

Project Title:

Evolutionary and Anthropogenic Constraints and the Present Status of an Ozark Endemic (*Euphydryas phaeton ozarke*)

Project Summary:

The ecology and natural history of the Ozark subspecies of the Baltimore Checkerspot differs from populations of the nominate subspecies. There are indications that genetic differences are of a magnitude to warrant protecting and maintaining the unique populations within the Ozark Mountains, which may actually warrant full-species recognition. The literature referring to the species deals almost entirely with non-Ozark populations and thus its relevance to *ozarke* is unknown. Based on preliminary data, we believe that the juxtaposition, survivability, and stability of Ozark populations are tied to fire intervals, placement and maintenance of roadways, and perhaps seasonally to the browsing of larval food plants by White-tailed Deer (a factor of concern in other segments of the range of this butterfly - Durkin 2009).

Project Leader:

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Project Budget:

Requested SWG: 35% match scenario = \$23,114 / 50% match scenario = \$23,114
Match amount provided: 35% scenario = \$12,446 / 50% match scenario = \$23,114
Total 35% = \$35,560 Total 50% = \$46,228

(Presented in greater detail on page 4.)

Evolutionary and Anthropogenic Constraints and the Present Status of an Ozark Endemic (*Euphydryas phaeton ozarke*)

(Research proposal falls within two broad areas of interest: Climate Change and Unique Biogeography: Status of Disjunct and Relict Populations)

Need

The Baltimore Checkerspot Butterfly (*Euphydryas phaeton*) has declined throughout segments of its range; a prime example being in the state of Maryland (Durkin 2009). Generally listed as very local in occurrence, the species occupies a rather broad geographic range. However, throughout most of the range it is represented by the nominate subspecies *phaeton*, which occupies wet meadows, bogs, and marshes and has as its larval food plant turtlehead (*Chelone* spp.). Within Arkansas and Missouri, the subspecies is *ozarke*, which in stark contrast to the nominate subspecies is found in dry, open wooded hillsides and glades. In Arkansas the larval food plant prior to overwintering is false foxglove (*Aureolaria* spp.).

Knowledge concerning the Ozark endemic subspecies of Baltimore Checkerspot is extremely limited and much of what is currently believed has been extrapolated from studies focusing on the nominate subspecies. The latter exists in scattered populations along the eastern seaboard and into the Appalachian Mountains, where it is spatially variable in population density (Brussard and Vawter 1975). The range extends north into Canada and south into parts of Tennessee, Georgia, Alabama, and Mississippi. In these areas the larvae are reported to develop on turtlehead (Stamp 1982), though there has been a shift in some areas to recently introduced weed plantain (*Plantago lanceolata*). This shift is thought to be due to anthropogenic factors, including changing climatic conditions that favor the more hardy plantain (Bowers et al. 1992).

Turtlehead is a plant species noted to be highly specific for growth conditions, described as wetland and riparian forests. False foxglove seemingly hosts an equally strict set of growth conditions that are largely different from turtlehead. As a partial root parasite, false foxglove requires an oak host and edaphic factors that permit access to the oak root system. These conditions are met in the Ozark Mountain region, where steep hillsides and an abundance of oak trees are evident. Due to the differences in growth requirements of the host plants for each subspecies, the environment and habitat characteristics in which the subspecies are reported vary greatly; the eastern subspecies is referred to as a marshland insect (Bowers 1978) whereas the Ozark subspecies is a much more xeric insect.

Location

Our study will take place in northern Arkansas, the area of primary occurrence within the state (Fig. 1a), at sites where we have documented several *ozarke* populations (Fig. 1b). In these areas, *ozarke* is dependent in summer and fall, before overwintering as communal “nesting” groups, upon false foxglove. Dependence upon false foxglove is reduced in spring upon emergence and further growth prior to pupating, as other plant species may be used at this stage. Exceptions to the former are not known and, given the current data base, are unlikely. However, still within Arkansas but further east, limited stands of turtlehead occur in at least two locations along Crowley’s Ridge. We anticipate exploring the Crowley’s Ridge sites for checkerspots but, failing to find any (no current or historic records), efforts in this area will be limited.

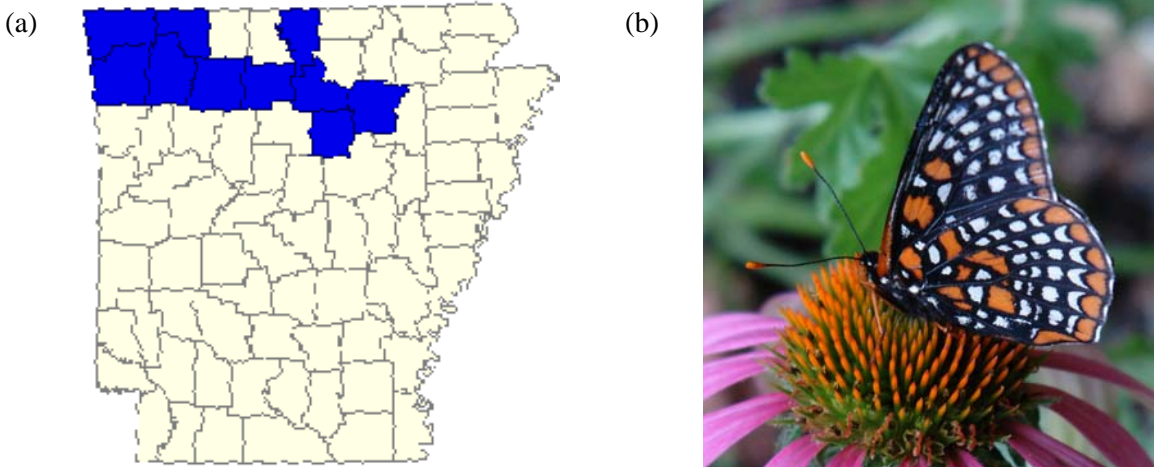


Figure 1: (a) Distribution of *Euphydryas phaeton ozarke* in Arkansas; (b) Ozark Baltimore Checkerspot from the Buffalo National River.

Goals, objectives, and approach

Based on a variety of factors, we hypothesize that the Ozark subspecies may warrant full species status. However, this project seeks not to process data to that end, but to provide knowledge that will help maintain populations at levels that guarantee their persistence. We believe that anthropogenic activity has much to do with distribution, juxtaposition within habitats, and abundance. For example, preliminary data suggest that this butterfly responds favorably to fire and may require periodic fires to maintain suitable habitat. On the other hand, habitats adjacent to roadways are often utilized to the exclusion of others, which places populations in jeopardy given traffic, road maintenance, and erosion. Changing climatic conditions have altered the ecology of the eastern subspecies (see an earlier paragraph), but there is little basis for comparison until more data are available for Ozark populations.

There are four (4) components to the research as we currently envision the study unfolding; these are:

1. Genetic characterization (many tissue samples already in hand)
2. Browse surveys (enough surveys completed to know that larval food plant is heavily browsed - expand our data base)
3. Study factors that serve to create proper light conditions for larval food plant (our emphasis will continue to be on fire and roads)
4. Identify key threats/mortality factors for each life cycle stage (egg, larvae, adult).

We will approach this project by locating active *ozarke* populations with respect to availability and distribution of host plant(s). Data will be collected concerning the viability of host plant(s) and checkerspots simultaneously, as well as environmental descriptions therein. Exploration of

many northern counties is a prerequisite for finding populations and gaining adequate sample sizes. Fortunately, many populations have already been located and thus this task has been greatly minimized through preliminary investigations. We will relate distributional data to fire restoration activities and test for possible correlations. Additionally, it has been reported and we have data in support of the fact that White-tail Deer, at certain times of the year, heavily browse false foxglove. This is readily seen in the field but the important aspect deals with the timing and seasonality of this activity.

Expected results

Seemingly, for the first time, the status of this unique butterfly in the state of Arkansas will be available. Information regarding the protection and preservation of existing populations and insight into management practices that will help to insure the continued viability of isolated populations will result. Factors that are potentially detrimental to the continued survival of this unique butterfly within the Ozark Mountain region will also be known. The proposed study will thus give the various management agencies having jurisdiction over habitats utilized by the species information upon which to make informed decisions.

Budget

Scenario 1 (35% match)

Category	Totals	Match	Grant
Salary / Benefits	\$21,714	\$7,600	\$14,114
Supplies	6,154	2,154	4,000
Travel	7,692	2,692	5,000
Grand Total	\$35,560	\$12,446	\$23,114

Scenario 2 (50% match)

Category	Totals	Match	Grant
Salary / Benefits	\$28,228	\$14,114	\$14,114
Supplies	8,000	4,000	4,000
Travel	10,000	5,000	5,000
Grand Total	\$46,228	\$23,114	\$23,114

Qualifications

William H. Baltosser is a professor of biology at the University of Arkansas at Little Rock having expertise in ecology, molecular systematics, and biostatistics. He is currently the PI for a three-year study (2009, 2010, and 2011) of the Lepidoptera (butterflies, skippers, and moths) occurring along the Buffalo National River and vicinity. He has also completed a four-year study of the butterflies and skippers occurring in Tallgrass Prairie habitats within the Arkansas River Valley Ecoregion, and has recently completed a second year of data collection dealing with restoring Blackland Prairie and Oak-Hickory Woodlands (via cedar thinning and prescribed fire) with respect to the impact of these activities on the Lepidoptera fauna. Prior to these activities Dr. Baltosser conducted state-wide inventories and researched various aspects of the ecology and natural history of Diana and Great Spangled fritillaries. Aspects of this project are still on-going and being conducted in conjunction with agencies such as the Arkansas Game and Fish Commission, Arkansas Natural Heritage Commission, the National Park Service, the U.S. Forest Service, and the Nature Conservancy.

Stephen M. Robertson received his BS degree in biology from the University of Arkansas at Little Rock in 2010. While completing his degree he assisted Dr. Baltosser with Lepidoptera surveys along the Buffalo National River and with the former's activities in Blackland Prairie and Oak-Hickory Woodlands in southeastern Arkansas. He is currently a graduate student working on his MS degree; his research focuses on the Baltimore Checkerspot.

Ruth L. Andre holds a Bachelor's Degree in Environmental Education and K-8 Teacher Certification. She retired last year from teaching science for the St. Joe Arkansas school system for 25 years. She has conducted and compiled butterfly counts for the North American Butterfly Association for 5 years and has been a member of the International Butterfly Breeders Association for 10 years. She has raised numerous species of Lepidoptera and provides butterfly presentations for local Master Gardener groups and parks.

Literature Cited

- Bowers, M. D. 1978. Over-wintering behavior in *Euphydryas phaeton* (Nymphalidae). *Journal of the Lepidopterists' Society* 32:282-288.
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- Brussard, P. F. and A. T. Vawter. 1975. Population structure, gene flow, and natural selection in populations of *Euphydryas phaeton*. *Heredity* 34:407-415.
- Durkin, P. M. 2009. Conservation Matters: Efforts to restore the Baltimore Checkerspot (*Euphydryas phaeton*) in Maryland. *News of the Lepidopterists' Society* 51:3-4, 31.
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