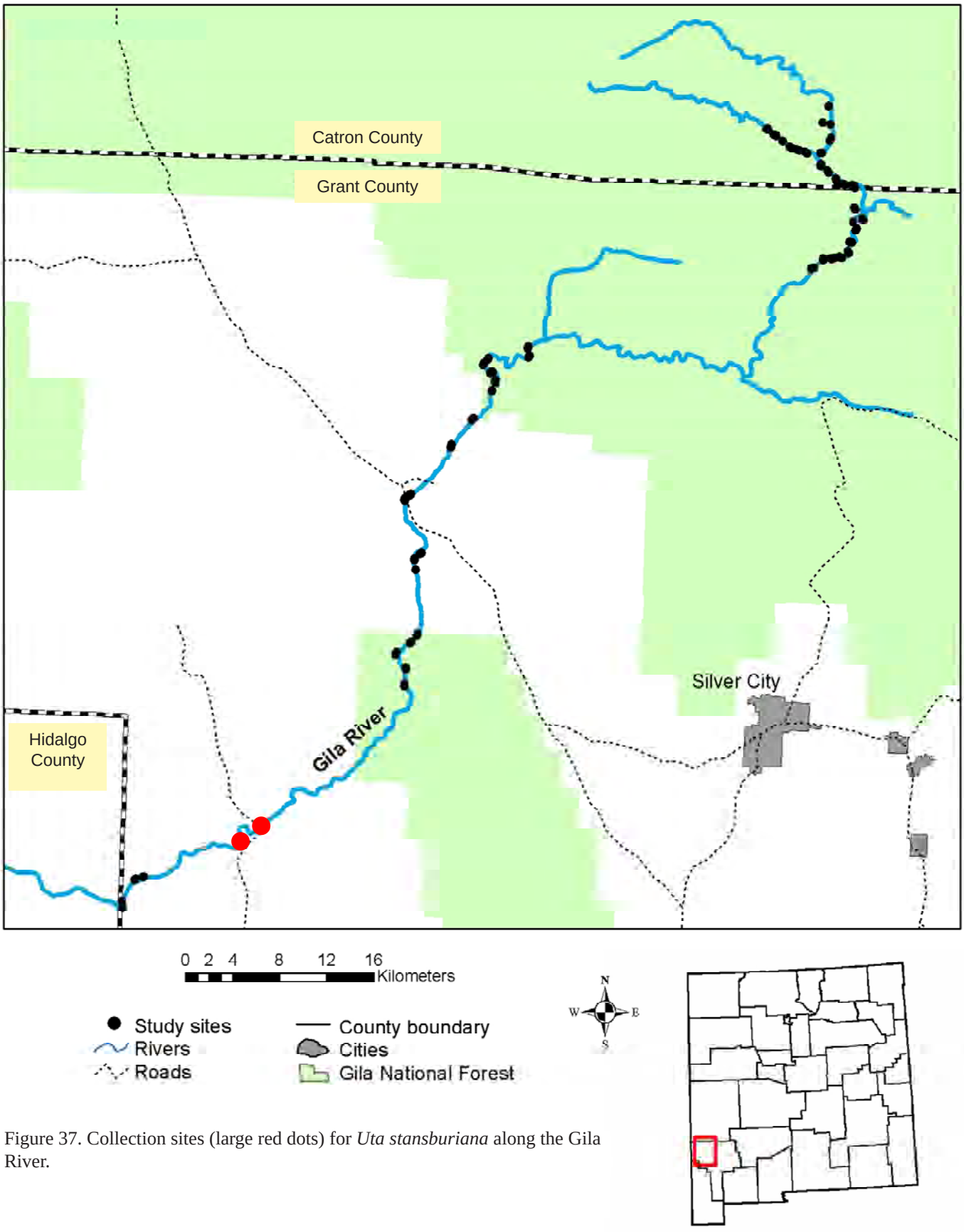

Figure 37. Collection sites (large red dots) for *Uta stansburiana* along the Gila River.

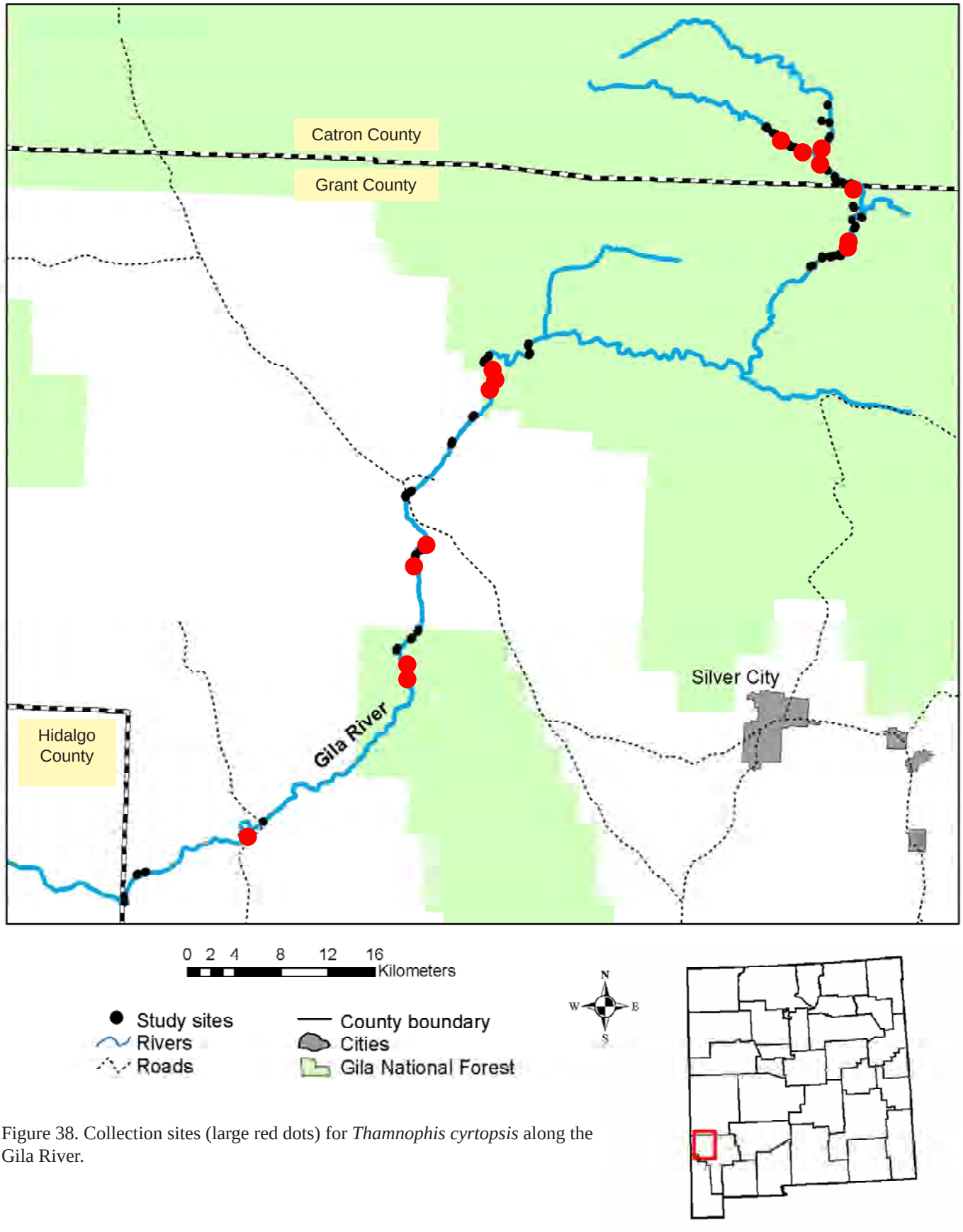

Figure 38. Collection sites (large red dots) for *Thamnophis cyrtopsis* along the Gila River.

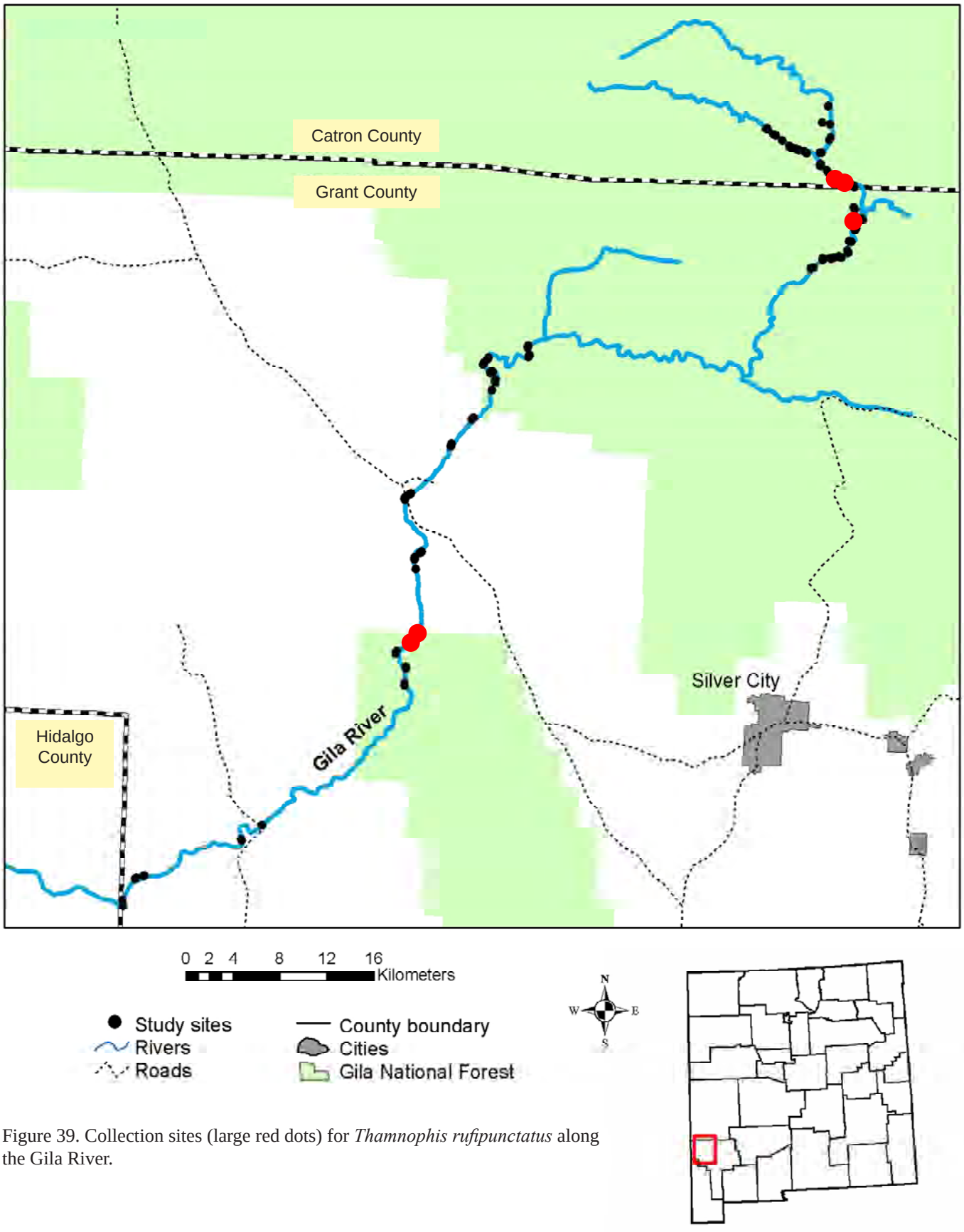

Figure 39. Collection sites (large red dots) for *Thamnophis rufipunctatus* along the Gila River.

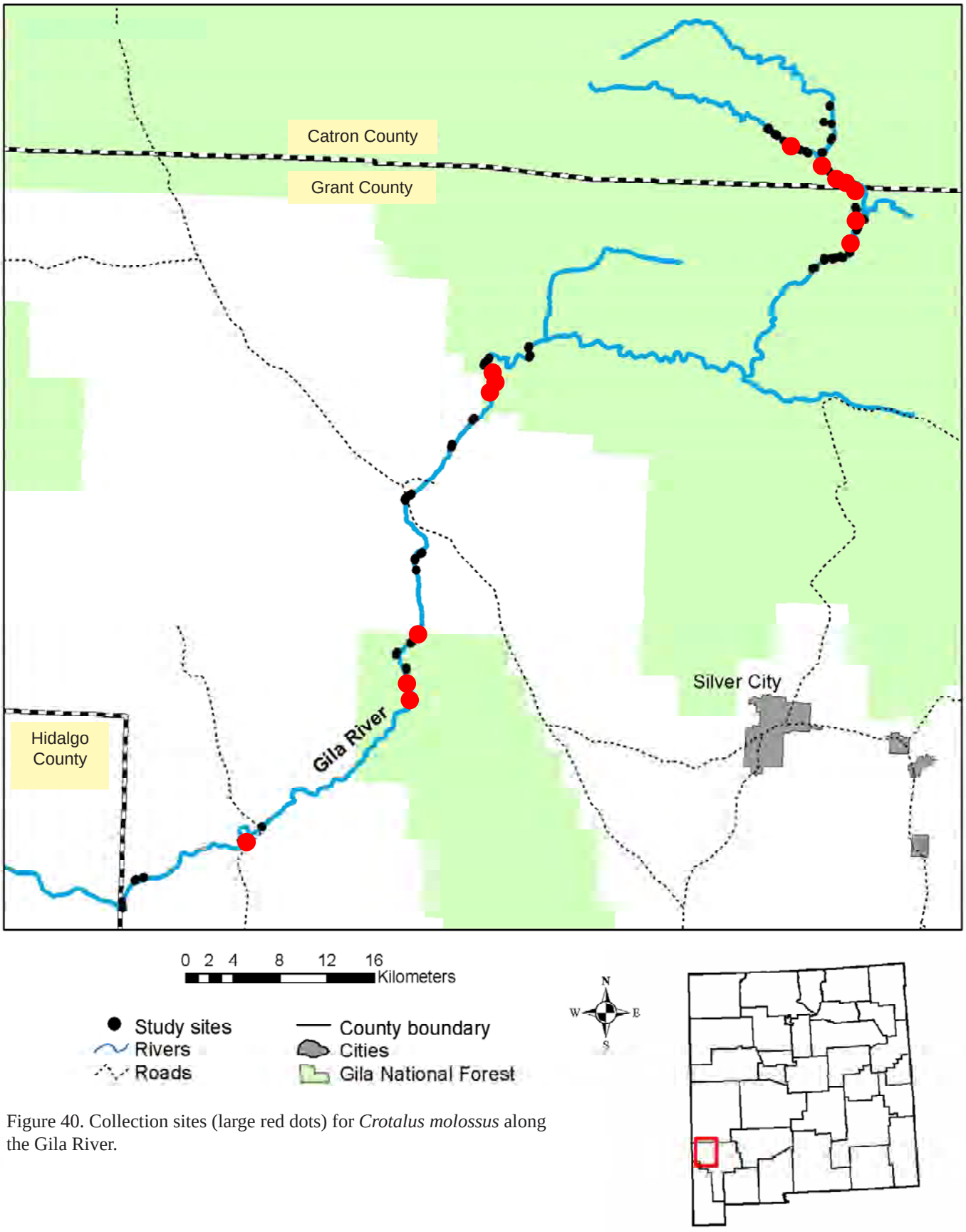

Figure 40. Collection sites (large red dots) for *Crotalus molossus* along the Gila River.

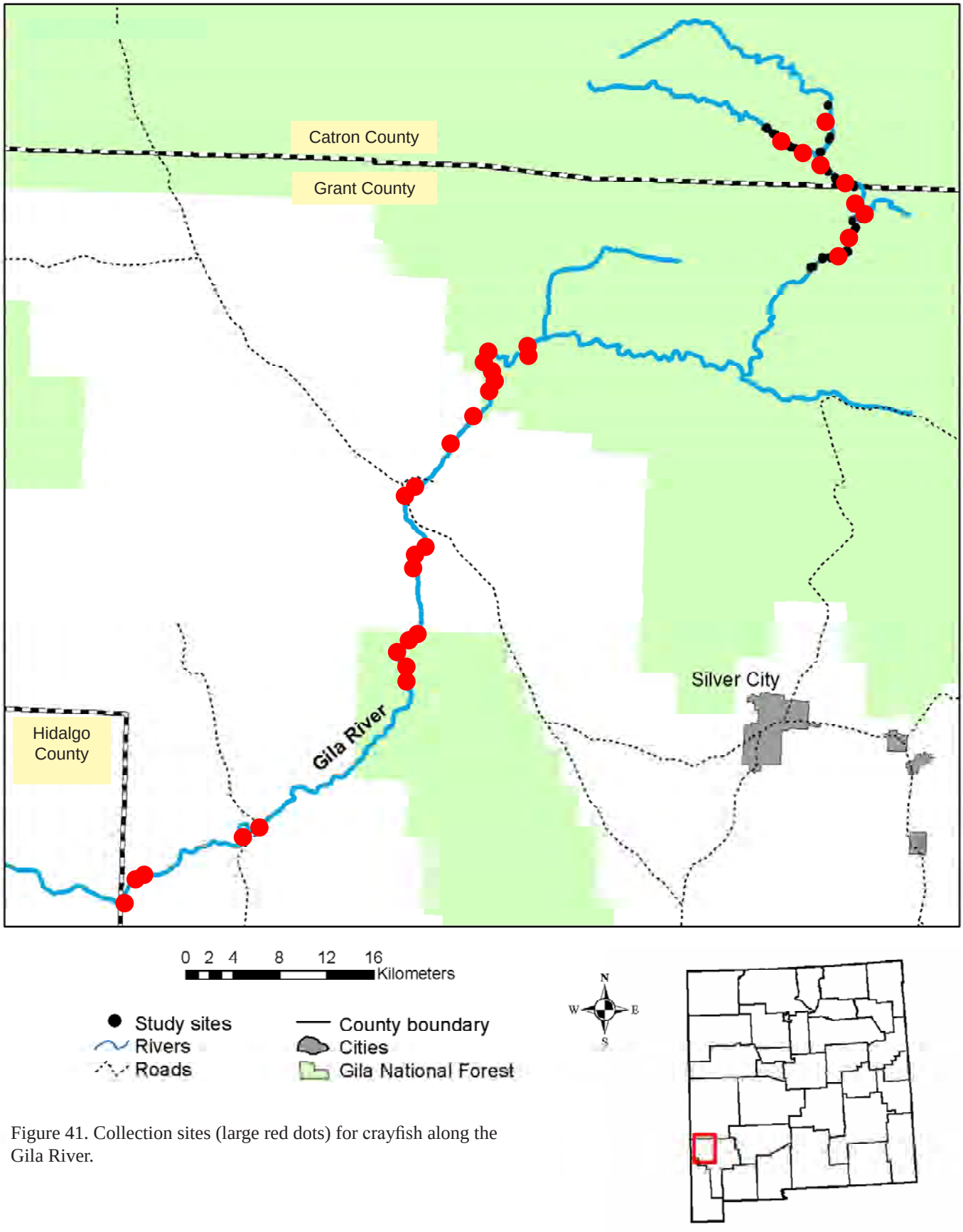

Figure 41. Collection sites (large red dots) for crayfish along the Gila River.

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