2015 State Wildlife Grant Proposal

Project Title: Conservation of collared lizards (*Crotaphytus collaris*) at risk: Habitat restoration at Pruitt Glade, Buffalo National River.

Project Summary: The goal of this project is to conserve a declining collared lizard population in immediate need of habitat restoration. The objectives of this project will be to improve habitat quality and quantity at Pruitt glade through prescribed burns and mechanical tree removal. Collared lizards at this site have been monitored for 3 years, providing baseline data, and monitoring will continue through the project duration. Effects of habitat restoration will be assessed through measured improvements in lizard characteristics (growth, body condition, reproduction and population size).

Project Leader:
Casey L. Brewster, Graduate Student, Department of Biology**,** University of Arkansas
SCEN 601, Fayetteville, AR. Phone: 240-377-1752, Email clbrewst@uark.edu

Project Partners:
Chuck J. Bitting, Natural Resource Program Manager, Buffalo National River
Phone: 870-365-2762, Email chuck_bitting@nps.gov

Kelly J. Irwin, Herpetologist, Arkansas Game & Fish Commission
Phone: 877-847-2690 Ext.16, Email kjirwin@agfc.state.ar.us

McRee Anderson, Interior Highland Fire Restoration Project Manager, The Nature Conservancy,
Phone: 870-861-5131, Email wanderson@tnc.org

Stacy Clark, Wildlife Biologist/Assistant Regional Manager, Arkansas Game & Fish Commission, Phone: 870-446-6180 Email stacey.clark@agfc.ar.gov

Fenn Wimberly, Fire Management Officer, Arkansas National Parks Group
Phone: 870-365-2766, Email fenn_wimberly@nps.gov

Steven J. Beaupre, Professor and Chair, Department of Biology, University of Arkansas
Phone: 479-575-3787, Email sbeaupre@uark.edu

John D. Wilson, Assistant Professor, Department of Biology, University of Arkansas
Phone: 479-575-2647, Email jwilson@uark.edu

Mathew E. Gifford, Assistant Professor, Department of Biology, University of Central Arkansas
Phone: 501-450-5846, Email megifford@uca.edu

Project Budget:

Total Project Cost:	$65,992.20
Total SWG Amount:	$32,980.20 (50%)
Matching Funds:	$33,012.00 (50%)

NEED: This project addresses two priorities listed in Table 1, SWG 2015 RFP: 1) Reptiles and Amphibians: Specifically target restoration of habitats in remnant collared lizard population localities, and monitor population response, and 2) Habitats: Habitat management to benefit SGCN, by increasing quality and patch size of glade habitat.

Collared lizard (*Crotaphytus collaris*) populations in Arkansas have suffered tremendous declines in recent years[1, 2], primarily as a result of habitat loss associated with fire suppression[3]. In Arkansas, collared lizards are restricted to glade habitats. Healthy glade ecosystems are distinct compared to other Interior Highland landscapes (e.g. mixed pine-hardwood forests, savannas and parries), providing diversity at both the habitat and species level. As an important predator in the glade community[4], the collared lizard is a pivotal species to glade ecosystems[5], making this species key to conservation of biodiversity in Arkansas.

Extant collared lizard populations outside of the White River Valley are increasingly uncommon, and most are on private lands (e.g. rock quarries), or consist of small (less than 15 adults) isolated populations[6]. Thus, it is important to place priority on collared lizard localities where extirpation risk is greatest.

We have identified a remnant collared lizard locality in the Buffalo National River (Pruitt glade) in immediate need of habitat restoration (Fig 1). This population suffers from the highest levels of woody plant encroachment of any we have sampled in Arkansas. Degraded habitat at Pruitt glade has resulted in declining population size (current population size ~15 adults), depressed reproduction rates and reduced body sizes (Fig 1). Additionally, the population at Pruitt glade occupies only a small portion (~ 4 acres) of the continuous glade habitat that could be occupied (~105 acres) with proper habitat restoration and management.

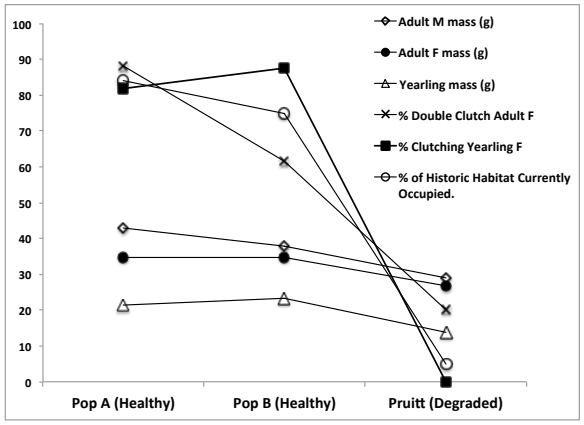

Figure 1: Comparison of average mass, % of adult females that double clutched, % of yearlings that clutched and % of historic habitat currently occupied among 3 populations (Sylamore populations A & B; healthy, and Pruitt population; degraded) from 2013-14.

Pruitt glade has great potential for the following reasons: 1) some habitat restoration has occurred in recent years (tree removal and prescribed fire), so most woody plant encroachment (albeit extensive) is in the form of recent understory growth, 2) the glade size (~105 acres) could provide one of the largest contiguous habitat patches for collared lizards in Arkansas, 3) if restored, the large habitat size would provide population stability and increased probability of colonization of unoccupied glade habitat outside of the management area.

Our proposed project is necessary to prevent extinction of the remnant population at Pruitt, and to prevent further loss of glade-associated biodiversity in Arkansas. Furthermore, our activities will serve as a model for glade restoration and collared lizard conservation that can be replicated at other localities where collared lizard populations are uncommon and declining.

PURPOSE AND OBJECTIVES: The purpose of this project is to improve habitat quality, increase patch size/connectivity and provide habitat conditions necessary for collared lizard population recovery and stability at the Pruitt glade site. Specifically, we will address the following **quantifiable objectives**: 1) Increase glade habitat quality and quantity by reducing

invasive shrub cover, increasing the number and quality of open basking sites, removing dense stands of Eastern Red Cedar and removing dense understory areas that limit habitat connectivity, and 2) improve collared population viability - as indicated by increased clutch size, clutch frequency, individual growth rates, population size, and use of currently unoccupied habitat (Fig1.)

LOCATION: This project will target calcareous glade and cliff/talus habitat (Central Interior Highland calcareous glade, cliff and talus), West of Pruitt landing (Pruitt glade), Newton Co. Rd 80, Buffalo National River. Pruitt glade is part of the Dissected Springfield-Plateau Elk River Hills Ecoregion, of the Ozark Highlands. The glade covers the south slopes of three adjacent hills (Map 1), with a total area of ~105 acres, and is part of a preexisting ~250 acre NPS fire unit.

APPROACH: Two general habitat management practices will be implemented through a collaborative agency effort (NPS, TNC and AGFC): 1) high intensity fires in Fall (Sept-Oct), annually over the next 3 seasons (starting in 2015) and mechanical removal (chainsaw) of Eastern Red Cedar before Sept 2015.

Habitat Sampling - Woody understory density, canopy cover density, % cover, and composition will be estimated using random transect sampling. Impact of changes in woody understory density on collared lizard habitat will be quantified by monitoring the distribution of available lizard body temperatures using standard thermal modeling approaches (these data have already been collected for 2013-14[6]). All habitat sampling will be conducted before (2015), during (2016-17), and after habitat management (2017-2018), and compared to data for 5 additional collared lizard localities (2 degraded and 3 intact habitats) at Sylamore (Ozark National Forest), sampled concurrently.

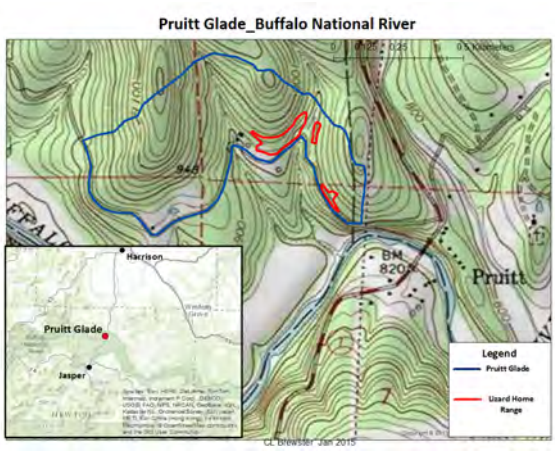

Figure 2: Map of Pruitt glade, Buffalo National River.

Population Response- We will conduct a mark-recapture study on collared lizards and assess responses based on individual and population-level demographic parameters. Lizard body size, clutch size and clutch frequency will be measured at time of capture, and previously un-occupied habitats will be monitored for colonization. Population data will be collected using standardized surveys (before, during and after habitat treatment) and robust-design analyses in Program MARK will be used to estimate population size, survival, and recruitment rates. Data from the Pruitt locality will be examined over time in relation to management activities and compared to 5 collared lizard localities at Sylamore. All "population response" data has been collected at the 6 sites (5 Sylamore, 1 Pruitt) for 2013-2014, providing a useful baseline dataset for comparisons[6].

EXPECTED RESULTS AND BENEFITS: We anticipate quantifiable evidence of habitat quality improvement immediately after first fire treatment, primarily through an increase in number and accessibility of thermally suitable basking sites. We anticipate a detectable increase in the habitat area occupied by lizard home ranges within the first activity season (May-Aug) after fire treatment. Similarly, we anticipate increases in age-specific body size, growth rate,

clutch size and clutch frequency before the end of the first activity season, in comparison to the previous 3 years (Fig 1). These data have been shown to be strong indicators of future population growth, and will form a strong foundation for monitoring of population growth and viability, both of which are likely to respond on a timeline that extends beyond the duration of this project. Thus, this project includes a commitment to sampling the Pruitt site for a minimum of 4 years, and an assessment with the NPS for post project fire frequency scheduling at the Pruitt glade site.

The collared lizard is the primary SGCN targeted in this project. With successful habitat restoration, the Pruitt population could represent one of the only known meta-populations outside of the White River Valley in Arkansas. As glade habitats and associated ecosystems in Buffalo National River are substantially different from those in the White River Valley[7, 8], habitat management at Pruitt glade offers major benefits to conservation of biodiversity in Arkansas. Furthermore, land management that results in ecosystem stability at this site will potentially benefit 14 other SGCN (Table 1) associated with this glade habitats.

Taxa	Scientific Name	Common Name	Habitat	County Record	Page #
Aves	*(Passerina ciris)*	Painted Bunting	Marginal	Yes	1093
Aves	*(Vermivora pinus)*	Blue-winged Warbler	Marginal	Yes	1092
Aves	*(Caprimulgus vociferus)*	Whip-poor-will	Suitable	Yes*	1093
Aves	*(Caprimulgus carolinensis)*	Chuck-will's-widow	Suitable	No	1092
Insectia	*(Cicindela obsoleta)*	Scrubland Tiger Beetle	Optimal	No	1094
Mammalia	*(Mustela frenata)*	Long-tailed Weasel	Data Gap	No	1095
Mammalia	*(Myotis sodalis)*	Indiana Bat	Marginal	Yes	1095
Mammalia	*(Notiosorex crawfordi)*	Desert Shrew	Suitable	No	1095
Mammalia	*(Corynorhinus townsendii ingens)*	Ozark Big-eared Bat	Suitable	No	1095
Mammalia	*(Myotis leibii)*	Eastern Small-Footed Bat	Suitable	Yes*	1095
Mammalia	*(Myotis grisescens)*	Gray Bat	Suitable	Yes*	1095
Reptilia	*(Sonora semiannulata)*	Ground Snake	Obligate	No	1096
Reptilia	*(Phrynosoma cornutum)*	Texas Horned Lizard	Suitable	No	1097
Reptilia	*(Crotaphytus collaris)*	Collared Lizard	Obligate	Yes*	1096
Reptilia	*(Ophisaurus attenuatus attenuatus)*	Western Slender Glass Lizard	Suitable	No	1096

* = Known Locality Record

Table 1: List of SGCN associated with Pruitt glade habitat

BUDGET:

SWG Portion (50% Total Project)			**$32,980.20**
Salaries:		GRA (CLB) Summer Stipend 6 months	$9,000.00
		Field Assistant Salary 6 months	$9,000.00
		Fringe (3.9% GRA, 5.1% Field Assistant)	$ 792.00
Travel:		Mileage ($0.42 @ 6000 mi)	$2,520.00
Equipment:		Digital Trail Cameras ($125.00 @ 20)	$2,500.00
		Thermochron IButtons ($18.00 @ 100)	$1,800.00
		Other Habitat Sampling Equipment	$1,320.00
Conference:		Registration, Room/Board, Travel ($950 @ 3 conferences)	$2,850.00
Total Direct		$29,782 **Indirect** (10%) $ 2978.20	
Match Portion (50% of Total Project)			**$33,012.00**
UARK:	(33.3%)	Unrecovered F&A Cost (47% - 10%)	$11,093.00
		Tuition (4 semesters; CLB)	$11,019.00
AGFC:	(10.0%)	Fire Crew ($425/fire @ 3 fires)	$1,300.00
		Chainsaw Crew ($1400/day @ 3 days)	$4,200.00
		Staff Time ($55/hr. @ 20 hrs.; KJI)	$1,100.00
TNC:	(6.5%)	Fire Crew ($425/fire @ 3 fires)	$1,300.00
		Chainsaw Crew ($1500/day @ 2 days)	$3,000.00
Project Total			**$65, 992.20**
Other Project Money (Federal; Non-allowable for Match)			
NPS		Fire Crew ($890/fire @ 3 fires)	$2670.00
		Chainsaw Crew ($1400 day @ 3 days)	$4200.00
		Staff Time ($50/hr. @ 20 hrs.; CJB)	$1,000.00
		Lodging Facilities ($10.0/day @ 60 days)	$600.00
Combined Agencies Project Total			**$74,462.20**

QUALIFICATIONS

Casey L. Brewster: M.S. 2012. UALR. Pat Tillman Military Scholar and current PhD graduate student at the University of Arkansas. He has studied collared lizards for over 5 years, and is currently working with the Ozark-St. Francis National Forest and AGFC to re-establish collared lizards to restored habitat localities in the Sylamore Ranger district.

Chuck Bitting: B.S. 1985. Geology, Missouri State University. He is the Natural Resource Program Manager at Buffalo National River and has directed the Terrestrial Habitat Management Program at the National Park for the past 8 years.

Kelly J. Irwin: M.S. 1997. Wildlife & Fisheries Science, Texas A&M University. He has worked on amphibian and reptile conservation and management projects as AGFC herpetologist for 15 years.

McRee Anderson: 12 years of fire management experience. Director, Fire Restoration Program AR Chapter of The Nature Conservancy (TNC). He is currently a National Wildfire Coordinating Group (NWCG) certified RXB2 Burn Boss. McRee co-leads TNC's Prescribed Fire Program.

Stacy Clark: Wildlife Biologist and Assistant Regional Manager for Wildlife Division Region 7. Area Manager for Gene Rush WMA and Richland Valley Sonny Varnell Elk Conservation Area.

Fenn Wimberly: Over 20 years of fire management and wildlife habitat restoration projects. Projects have included a wide variety of timber, glade, native tall and short grass prairie and bottomland hardwood forest habitat management with the US Fish and Wildlife Service and the National Park Service.

Steven J. Beaupre: Professor and Chair of the Department of Biological Sciences at the University of Arkansas. He joined UA faculty in Fall of 1995, and focuses on Physiological Ecology of reptiles, specializing on environmental influences on bioenergetics, life-histories, and population biology. He has a specialty in thermal biology that will support Mr. Brewster's measurements of changes in habitat thermal suitability.

John D. Wilson: PhD University of Georgia. Assistant Professor University of Arkansas. 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.

Matthew Gifford: PhD Washington University. Assistant Professor, University of Central Arkansas. His research focuses on the influence of environmental variation on physiological and ecological processes in reptiles and amphibians. Much of his research focuses on the influence of temperature on physiological function, life history and fitness in lizards.

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