

Species: Regal Fritillary (*Speyeria idalia*)

Global Rank: G3

State Rank: S1

State Wildlife Action Plan: Immediate Concern Responsibility Species

Climate Change Vulnerability: Not Vulnerable / Presumed Stable

Confidence: Very High

#### Habitat:

The Regal Fritillary is associated with tall-grass prairie and wet fields and meadows in the core of its range in the Midwest. This butterfly formerly ranged over much of the eastern U.S. including Pennsylvania in a variety of open and often wet meadows, pastures, old fields, and hayfields, mostly created by humans (Glassberg 1999, NatureServe 2008). The last remaining population in Pennsylvania is associated with three main habitat components: violet food plants (*Viola* spp.) for larvae, adult nectar sources, and native warm season bunch grasses for larvae, pupae, and resting adults (pers. comm. Mark Swartz).

NatureServe (2008) further reports that “Treed habitats seem to be effective barriers to adults, but species can occur in savanna if trees are sparse or clumped. Absence of this species in prairie preserves is a significant negative indicator for community integrity and probably sometimes reflects failure to have recovered from past management practices such as complete burns and/or small patch size. Studies by Ann Swengel in Wisconsin and Missouri indicate that this species is negatively impacted by prescribed burning at normal frequencies. Other observers have suggested the same. High densities at some unburned Missouri sites and an apparent substantial increase in PA after cessation of burning support her views. Schweitzer suspects, based mostly on eastern habitats and direct observations of adults in Rhode Island, that subspecies *Speyeria idalia idalia* preferred recently or currently grazed areas and many references to it mention pastures. While more data are needed, it appears that there is a major difference between eastern and western subspecies in their ability to utilize artificial habitats such as hayfields and non-prairie pastures. This species may require relatively large habitats on the order of perhaps 50 hectares for a marginally viable occurrence.”

#### Subspecies Status:

Williams (2002) presents evidence that eastern populations represent a subspecies (*Speyeria idalia idalia*) distinct from western populations (*Speyeria idalia occidentalis*) (NatureServe 2008). The most current and comprehensive molecular evidence to date has been gathered by Dr. Jason Weintraub (Academy of Natural Sciences) and his colleagues. Their data does not support the validity of "eastern" and "western" subspecies of *Speyeria idalia* (Weintraub pers. comm.). However, morphological, genetic, and habitat differences do suggest that Regal Fritillaries in Pennsylvania are significant on a population (haplotype) level, differing in some ways from western populations (NatureServe 2008, Weintraub pers. comm.). Therefore on factors of rarity,

genetic distinctness, and Pennsylvania relictual occurrence, this species is a PA responsibility species (Rawlins 2007).

#### Threats:

The Regal Fritillary was historically widespread and common but declined precipitously in recent years and is now extirpated in all eastern states except Pennsylvania and Virginia. This is a large, attractive, conspicuous species that is not easily overlooked. The Regal Fritillary does not require pristine or extremely specialized habitats in Pennsylvania. It can inhabit upland forests, clearings, grasslands, as well as marshy or even swampy areas across its range (Rawlins 2007).

According to NatureServe (2008), the Regal Fritillary has declined for uncertain reasons, though likely a combination of factors are at play. These threats include loss and fragmentation of habitat to agriculture (other than pasture or hayfield) and development, conversion of pastures and hay fields to plowed croplands, reforestation, pesticides including gypsy moth sprays, herbicides, and inappropriate and/or overuse of fire in prescribed burn programs. Factors such as those above are probably often the ultimate causes of decline via a break down of metapopulation function. Isolated colonies are more susceptible to localized extirpations due to threats and local catastrophic events (severe weather, natural fires, etc). This species is generally highly dependent on management, either on preserves (usually prescribed burning) or in active pastures which are probably its best habitats (Powell and Kindscher 2007). This species is most secure near the southern limit of its range; to the north its habitats are more scarce and fragmented. Therefore global warming is an anticipated threat, since losses in the southern part of its range would not be compensated by expansion farther north. Note that Pennsylvania is both on the eastern and northern edge of the Regal Fritillary's range. In the CCVI index 'northern edge of range' was selected for the 'Relation of Species' Range to Assessment Area' since this appears to be the more important aspect of its range in light of climate change.

#### Main factors Contributing to Vulnerability Rank:

The climate change vulnerability rating of 'Not Vulnerable / Presumed Stable' resulted from a blending of competing factors that could increase or decrease this species' sensitivity to climate change. For example the Regal Fritillary does not require pristine or extremely specialized habitats in Pennsylvania, but they are fairly dependent upon humans to create and maintain suitable grassland habitat. Vulnerability is increased because Regal Fritillary caterpillars are limited to a diet of violets (*Viola* spp.) and the long-lived adults require a steady seasonal progression of nectar sources. However vulnerability is decreased because the Regal Fritillary is both a highly fecund butterfly, capable of laying thousands of eggs, and a strong flier, capable of dispersing to new habitats. Historically prairies occupied vast areas. For grassland species not adapted to fire (e.g. the Regal Fritillary lacks an underground resting stage), an alternate life history strategy is to have sufficient population reservoirs in adjacent unburned habitats and the ability to disperse so that it can recolonize newly burned areas.

Today, grassland species persist on increasingly small and isolated habitat 'islands'. They are more at risk of extirpation to any catastrophic event, including pesticide applications, a large fire, or poorly timed mowing. Climate change is predicted to cause increased summer droughts, which could lead to more frequent and severe fires (Shortle et al. 2009). This could increase the amount of suitable open grassland habitat this species needs and so is considered to potentially decrease vulnerability. An important consideration in this assessment is that the extent of the remaining Regal Fritillary population in Pennsylvania is well known. The population is carefully monitored and managed, and measures are taken to prevent the complete burning of its occupied habitat, which could be catastrophic for the population.

Development of rights of ways for alternative energy infrastructure could create dispersal corridors connecting habitats. While potentially beneficial, these developments would require considerable investment in planning and resources to maximize the potential benefit for this species, therefore predicted impact of land use changes was ranked as 'Unknown'.

The region of Pennsylvania where *Speyeria idalia* still occurred within the past thirty years has experienced slightly lower than average precipitation variation in the past 50 years, making populations somewhat vulnerable to future changes in precipitation. Microhabitat changes in seasonal temperatures and moisture levels are expected to be important, but the direction of effects (positive, negative, neutral) cannot be predicted at this time. Seasonal patterns such as cool wet springs can lead to increased vulnerability of populations to viral, bacterial, or fungal pathogens that are suspected to have played a role in the rapid decline of *Speyeria idalia* in the eastern states (pers. comm. Weintraub). The genetic lineage (haplotype) of the last remaining metapopulation in Pennsylvania may have some natural resistance to such pathogens that has contributed to its survival so far, but more research is needed.

Despite the fact that this species is one of the most studied butterflies in Pennsylvania, existing research is almost completely lacking for critical life history questions. The following research recommendations were developed through personal communications with Dr. Jason Weintraub of the Academy of Natural Sciences and Dr. John Rawlins of the Carnegie Museum of Natural History:

- Quantitative data regarding successful survivorship of larvae and pupae. Of particular importance is microhabitat requirements for overwintering 1st instar *Speyeria idalia* larvae, and the potential impact of fire between October and March on this critical microhabitat.
- Quantitative data on the larval and pupal microhabitat requirements of the abundant and widespread Great Spangled Fritillary (*Speyeria cybele*) to provide comparative data.
- Quantitative assessment on the changes in flora and insect fauna after prescribed burns to build a recovery dataset over seasons and years.

- Investigation of why the Regal Fritillary survived in one location while it disappeared from others. Habitat-based correlates should be established between extant sites and potential reintroduction sites.

Migrations and Movements (adapted from NatureServe 2008): Some adult fritillaries will disperse away from home habitats, especially females. Fritillaries are long-lived, strong fliers easily capable of covering 1-6 kilometers in a day. Species of open habitats such as *Speyeria idalia* avoid entering wooded areas but they might fly over or around them. Developed areas cannot be assumed to be barriers as wandering adults have been observed visiting flower gardens in lightly urbanized areas.

#### Literature Cited:

Glassberg, Jeffrey. 1999. *Butterflies through Binoculars - The East*. Oxford University Press, New York, New York.

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: July 17, 2008)

Powell, Busby and Kindscher. 2007. Status of the Regal Fritillary (*Speyeria idalia*) and effects of fire management on its abundance in northeastern Kansas. *Journal of Insect Conservation*

Rawlins, J. E. 2007. Pennsylvania Comprehensive Wildlife Conservation Strategy Version 1.1, Appendix 5, Invertebrates. *In* Pennsylvania Game Commission. 2005. Pennsylvania Comprehensive Wildlife Conservation Strategy Version 1.0.

Williams, B.E. 2002. Recognition of western populations of *Speyeria idalia* (Nymphalidae) as a new subspecies. *Journal of the Lepidopterists' Society* 55(4):144-149.