

## **2017 State Wildlife Grant Proposal**

**Project Title:** Distribution, occupancy, and habitat associations of prairie-associated reptile and amphibian species of greatest conservation need in Northwest Arkansas.

### **Project Summary:**

This project addresses the critical need to determine the distribution, status, and specific habitat requirements of prairie-associated reptile and amphibian species in historic tallgrass prairie regions of Northwest Arkansas. Fourteen reptile and amphibian species of greatest conservation need (SCGN) are restricted to, or strongly associated with, prairie habitats, but nearly all lack distribution and habitat association data needed to inform conservation and management. The objectives of the proposed research are to: 1) use rigorous sampling and Bayesian occupancy analyses to establish the current distribution of prairie-associated reptile and amphibian SCGN within historic prairies of Northwest Arkansas; (2) determine landscape and habitat covariates that best predict occupancy and abundance of these species. The field techniques proposed for detecting these secretive species have been tested at a previously restored prairie habitat (Woolsey Wet Prairie, Fayetteville, AR) and identified previously unrecorded populations of two SCGN species. This study will provide baseline data for each of the fourteen SCGN species, as well as result in the production of comprehensive distribution maps, GIS layers detailing occurrence, and habitat and environmental relationships needed for future conservation and management of each species.

### **Project Leader:**

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### **Project Partners:**

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### **Project Budget:**

Total Project Cost: \$77,255  
Total SWG Amount: \$42,691  
Matching Funds: \$34,564

## Project Statement

**Need:** This project addresses the critical need to determine the distribution, status, and habitat requirements of prairie-associated herpetofauna in historic tallgrass prairie regions of Northwest Arkansas (SWG RFP; Table 1, Reptiles and Amphibians). Amphibians and reptiles (herpetofauna) comprise a substantial component of vertebrate biodiversity in Arkansas and are important as ecosystem components and bioindicators, but are currently experiencing unprecedented population declines at a global scale (Houlahan et al. 2000, Gibbons et al. 2000, Stuart et al. 2004). However, because cryptic behavior and sporadic or infrequent activity result in low detectability (Durso et al. 2011, Willson et al. 2011), the population status or even regional distribution of many reptiles and amphibians are unknown (Todd et al. 2010).

Tallgrass prairie reaches its southeastern extent in our region (Transeau 1935); thus, many prairie-associated species reach their range limits and have limited distribution in Arkansas. Northwest Arkansas once hosted substantial prairie habitat, but current estimates suggest that less than 1% of historic tallgrass prairie remains (ANHC 2003). Fourteen amphibian and reptile SGCN are restricted to, or associated with, prairie habitats within Arkansas (Table 1) and several additional prairie-associated species have strong potential to occur within the state, but have not been conclusively confirmed. Yet, no comprehensive herpetological surveys have been conducted within remnant prairie habitats in Northwest Arkansas, and it is likely that populations of these secretive species have been overlooked. For example, a recent intensive survey of Woolsey Wet Prairie Sanctuary, less than five miles from downtown Fayetteville, identified populations of Graham's Crayfish Snake and Crawfish Frog that had gone undetected for decades (Baecher et al. *in review*). Additionally, the prairie-associated Lined Snake was recently documented for the first time in Arkansas in the city of Bentonville. Thus, there is a critical need to determine the status of prairie-associated herpetofauna in Northwest Arkansas using rigorous field and analytical methods that account for imperfect detection of these secretive species. Data on species' distributions and habitat associations will help guide future habitat protection, restoration, and management to benefit SGCN.

**Table 1.** List of SGCN associated with prairie habitats in Northwest Arkansas. †Association with Ozark-Ouachita Prairie and Woodland Habitat. \*Occurs in prairie habitat in Oklahoma, but AR records are from Glade/Barren.

Taxa	Scientific Name	Common Name	S		Priority		Research Need		AWAP
			Rank	Score	Habitat†	Distribution/Abundance	Pg #		
Amphibia	<i>Lithobates areolatus</i>	Crawfish Frog	S2	23	Optimal	Yes		85	
Amphibia	<i>Spea bombifrons</i>	Plains Spadefoot	S1	23	Optimal	Yes		124	
Amphibia	<i>Gastrophryne olivacea</i>	Great Plains Narrowmouth Toad	S2	19	Optimal	Yes		73	
Amphibia	<i>Pseudacris streckeri</i>	Strecker's Chorus Frog	S2	19	Optimal	Yes		115	
Amphibia	<i>Pseudacris maculata</i>	Boreal Chorus Frog	S2	19	Optimal	Yes		112	
Amphibia	<i>Scaphiopus hurterii</i>	Hurter's Spadefoot	S2	19	Optimal	Yes		121	
Amphibia	<i>Ambystoma tigrinum</i>	Eastern Tiger Salamander	S3	15	Optimal	Yes		42	
Reptilia	<i>Plestiodon obsoletus</i>	Great Plains Skink	S1	23	Optimal	Yes		1111	
Reptilia	<i>Tropidoclonion lineatum</i>	Lined Snake	S1	23	Optimal	Yes		1129	
Reptilia	<i>Sonora semiannulata</i>	Ground Snake	S1	23	*	Yes		1123	
Reptilia	<i>Terrapene ornata</i>	Omate Box Turtle	S2	19	Optimal	Yes		1126	
Reptilia	<i>Plestiodon septentrionalis</i>	Prairie Skink	S2	19	Optimal	Yes		1114	
Reptilia	<i>Regina grahamii</i>	Graham's Crayfish Snake	S2	19	Optimal	Yes		1117	
Reptilia	<i>Ophisaurus attenuatus</i>	Slender Glass Lizard	S3	15	Optimal	Yes		1108	
<b>Potentially occurring or questionable species not yet confirmed in Arkansas</b>									
Amphibia	<i>Pseudacris clarkii</i>	Spotted Chorus Frog							
Reptilia	<i>Kinosternon flavescens</i>	Yellow Mud Turtle							
Reptilia	<i>Phrynosoma cornutum</i>	Texas Horned Lizard							
Reptilia	<i>Pituophis catenifer</i>	Bullsnake							

**Purpose and Objectives:** The objectives of the proposed research are to: 1) Establish the current distribution of prairie-associated reptile and amphibian SCGN within historic prairies of Northwest Arkansas; (2) determine landscape and habitat covariates that best predict occurrence and abundance of these species.

**Location:** The proposed research will be conducted at a minimum of 25 historic prairie sites in Benton, Washington, Crawford, Madison, and Carroll Counties. Sites will be selected to include the best remaining prairie habitats in the region, including sites owned/managed by state (e.g., Arkansas Natural Heritage, Game and Fish Commission), the Federal Government (National Park Service: Pea Ridge/Prairie Grove National Battlefields; Dept. of Defense: Fort Chaffee), local conservation organizations (Northwest Arkansas Land Trust, Cities of Fayetteville, Bentonville, Fort Smith, etc.), and high quality habitats located on private land. We will particularly aim to survey all known historic localities of prairie-associated SGCN in the region. For the past two years, we have been surveying for Crawfish Frogs across this study region and have already identified and gained access to many of the sites targeted for this project.

**Approach:** We will use an occupancy modeling framework to evaluate the occurrence of prairie-associated reptile and amphibian SGCN across a large number of study sites in Northwest Arkansas, while accounting for imperfect detection probability. We will conduct repeated, effort constrained sampling of 25 sites over two years, using four well-established field techniques (Willson and Gibbons 2009, Willson 2016) that target different reptile and amphibian groups: visual encounter surveys (VES; lizards, diurnal snakes, and common anurans), coverboards (fossorial snakes, lizards, and salamanders), minnow traps (aquatic snakes, small turtles, and aquatic amphibians), and call surveys (anurans). We have found this combination of techniques to be highly effective for detecting secretive prairie-associated herpetofauna in the region (Beacher et al. *in review*). We will conduct 10 VES at each site over two field seasons (5 surveys in 2018; 5 surveys in 2019). Each VES will consist of two observers opportunistically searching appropriate microhabitats for herpetofauna (under cover objects, appropriate basking sites, etc.) for 2 hours and checking 30 minnow traps that were set the previous night. Additionally we will deploy 10, 100 x 50 cm plywood coverboards in optimal habitat at each site and sample them during VES surveys. All reptiles and amphibians encountered will be captured, identified to species, photo-vouchered, and released at the end of the survey. Four anuran call surveys will be completed at each site, timed to target peak breeding activity of target species.

For each site, we will measure a variety of site characteristics (e.g., vegetation cover and composition, wetland extent and hydroperiod, history of fire, etc.) and use GIS to extract landscape attributes (e.g., geographic location, soil type, topography, historic land use, etc.) to use as covariates potentially explaining species occupancy and community composition. We will also record a variety of sampling covariates (e.g., date, time, air temperature, barometric pressure, cloud cover, and current/recent precipitation) to be used as potential predictors of detection probability.

We will analyze survey data using a hierarchical Bayesian modeling approach (Dorazio et al. 2006, Zipkin et al. 2009) to estimate community (i.e., species richness and evenness) and species-specific patterns of site occupancy in relation to site and landscape covariates. Hierarchical Bayesian analysis of detect/non-detect data maintain separate species-specific estimates of occurrence and detection probability while relating these data to a broader analysis of species richness; thus, combining species-level and community-level attributes into the same modeling framework (Dorazio et al. 2006, Zipkin et al. 2009, Hunt et al. 2013). Importantly, this

approach accounts for imperfect detection and improves precision of individual parameter estimates, particularly for rare species, by considering them in the context of the larger community (Dorazio and Royle 2005, Dorazio et al. 2006). This is likely an important feature, given data for many amphibian and reptile species can be sparse. We will organize our data in program R and execute data analysis in WinBUGS using R2WinBUGS. Models will be evaluated by examining credible intervals and convergence chain history plots for parameter estimates in conjunction with the Gelman and Rubin (1992) statistic.

**Timeline**

Task	2018				2019			
	Jan-Mar	Apr-June	Jul-Sept	Oct-Dec	Jan-Mar	Apr-June	July-Sept	Oct-Dec
VES and Coverboards	X	X	X	X	X	X	X	
Call Surveys	X	X	X		X	X	X	
Occupancy modeling				X			X	X
Report and manuscript prep							X	X

**Expected Results and Benefits**

- 1) Comprehensive distribution maps and GIS layers detailing occurrence of prairie-associated SGCN occurring or potentially occurring in Northwest Arkansas (Table 1), as well as detection-probability informed statements about confidence of species absence at sites where they were not documented.
- 2) Models detailing relationships between site and landscape covariates and occupancy probability for each species. This knowledge will aid in diagnosing threats, guiding future management actions, and identifying potential additional localities for SGCN species.

**Budget (2 yrs: 1/1/2018 – 12/31/2019)**

Expense	SWG Request	Matching Funds	Total
Graduate Student Summer Salary (2 years)	\$11,725	\$0	\$11,725
Hourly Technician (3 mo. per yr)	\$9,428	\$0	\$9,428
PI Salary (1.0 mo. per year)	\$0	\$23,433	\$23,433
Travel: Field work (6,000 mi / yr @ 0.42 per mi)	\$5,040	\$0	\$5,040
Field supplies: coverboards (SWG: 250 @ \$7); \$500 per year for misc. field supplies	\$2,750	0	\$2,750
Indirect costs (47.5% F&A)	\$13,748	\$11,131	\$24,879
<b>TOTAL</b>	<b>\$42,691</b>	<b>\$34,564</b>	<b>\$77,255</b>

## QUALIFICATIONS

**John D. Willson:** J.D. Willson is an assistant professor in the Department of Biological Sciences at the University of Arkansas, Fayetteville. He completed his graduate research at the University of Georgia's Savannah River Ecology Laboratory and served as a postdoctoral researcher in the Department of Fish and Wildlife Conservation at Virginia Tech. His research uses a combination of descriptive, experimental, and theoretical approaches to understand population and community dynamics of reptiles and amphibians within the context of pressing conservation issues such as habitat alteration, pollution, and invasive species. Current projects in his lab include long-term studies of semi-aquatic snake population and community dynamics, evaluations of the effects of intensive forestry on reptile and amphibian communities, studies of the effects of land-use and management actions on prairie-associated herpetofauna, and research on the ecology and management of invasive Burmese pythons in Florida. J.D. has authored or co-authored over 50 scientific articles and book chapters and serves as editor of snake natural history notes for *Herpetological Review*.

**Chelsea S. Kross:** Chelsea Kross joined the Department of Biological Sciences at the University of Arkansas, Fayetteville, in 2014 as a Ph.D. student after completing her M.S. at Eastern Kentucky University. She has studied Crawfish Frogs for the past 3 years, and has spearheaded monitoring of the herpetofaunal community at Woolsey Wet Prairie Sanctuary, a recently restored prairie habitat in Fayetteville, AR. Chelsea is familiar with all of the proposed study techniques and is currently working to determine occupancy patterns of Crawfish Frogs in Northwest Arkansas.

**Kelly J. Irwin** obtained his M.S. in Wildlife & Fisheries Science from Texas A&M University in 1997. He has worked on amphibian and reptile conservation and management projects as the Arkansas Game and Fish Commission Herpetologist for 17 years and serves on the Board of Directors of the Center for North American Herpetology.

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