

2011 Arkansas State Wildlife Grant Pre-Proposal

1. General Information

a) Title of Project: Insects and lizards as indicators of glade restoration status

b) Project Summary: (maximum 6 lines)

Glades are unique landscape features of upland woodland habitats in Arkansas. Changes in glade vegetation structure due to fire suppression threaten their associated wildlife diversity. The proposed project builds upon ongoing SWG-funded glade restoration efforts. We will intensively survey the insect and lizard communities of three managed glade sites in central Arkansas to determine the ecological effects of restoration and to document the distributions of rare and endemic species. Results will be used to generate an efficient habitat assessment index that will be useful to resource managers.

c) Name of Project Leader and Job Title: Dr. Stephen P. Yanoviak, Assistant Professor

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h) Project Partners:

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2) Douglas Zollner, The Nature Conservancy, 601 North University Ave., Little Rock, Arkansas 72205, zollner@tnc.org, (501) 804-6242

3) Dr. Matt Gifford, Dept. of Biology, Univ. of Arkansas at Little Rock, 2801 South University Ave., Little Rock, AR 72204, megifford@ualr.edu, (501) 569-3911

i) Total Project Cost: \$107,330

j) SWG Amount: \$ 53,283 (49.6%)

k) Matching Funds: \$ 54,047 (50.4%)

1) UALR cash = \$25,047

2) TNC in kind = \$29,000

2. Project Statement

a) Need

This research addresses two priorities listed in Attachment A of the 2011 SWG RFP: 1) INSECTS: Arkansas's unique biogeography: status of disjunct and relict populations; and 2) HABITATS: woodlands and glades. Additionally, we propose to assess the efficacy of SWG-funded glade restoration measures currently in progress (Melnechuk 2008).

Glades are islands of exposed rocky areas embedded within upland woodland habitats in the Ozarks (e.g., Baskin *et al.* 2007). Under natural circumstances, glades burn frequently and support relatively specialized low vegetation dominated by grasses and forbs (e.g., Jenkins *et al.* 1997). Fire suppression over the past several decades has degraded glade habitats by permitting colonization by eastern red cedar (*Juniperus virginiana*) and increases in woody stem density. Consequently, vegetation, light, and temperature on glades have been dramatically altered relative to their historical state (Jenkins *et al.* 1997). The broader consequences of such alterations are likely to be most apparent in active, poikilothermic animals, such as insects and lizards, including collard lizards (*Crotaphytus collaris*) and other potential SGCN (e.g., Bergmann & Chaplin 1992, Templeton *et al.* 2001, Brisson *et al.* 2003). Cedar removal and the reintroduction of fire effectively restore glade habitats and can enhance biodiversity (Jenkins & Jenkins 2006). The proposed project will measure these effects in conjunction with ongoing glade restoration efforts in Arkansas (Melnechuk 2008).

Insects are an excellent focal group for monitoring ecosystem health for at least three reasons. First, they are ubiquitous in terrestrial habitats; at mid-latitude locations like Arkansas, insects are active and conspicuous during most of the year. Second, many groups of insects (ants, butterflies, grasshoppers) are relatively easy to collect and identify, facilitating their use in structured inventories. Finally, insects are important members of terrestrial food webs; they function at multiple trophic levels and influence the dynamics of ecosystem processes such as carbon cycling. The insects of Arkansas are not well documented, yet the diverse topography of the state suggests that many endemic species are present but remain undiscovered. This project will help fill that gap while also examining the role of insects as prey for lizard populations in glades (cf. Östman *et al.* 2007).

b) Objectives

- 1) Survey the insect and lizard fauna of glades in various stages of restoration, and of adjacent woodland habitats.
- 2) Use information gained from surveys to assess the efficacy of glade restoration methods currently employed by resource managers (Melnechuk 2008).
- 3) Determine how the composition and abundance of prey (insects) in glades influences the viability of resident lizard populations.
- 4) Develop habitat quality assessment tools that can be utilized in future glade restoration projects.
- 5) Establish a long term glade fauna monitoring program.

c) Expected Results and Benefits

This study will provide **practical benefits** to all wildlife biologists and managers working in glades by creating an efficient and effective method for assessing glade habitat quality and the outcome of restoration efforts. This study will also provide **information benefits** by quantifying the distributions of threatened rare and endemic insect species associated with woodlands and glades at various sites in the state. Most of the insects currently listed as potential SGCN are the product of limited sampling in relatively isolated habitats. Collection efforts proposed in this project have great potential to refine and expand this database. This project will provide **educational benefits** by training future professional field biologists and resource managers. Specifically, SWG funding will directly support one graduate student and facilitate the participation of several undergraduate field assistants in Steve Yanoviak's lab at the University of Arkansas at Little Rock. The graduate student will gain practical knowledge adequately preparing him/her for future employment in a state wildlife or conservation agency. Undergraduate students participating in the project as field assistants (and earning Independent Study credits at UALR)

will gain hands-on experience in the design and implementation of field-based research and habitat management techniques. Finally, this project will provide **networking benefits** by supporting a collaborative partnership between UALR and The Nature Conservancy. This partnership will strengthen working relationships between academic and management ecologists and will pave the way for additional collaborative studies. The results of this project will be summarized in AGFC progress reports and presented at the annual Arkansas Wildlife Action Plan meeting at Mt. Magazine. Results stemming from MS student research associated with this project will also be published in peer-reviewed articles, and presented in local and national professional conferences.

d) Approach

Sampling Areas and Monitoring Plan. At least 5 sampling areas will be established at each of the three glade restoration sites (Fig. 1). Each sampling area will consist of a glade and a similarly-sized patch of adjacent (or nearby) woodland habitat. Sampling areas will be further divided into quadrats and line transects to facilitate structured faunal inventories. Basic ecological characteristics of each quadrat and transect will be measured following standard protocols (e.g., vegetation composition, % cover, slope, aspect). Data will be collected from each sampling area every 10-14 days for 10 weeks during the summer of project year 1, every 4-8 weeks in year 2, and annually thereafter.

Insect and Lizard Surveys. Insects will be surveyed in sampling areas using a combination of active collecting and passive trapping. Both approaches provide useful data for diversity estimation, but passive trapping additionally measures general insect activity. Active collecting methods will consist of sweep-netting (standardized by effort) and baiting (tuna-honey mixtures attract resident ants, bees, wasps, flies, and beetles) in each quadrat. Passive collecting will employ unbaited pitfall traps (to capture the ground-dwelling fauna) in each quadrat, and one pair of Malaise traps to capture flying insects in each sampling area (i.e., one trap in the glade and one in its adjacent woodland; Fig. 2).

Lizards will be visually surveyed along transects by students appropriately trained in the Gifford lab at UALR. Collected data will complement the results of other glade-lizard studies (Templeton *et al.* 2001, Brisson *et al.* 2003, Östman *et al.* 2007), and will minimally include species, approximate age, sex, and size class. The importance of insects in the diets of glade-inhabiting lizards will be determined from gut contents obtained by flushing from a subsample of lizards collected from (and returned live to) the sampling areas.

Prey Composition and Community Analyses. Insects captured in the study areas will be counted, measured to estimate overall body size, and identified to family (or lower, as appropriate). Insect body size-abundance distributions will be compared with lizard composition and abundance, and with gut contents of the most common species. Multivariate analyses will be used to assess the effects of habitat parameters and glade restoration status on insect and lizard community parameters (abundance, diversity and composition). We will similarly compare the efficacy of the different sampling methods to determine which provides the greatest information return per unit time and effort. *This information will be used to generate a simple method of assessing glade habitat quality based on a snapshot of data collected by resource managers who may have little or no entomological training.* Ultimately, our goal is to generate a standardized rapid bioassessment protocol for glade/woodland habitats similar to those used by freshwater biologists.

e) Location of Work

The proposed work will be conducted at three glades in central Arkansas that are currently managed by The Nature Conservancy Arkansas Field Office or the Arkansas Natural Heritage Commission: Trap

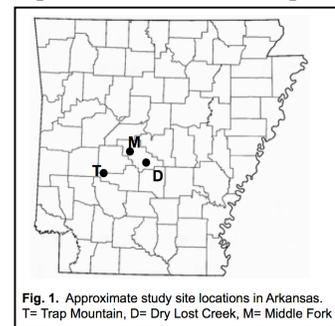


Fig. 1. Approximate study site locations in Arkansas. T= Trap Mountain, D= Dry Lost Creek, M= Middle Fork



Fig. 2. Malaise trap in use.

Mountain, Dry Lost Creek, and Middle Fork Barrens Natural Area (Fig. 1). Collectively, these sites occupy the Ouachita Mountains and South Central Plains Ecoregions.

f) Literature Cited

Baskin, J. M., *et al.* 2007. Calcareous rock outcrop vegetation of eastern North America (exclusive of the Nashville Basin), with particular reference to use of the term "cedar glades". *Bot. Rev.* 73: 303-325.

Bergmann, D. J. and S. J. Chaplin. 1992. Correlates of species composition of grasshopper (Orthoptera: Acrididae) communities on Ozark cedar glades. *Southwest. Nat.* 37: 362-371.

Brisson, J. A., *et al.* 2003. Impact of fire management on the ecology of collared lizard (*Crotaphytus collaris*) populations living on the Ozark Plateau. *Anim. Conserv.* 6: 247-254.

Jenkins, S. E. and M. A. Jenkins. 2006. Effects of prescribed fire on the vegetation of a savanna-glade complex in northern Arkansas. *Southeast. Nat.* 5: 113-126.

Jenkins, S. E., *et al.* 1997. Vegetation-site relationships and fire history of a savanna-glade-woodland mosaic in the Ozarks. Pp. 184-201 *in*: S. G. Pallardy *et al.*, eds. Proceedings of the 11th Central Hardwood Forest Conference. USDA Forest Service Gen. Tech. Rep. NC-188.

Melnechuk, M. 2008. Central Arkansas glade and woodland restoration. Arkansas State Wildlife Grant awarded to The Nature Conservancy.

Östman, Ö., *et al.* 2007. Habitat area affects arthropod communities directly and indirectly through top predators. *Ecography* 30: 359-366.

Templeton, A. R., *et al.* 2001. Disrupting evolutionary processes: the effect of habitat fragmentation on collared lizards in the Missouri Ozarks. *PNAS* 98: 5426-5432.

3. Budget

a) AGFC Portion (= 49.6% total project cost)

Salaries and Fringe	
PI (Yanoviak) 2% of annual salary	1106
MS Student (2 yr @ \$14,000/year)	28,000
Fringe (1% for student, 26% for PI)	568
Supplies and Equipment	
Berlese funnels (20 @ \$85 ea.), pitfall traps, and related sampling gear	2000
Malaise traps (10 @ \$270 ea.) and related supplies	3000
Misc lab and field supplies (sample processing and storage)	1000
One stereoscope (Meiji RZ5) dedicated to the project	7040
Travel	
Mileage (0.43 per mile, est. 7500 miles)	3225
Meals & Lodging	2500
Total Direct Costs:	\$48,439
Indirect Costs (10% SWG allowed)	4844
AGFC Amount:	\$53,283

b) UALR Match (= 23.4% total project cost)

Tuition (2 years @ \$5,500 per year)	11,000
Waived indirect costs (Federal rate 39% - SWG 10%)	14,047
UALR Amount:	\$25,047

c) TNC Match (= 27.0% total project cost)

Three prescribed fires on glades under restoration (\$7,000 ea.)	21,000
Invasive species management on glades under restoration	3000
Volunteer hours on glades under restoration	5000
TNC Amount:	\$29,000

d) Total Project Cost **\$107,330**

4. Qualifications

Dr. Stephen P. Yanoviak - Dr. Yanoviak is a professional insect ecologist with over 20 years of field experience in temperate and tropical ecosystems (see www.canopyants.com). He received his B.S. and M.S. degrees in Entomology, and his Ph.D. in Zoology with a focus on insect ecology. His recent studies of ant biology have been published in top journals (e.g., *Nature*, *PNAS*), and continue to receive international media attention (e.g., *The New York Times*, *National Geographic*). Dr. Yanoviak oversees the UALR insect museum. His lab is well equipped to conduct the proposed research, including bench space, storage space, electronic balance, and computer resources.

Robin M. Verble - Robin Verble received her MS in Entomology from UA-Fayetteville, where she studied ant ecology in managed forests in NW Arkansas. She currently studies the ant fauna of the Arkansas Ozarks and has partnered with The Nature Conservancy on past projects.

Doug Zollner - Doug Zollner, Director of Science for The Nature Conservancy, has extensive practical experience with fire management and the field ecology of nongame wildlife, especially birds. His knowledge of disturbance ecology, fire management, and bird biology appropriately extends the project scope well beyond insects.

Dr. Matthew E. Gifford - Dr. Gifford is an Assistant Professor in the Biology Department at UALR. He is a broadly-trained professional herpetologist and physiological ecologist. His current research focuses on the influence of environmental conditions on the physiology and ecology of vertebrate ectotherms (salamanders and lizards) in Arkansas. Matt has extensive experience in field biology and population modeling. The Gifford lab at UALR is well equipped to contribute to the proposed research, including environmental chambers, field equipment and expertise, and computer resources.

The Nature Conservancy Arkansas Field Office - The Nature Conservancy (TNC) has worked in the glades and woodlands of Arkansas for approximately 15 years. TNC has developed a broad understanding of this at-risk ecosystem through years of scientific observation and use of adaptive management in implementation of restoration techniques. TNC maintains an excellent working relationship with conservation organizations such as the Arkansas Natural Heritage Commission. This relationship increases our capacity to organize teams made up of experts in the field of restoration of at-risk habitats. TNC also maintains science and conservation staffs that are trained in implementation of strategic actions and monitoring. Finally, through completion of other restoration activities, TNC has demonstrated the ability to successfully complete this project.