1. Cover Page

a. Title: Range, population size, and habitat utilization of the Texas frosted elfin (*Callophrys irus hadros*).

b. Project Summary: The goal of this proposal is to determine the status and habitat utilization of *Callophrys irus hadros* (Texas frosted elfin). This Lepidoptera species has been recorded only a few times in Arkansas and occupies habitats that have been severely impacted by human activity. It has not been studied in detail in Arkansas. *Callophrys irus hadros* is the only Lepidoptera listed on the 2017 State Wildlife Grant Funding Priorities (SWGFP) and has been petitioned for listing by the U.S. Fish and Wildlife Service under the Endangered Species Act. It is associated with prairies, grassland, and open woodland habitats, which are high priority for habitats under the 2017 SWGFP. Once the range, population size, and habitat utilization of this species is more fully understood, conservation recommendations will be developed to improve the chances of survival of this presumed rare component of Arkansas biodiversity and contribute to actions that may preclude the need to list the species.

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
Project Activities: He will participate in field and laboratory work and help coordinate student field workers.

Maureen McClung. Assistant Professor of Biology, Hendrix College. 1600 Washington Ave. Conway, AR 72032. Phone: 501-450-1486. Email: mcclung@hendrix.edu
Project Activities: She will participate in field and laboratory work and help coordinate student field workers.

d. Project Partners:

Melissa Lombardi, Endangered Species Biologist, U.S. Fish and Wildlife Service, Arkansas Field Office, 110 S. Amity Road, Suite 300, Conway, AR 72032. Phone: 501-513-4488. Email: melissa_lombardi@fws.gov
Project Activities: She will assist in field work when available and provide supplies, equipment, and vehicles.

William H. Baltosser, Department of Biology, University of Arkansas at Little Rock, 2801 S. University Ave., Little Rock, AR 72204. Phone: 501-569-3521. Email: whbaltosser@ualr.edu
Project Activities: He will assist in field work when available and consult on methodologies and strategies for habitat analysis.

e. Project Budget

SWG Requested Amount	$35,540
Match	$22,278
Total	$57,818

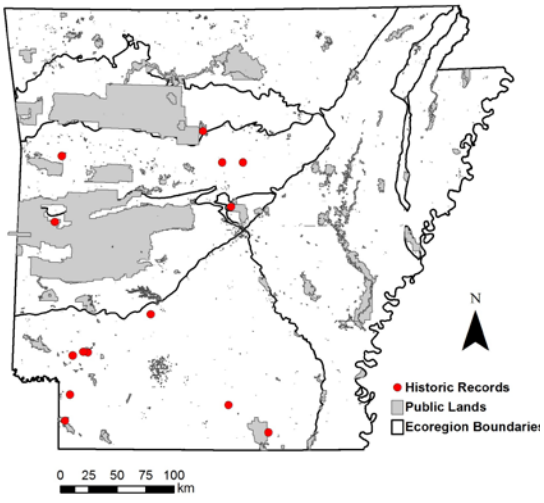
2. Project Statement

a. Need: The 2017 State Wildlife Grant Funding priorities addressed by this proposal include the Texas frosted elfin (*Callophrys irus hadros*), prairies and native grasslands, and woodlands (oak woodlands and pine-oak flatwoods). The butterfly chosen in this study represents a presumably rare and poorly studied species within Arkansas, with only a few known localities. It is associated with habitats that have become increasingly rare and/or modified, so it could represent an indicator species for habitat that is of particular conservation value. The occurrence of this species would indicate the presence of ecologically valuable habitat that could be targeted for preservation and/or active management.

b. Purpose and Objectives: While related subspecies have been studied in some detail (Wagner et al. 2003, Albanese et al. 2008, Pfitsch and Williams 2009, Bried et al. 2012), the natural history, population status, and range of this rare butterfly in Arkansas is poorly known. The first year of the study will focus on determining population locations so that an accurate range map can be constructed for this 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, including the best habitat to target for conservation efforts and potential management activities. *Callophrys irus hadros* has potentially suitable habitat in areas of public lands, making management proposals practical. However, most of these habitats are small and isolated. Some populations in close proximity may benefit from increased land conservation efforts that would connect small disjunct populations using habitat corridors.

c. Location: Our search for this butterfly will begin in areas with recent occurrence records, including Cherokee Prairie Natural Area and Rick Evans Grandview Prairie Wildlife Management Area. Our search will then expand to public lands selected from historical records from the literature, University of Arkansas Arthropod Museum specimen collection locations, and other habitats that appear similar to known and historical localities. The sites that have potentially suitable habitat are in the form of prairies that are closely associated with open woodlands. The sites span the ecoregions of the Boston Mountains, Arkansas River Valley, Ouachita Mountains, and the South Central Plains/Gulf Coastal Plains. Counties include: Clark, Conway, Hempstead, Faulkner, Franklin, Miller, Montgomery, Pike, Polk, Pulaski, Scott, Stone, Union, and Van Buren.

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



d. Approach: During the first year (2018), we will focus on locating sites where the species is present. Search efforts will coincide with flight period of March-early June. We will visit sites (Figure 1) and search for nectaring adults on preferred food plants (*Lupinus* and *Baptista* spp., Wagner et al. 2003). Individuals will be captured using nets for examination and identification in the hand and then released. Once the presence of this species has been confirmed at a site, we will perform surveys of habitat characteristics thought to be important (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 occupied sites, as well as information on patch size and management history, to create potential habitat maps for the species so that our search sites can be expanded in 2019. During this second field season, we will conduct systematic transect surveys using distance sampling (Buckland et al. 2005, Isaac et al. 2011, Grundel 2014) to estimate abundance at each site where it has been confirmed. We will also expand the search to locations indicated by the habitat maps created from the data collected in 2018. At the conclusion of the 2019 field season we will have an accurate map of the Arkansas range for *C. irus hadros*, understand its habitat utilization, and be able to make management recommendations.

e. Expected Results and Benefits: This study focuses on a Lepidoptera Species of Greatest Conservation Need (SGCN) in Arkansas, *C. irus hadros* (priority score = 42) and the only Lepidoptera listed on the priorities list for 2017. Our results will expand current knowledge on the population distributions and abundance of this species, as well as help inform management decisions supporting its habitat. The project also addresses the status of a rare pollinator which relates to the 2014 Presidential memorandum on pollinator health (Obama 2014). The oak woodlands/pine oak flatwoods and prairies utilized by *C. irus hadros* also supports 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. This project will impact undergraduate education in a positive way. Three 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. Students who participate in this project will be encouraged to continue their education in graduate school, in particular under the guidance of Dr. Baltosser, a Lepidoptera expert who is a project partner.

References

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f. Budget

	Year 1: Jan 1 - Dec 31, 2018	Year 2: Jan 1 – Sept. 30, 2019
SWG REQUEST		
Salary		
Moran (2/9 Salary Spring 2019 during sabbatical)		18,222
Adjunct Salary (1 course release for McClung)	3,750	
FICA	287	1,681
Travel		
Fuel	2,000	2,000
Food	1,800	1,800
Camping Fees/Supplies	500	500
Supplies		
Field and lab supplies	1,500	1,500
Subtotal SWG Request	**9,837**	**25,703**
MATCH		
Travel		
Vehicle Rental (college van)	6,000	6,000
Unrecovered indirect costs (15% of salaries)	563	3,296
Fringe Benefits (health and retirement, Moran salary)		4,619
Student Summer Housing (May 15 – June 7 each year)	900	900
Subtotal Match	**7,463**	**14,815**
SWG REQUEST		**35,540**
TOTAL MATCH (38.5%)		**22,278**
TOTAL GRANT		**$57,818**

3. Qualifications

Dr. Matthew Moran has over 25 years of field research experience. His expertise includes insect and grassland ecology, plant-animal interactions, and conservation biology. He has previously studied and published on the range and habitat requirements of the Diana fritillary butterfly (Moran and Baldridge 2002). He has 30 peer reviewed publications.
Education: Ph.D. University of Delaware (1996), B.A. University of Delaware (1991)
Current Position: Professor of Biology at Hendrix College

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) and has 5 peer reviewed publications.
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)
Current Position: Assistant Professor of Biology at Hendrix College

Dr. Melissa Lombardi is a veterinarian with the U.S. Fish and Wildlife Service and is the lead biologist for insect taxa for the Service in Arkansas. She has worked extensively with American Burying Beetle and on projects with Rattlesnake-Master Borer Moth.
Education: M.Sc. Fisheries and Wildlife Science, Arkansas Tech University (2014); DVM, Louisiana State University School of Veterinary Medicine (2000); B.A., Hendrix College (1995)
Current Position: Endangered Species Biologist, U.S. Fish and Wildlife Service Arkansas Ecological Services Field Office

Dr. William H. Baltosser has more than 50 scientific publications in a career that spans forty years of research experience. He has made numerous presentations at scientific meetings (15 presentations in the last 5 years) and his expertise spans the gamut from invertebrates (primarily Lepidoptera) to many groups of vertebrates (primarily birds). His current research interests are in conservation biology with a variety of studies involving Lepidoptera throughout Arkansas in progress. Much of his research incorporates cell and molecular aspects coupled with traditional field investigations. His knowledge of experimental design and statistical analysis are skills that he teaches in the classroom and shares with undergraduate and graduate students working under his direction.
Education: Ph.D. New Mexico State University (1984), M.S. New Mexico State University (1979), B.A. Western New Mexico Universit7 (1975)
Current Position: Professor of Biology, University of Arkansas at Little Rock