

## **1. Cover Page**

**a. Title:** Range, population size, and habitat preference of two rare Arkansas Lepidoptera, the Texas Frosted Elfin (*Callophrys irus hadros*) and Linda's roadside skipper (*Amblyscirtes linda*).

**b. Project Summary:** The goal of this proposal is to determine the status of *Callophrys irus hadros* (Texas frosted elfin) and *Amblyscirtes linda* (Linda's roadside skipper). Both of these Lepidoptera have been recorded only a few times in Arkansas, and they occupy habitats that have been severely impacted by human activity. Neither has been studied in detail in Arkansas. *Amblyscirtes linda* has been petitioned for federal listing and could therefore impact Arkansas land use and management decisions in the near future. *Callophrys irus hadros* has the highest conservation priority score of any Arkansas Lepidoptera. Once the range and population sizes of these two species are more fully understood, conservation recommendations can be developed to improve the chances of survival for these two presumably rare components of Arkansas biodiversity.

**c. Project Leaders:**

Matthew D. Moran. Professor of Biology, Hendrix College. 1600 Washington Ave. Conway, AR 72032. Phone: 501-450-3814. Email: [moran@hendrix.edu](mailto:moran@hendrix.edu)

Maureen McClung. Assistant Professor of Biology, Hendrix College. 1600 Washington Ave. Conway, AR 72032. Phone: 501-450-1486. Email: [mcclung@hendrix.edu](mailto:mcclung@hendrix.edu)

**d. Project Partners:** none

**e. Project Budget**

SWG Requested Amount	\$86,701
Match	\$47,695
Total	\$134,396

## **2. Project Statement**

**a. Need:** The 2015 State Wildlife Grant Funding priorities addressed by this proposal include *Amblyscirtes linda*, small stream-river riparian forest, prairies, and woodlands (oak woodlands and pine-oak flatwoods). The two butterfly/skipper species chosen in this study represent rare and poorly studied species within Arkansas, each with only a few known localities. Each is also associated with habitats that have become increasingly rare, so they could represent indicator species for habitat that is of particular conservation value. *Amblyscirtes linda* (Linda's roadside skipper) has been petitioned for federal listing and is a priority insect for Arkansas. It is found along small woodland streams, seems to prefer undisturbed woodlands (Heitzman and Heitzman 1970), and is probably impacted for timber harvesting and agricultural development. The Texas frosted elfin (*Callophrys irus hadros*) is found in open woodland habitat and the larvae feed only on species within the *Lupinus* and *Baptisia* genera (Albanese et al. 2008). Habitat for this species is threatened by fire suppression and conversion of woodland habitat to monoculture pine plantations (Wagner et al. 2003). This species has the highest calculated priority score of any Lepidoptera in Arkansas. The presence of these species would indicate the presence of ecologically valuable habitat that could be targeted for preservation (in the case of *A. linda*) and/or active management (in the case of *C. irus hadros*).

**b. Purpose and Objectives:** The natural history, population status, and range of these two presumably rare butterflies that range in Arkansas are poorly known. The goal of our project will be to determine the range, population sizes, and habitat preferences of these two species of conservation concern in Arkansas. The first year of the study will focus on determining population locations so that an accurate range map can be constructed for both species. The second year we will continue to search for additional populations, but our main focus will be to estimate sizes of known populations and analyze habitat characteristics that predict abundance. The population data combined with habitat analysis will then allow us to suggest management approaches for each species including the best habitat to target for conservation efforts and potential management activities. Both species in this proposal have potentially suitable habitat that exists in areas of public lands, making management proposals more likely to be practical.

**c. Location:** Our search for these Lepidoptera will begin in areas with recent occurrence records, including Cherokee Prairie Natural Area and Rick Evans Grandview Prairie Wildlife Management Area for *C. irus hadros* and Cossatot State Park and Fort Chaffee for *A. linda*. Then our search will expand to public lands selected from possible historical records from the literature, University of Arkansas Arthropod Museum specimens, and other habitat that appears similar to known and historical localities. For *C. irus hadros*, the sites have potentially suitable habitat in the form of prairies that are closely associated with open woodlands. For *A. linda*, we chose sites that have relatively undisturbed forests associated with streams, in

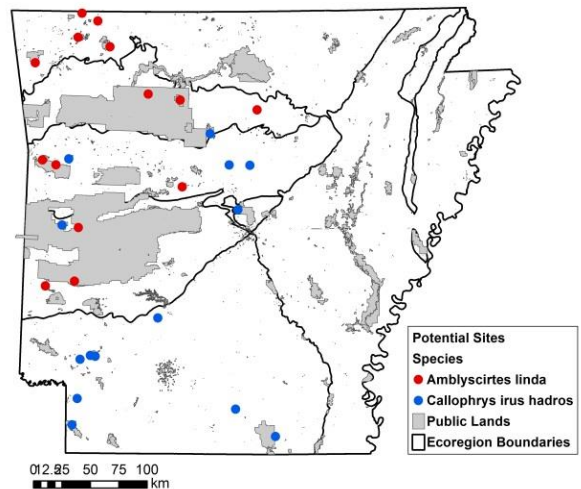


Figure 1. Arkansas sites with potential for hosting populations of *C. irus hadros* and *A. linda*.

particular those with old-growth or mature forest characteristics. The sites span the ecoregions of the Ozark Mountains, Boston Mountains, Arkansas Valley, Ouachita Mountains, and the South Central Plains/Gulf Coastal Plains. Counties include: Benton, Carroll, Clark, Conway, Crossett, Hempstead, Faulkner, Franklin, Madison, Miller, Montgomery, Newton, Pike, Polk, Pulaski, Searcy, Sebastian, Scott, Stone, Union, Van Buren, and Washington.

**d. Approach:** During the first year, we will focus on locating sites where these species are present. Search efforts will coincide with flight periods (March-April for *C. irus hadros*, April-July for *A. linda*). We will visit sites (Figure 1) and search for nectaring adults on preferred food plants (*Lupinus* and *Baptista* spp. for *C. irus hadros* and *Chasmanthium latifolia* for *A. linda*). Individuals will be captured using nets for examination and identification in the hand. Once the presence of these species has been confirmed at a site, we will perform surveys of habitat characteristics thought to be important for each species (e.g. density of food plants, canopy and shrub cover, vegetation composition, and soil types). During the academic year, we will use habitat variables from sites occupied by these species, as well as information on patch size and management history, to create potential habitat maps for these species so that our search sites can be expanded in 2017. During this second field season, we will conduct systematic transect surveys using distance sampling (Buckland et al. 2005, Isaac et al. 2011, Grundel 2014) in order to estimate abundance for these species at each site. Habitat covariates will be included in our analyses so that we may make recommendations as to which habitat characteristics are most important in determining the size of populations.

**e. Expected Results and Benefits:** This study focuses on two Lepidoptera Species of Greatest Conservation Need (SGCN) in Arkansas, *C. irus hadros* (priority score = 65) and *A. linda* (Priority Score = 38). Our results will expand current knowledge on the population distributions and abundance of these species, as well as help inform management decisions supporting their habitat. The oak woodlands/pine oak flatwoods preferred by *C. irus hadros* and undisturbed riparian habitat preferred by *A. linda* also support additional species on the SGCN list. Other SGCN with high priority scores that potentially overlap with *C. irus hadros* include *Picoides borealis*, *Ammodramus henslowii*, and many additional species with lower priority scores. Those that overlap the site for *A. linda* include *Noturus taylori*, *Percina pantheria*, and several crayfish species. In addition to the scientific and conservation benefits, this project will impact undergraduate education in a positive way. Five undergraduate students will work on the project each year. The opportunity to do undergraduate research is of paramount importance for acceptance into graduate school and has been shown to enhance retention in the sciences.

## References

- Albanese, G., Vickery, P.D., and Sievert, P.R. 2008. Microhabitat use by larvae and females of a rare barrens butterfly, Frosted Elfin (*Callophrys irus*). *Journal of Insect Conservation* 136:53-64.
- Buckland, S.T., Anderson, D.R., Burnham, K.P., and Laake, J.L. 2005. Distance Sampling. *Encyclopedia of Biostatistics*. 2.
- Grundel, R. 2014. A guide to the use of distance sampling to estimate abundance of Karner blue butterflies. Retrieved 10Feb15 from <http://www.fws.gov/midwest/endangered/insects/kbb/kbbdistancesampling.html>
- Heitzman, J.R., and Heitzman, R.L. 1970. The life history of *Amblyscirtes linda* (Hesperiidae). *Journal of Research on the Lepidoptera* 83:99-104.

Wagner, D.L., Nelson, M.W., and Schweitzer, D. 2003. Shrubland Lepidoptera of southern New England and southeastern New York: Ecology, conservation, and management. *Forest Ecology and Management* 185:95-112.

Isaac, N.J.B., Cruickshanks, K.L., Weddle, A.M., Marcus Rowcliffe, J., Brereton, T.M., Dennis, R.L.H., Shuker, D.M. and Thomas, C.D. 2011. Distance sampling and the challenge of monitoring butterfly populations. *Methods in Ecology and Evolution* 2:585–594.

## f. Budget

	Year 1: Jan 1 - Dec 31, 2016	Year 2: Jan 1 - Dec 31, 2017
<b>GRANT</b>		
<i>Salary</i>		
Moran (1.25 months Summer Salary)	8,542	8,713
McClung (1.25 Summer Salary)	6,042	6,163
Adjunct Salary (1 course release for McClung)	3,750	3,750
Student Summer Stipends (yr 1: 3,000 X 5; yr2: 3,100 X 5)	15,000	15,500
FICA	2,550	2,611
Fringe Benefits (Faculty Summer Salary)	999	1,081
<i>Travel</i>		
Fuel	2,000	2,000
Food	2,000	2,000
Camping Fees/Supplies	500	500
<i>Supplies</i>		
Field and lab supplies	1,500	1,500
<b>Subtotal Grant</b>	<b>42,883</b>	<b>43,818</b>
<b>MATCH</b>		
<i>Salary</i>		
Moran (Partial Academic Year Salary 1/8 spring semester)	5,000	5,100
McClung (Partial Academic Year Salary 1/8 spring semester)	3,625	3,698
FICA	660	673
Unrecovered Indirect Costs: 15% of summer salaries	5,001	5,063
<i>Housing</i>		
Student Summer Housing	3,375	3,500
<i>Travel</i>		
Vehicle Rental (college van)	6,000	6,000
<b>Subtotal Match</b>	<b>23,661</b>	<b>24,034</b>
<b>TOTAL MATCH (35.5% of total grant)</b>		<b>47,695</b>
<b>SWG REQUESTED AMOUNT</b>		<b>86,701</b>
<b>TOTAL GRANT</b>		<b>\$134,396</b>

### **3. Qualifications**

**Dr. Matthew Moran** has over 20 years of field research experience. His expertise includes insect and grassland ecology, plant-animal interactions, conservation and evolutionary biology. He has previously studied and published on the range and habitat requirements of the Diana fritillary butterfly (Moran and Baldrige 2002). He has published 24 peer reviewed publications.

**Education:** Ph.D. Ecology, University of Delaware (1996), B.A. Biology, University of Delaware (1991)

**Current Position:** Professor of Biology at Hendrix College, Area Chair: Natural Sciences, Member of the Environmental Studies Program

**Recent Peer Reviewed Publications:** \*undergraduate co-author

**Moran, M. D.,** A.B. Cox\*, R.L. Wells\*, C.C. Benichou\*, and M.R. McClung. 2015. Habitat loss and modification due to gas development in the Fayetteville Shale. *Environmental Management. In press.*

Boone, M.J.\*, C.N.Davis\*, L. Klasek\*, J. del Sol\*, K. Roehm\*, and **M.D. Moran.** 2015. A test of Pleistocene mammal seed dispersal in anachronistic fruits using extant ecological and physiological analogs. *Southeastern Naturalist. In press.*

**Moran, M.D.** 2014. Bison grazing increases arthropod abundance and diversity in a tallgrass prairie. *Environmental Entomology.* 43:1174-1184.

Penner, J.L., K. Zalocusky\*, L. Holifield\*, J. Abernathy\*, B. McGuff\*, S. Schichtl\*, W. Weaver\*, and **M.D. Moran.** 2013. Are high pilferage rates an artefact of experimental design? The effects of food provisioning on foraging behaviour. *Southeastern Naturalist* 12:589-598.

Roehm, K.\* and **M.D. Moran.** 2013. Is the Coyote (*Canis latrans*) a potential seed disperser for the American Persimmon (*Diospyros virginiana*)? *American Midland Naturalist* 169:414-419.

**Dr. Maureen McClung** is an ecologist with experience in field studies across a variety of taxa, including birds, primates, fish, insects, and plants. She has worked extensively in the field abroad (New Zealand, Peru) and in Arkansas (Ozark Highlands).

**Current Position:** Assistant Professor of Biology at Hendrix College, Member of the Environmental Studies Program

**Education:** Ph.D. Biology, University of Arkansas (2013), M.Sc. Biology, University of North Carolina (2006), Pg.Dip.Sci Ecology, University of Otago New Zealand (2002), B.A. Biology Hendrix College (2001)

**Publications:**

Moran, M.D., A.B. Cox, R.L. Wells, C.C. Benichou, and **M.R. McClung.** 2015. Habitat loss and modification due to gas development in the Fayetteville Shale. *Environmental Management. In press.*

Bradley, C. and **M.R. McClung.** 2015. Vocal divergence in long calls of tamarins: an empirical test of allopatric speciation in *Saguinus fuscicollis nigrifrons* and *S. f. lagonotus*. *American Journal of Primatology. In Press*

**McClung, M.R.,** Seddon, P.J, Massaro, M., and A.N. Setiawan. 2004. Nature-based tourism impacts on yellow-eyed penguins *Megadyptes antipodes*: Does unregulated visitor access affect fledging weight and juvenile survival? *Biological Conservation* 119: 279-285.