Lepidoptera of Fort Indiantown Gap National Guard Training Center, Annville, Pennsylvania

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Abstract - Eighty-one species of butterflies and two-hundred and thirty-seven species of moths were identified from Fort Indiantown Gap, a National Guard training facility in south-central Pennsylvania. The Lepidoptera found here include the last remaining population of *Speyeria idalia idalia* (eastern regal fritillary), as well as the rare *Callophrys irus* (frosted elfin), *Hesperia leonardus* (Leonard's skipper), *Datana ranaeceps* (hand-maid moth), *Zale* sp. 1 nr. *lunifera* (Pine Barrens zale), and *Anisota stigma* (spiny oakworm moth). This habitat has a large and diverse Lepidoptera fauna, most likely due to periodic disturbance in some areas, conservation efforts to maintain native grassland, and a diverse plant community.

Introduction

Lepidoptera can be charismatic insects that often attract attention from naturalists and scientists for esthetic, ecological, and conservation reasons (Glassberg 1999, Hogsden and Hutchinson 2004). Butterflies have also been used as indicators of ecosystem diversity and health (Blair 1999, Brown and Frettas 2000, Gilbert 1984, Kremen 1992, Murphy et al. 1990, Noss 1990, Pyle et al. 1981, Swengel 1998). Military installations, due to their training requirements, are often large parcels of land that harbor habitats that act as refugia for wildlife. Species inadvertently protected on such parcels may be rare in other parts of their natural range because of habitat destruction or fragmentation. Fort Indiantown Gap National Guard Training Center (FTIG) is an approximately 7500-ha parcel that has been used by the military for training purposes of various types since 1931 (TNC 2000). Now protected from most land-use practices that have led to the demise of many species in other parts of the Northeast, this property provides a last refuge for species that require a sustainable grassland ecosystem, maintained by periodic disturbances, followed by periods of inactivity that allow for recovery. This study, which began as a flora and faunal study in 1999, was initiated as part of an ongoing mission to inventory biodiversity on Department of Defense

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land. Additions to this list were added during yearly field work to monitor the last remaining population of *Speyeria idalia idalia* Drury (eastern regal fritillary butterfly) (Williams 2001) there.

Field-site Description

FTIG, established in 1931 and located in south-central Pennsylvania (Fig. 1), has been continuously used by various branches of the military for training, including armored vehicle maneuvering, firing practice, infantry, and aircraft training. It is the second-busiest National Guard installation in the country, training more than 193,121 troops during 2002. These numerous activities lead to periodic soil disturbance and repeated small fires that act to maintain a large mosaic of grasslands dominated by native vegetation (Latham et al. 2007). These grasslands support what appears to be the only remaining population of eastern regal fritillary butterfly, and may support other grassland specialist species as well. Between 1992 and 2004, researchers with The Nature Conservancy (TNC), in cooperation with the military, conducted field research to monitor the eastern regal fritillary butterfly. Approximately 101 ha of grassland habitat have been set aside to protect this population. Land management designed to prevent invasion of woody

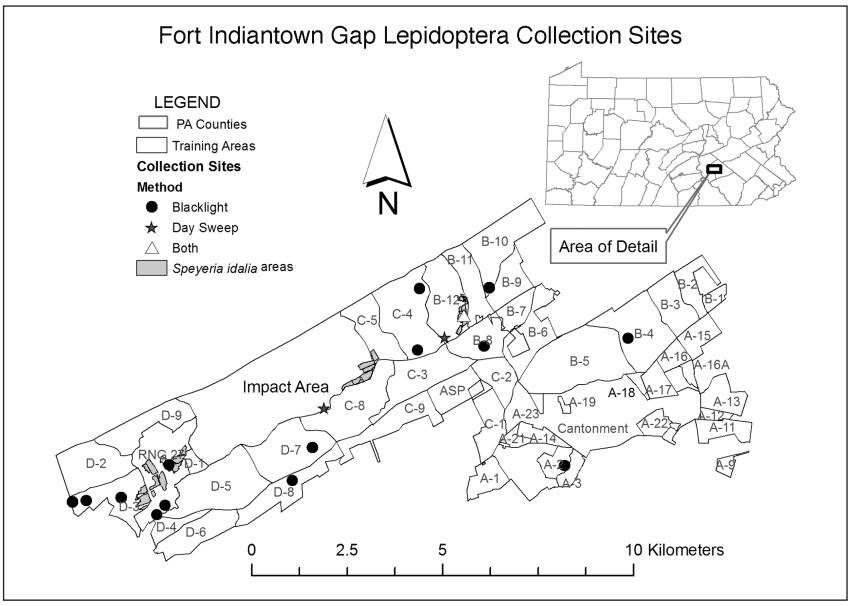

Figure 1. Map of Fort Indiantown Gap, Dauphin and Lebanon counties, PA, with training areas delineated and identified. Collection sites are indicated by collection method; circles are locations of black-light traps, stars indicate locations of daytime sweeps with insect nets, and triangles indicate a location where both collection methods were used. Regal fritillary sites in training areas B-12, D-3, D-1, and C-8 are restricted from most military activities; motorized vehicle use in these areas is limited.

and exotic invasive plant species has resulted in a stable population of this butterfly. In addition to these grassland habitats, FTIG is also extensively forested, contains 119 ha of wetland habitat (AMEC 2006), and is home to at least six species of rare plants (AMEC 2006). FTIG also supports rare vertebrate species including *Neotoma magister* Baird (Allegheny woodrat) (Hart 2002, TNC 2000), *Myotis septentrionalis* (Trouessart) (long-eared Myotis), *Lynx rufus* (Schreber) (bobcat) (TNC 2000), *Crotalus horridus* L. (Timber Rattlesnake) (Reinert 1999; B. Ferster and M.T. Swartz, pers. observ.), *Heterodon platirhinos* Latreille in Sonnini and Latreille (Eastern Hog-nosed Snake) (TNC 2000; B. Ferster and M.T. Swartz, pers. observ.), and *Agkistrodon contortrix mokasen* Palisot de Beauvois (Northern Copperhead) (TNC 2000; B. Ferster and M.T. Swartz, pers. observ.). The site also contains a healthy and diverse Lepidoptera fauna. Butterfly and moth species have been inventoried at FTIG since 1992, and in 1999, TNC was contracted to conduct a flora and fauna survey for FTIG (Barton 1996, TNC 2000), which resulted in a concerted effort to search for rare Lepidoptera species.

Methods

Night-flying Lepidoptera

Survey sites were chosen to best represent the variety of habitats found on the FTIG installation (Fig. 1). The sixteen black-light sites included *Quercus* spp. (oak) and *Acer* (maple) forest; oak and *Pinus* spp. (pine) forest; *Fraxinus* (ash), *Carya* spp. (hickory) and oak forest; *Tsuga* (hemlock) forest; disturbed forest dominated by small pines; open grassland; and *Acer rubrum* L. (red maple) swamp bordering an old field. The understory at forested sites was dominated by *Vaccinium* spp. (blueberry), *Hamemelis virginiana* L. (witch hazel), *Lindera benzoin* (L.) Blume (northern spicebush), *Viburnum prunifolium* L. (blackhaw), and *Rosa multiflora* Thunb. ex Murr. (multiflora rose). Ground cover consisted predominantly of *Dennstaedtia punctilobus* (Michx.) T. More (hay-scented fern). During May–September 1999, a total of seven nights (17–18 May, 15–16 June, 8–9 July, 14–15 July, 11–12 August, 8–9 September, and 1–2 November) were spent collecting night-flying Lepidoptera. Two to three sites were sampled per night, using one black-light trap per site. Trapping coincided with optimal collecting conditions; moths fly most actively around the time of a new moon, so trapping nights were set as close to a new moon as possible. Weather conditions were monitored, and severe conditions avoided. Black-light traps consisted of two 15-Watt black lights set over a funnel trap with trichloroethylene as a killing agent. The traps were connected to a 12-volt battery and operated overnight. Specimens were collected the following morning, removed from the trap, placed in plastic bags, and kept in a cooler until they could be pinned and spread for identification. On one trap night (8 July), military activity dictated that a trap not be left out all night; so instead, in two sites, one at the north end of

training area C-4, the second in training area B-4 (Fig. 1), two black lights were hung over a translucent 1.2- x 1.8-m white sheet and specimens were collected by hand as they landed. After collection, specimens were sorted, examples of each species were spread and pinned for identification and kept as voucher specimens. Most voucher specimens have been deposited in the collection of The State Museum of Pennsylvania, Harrisburg, PA. Voucher specimens of species of special concern, as well as all common species collected during the original 1999 survey, are located in the collection of the PA Natural Heritage Program (The Western Pennsylvania Conservancy Science Office) in Middletown, PA.

Day-flying Lepidoptera

During 1999, as part of a flora and fauna survey for species of special concern on FTIG property, a search for butterflies and skippers of special concern was conducted. Seventeen sites that met the basic habitat requirements for previously undocumented species of special concern at FTIG were selected and surveyed. These sites included grassland (designated regal fritillary, *Speyeria idalia*, habitat); areas that contained the food or nectar plants of rare species including *Baptisia tinctoria* (L.) R. Br. ex Ait. f. (yellow wildindigo), of *Callophrys irus* Godart (frosted elfin, [caterpillar foodplant]); *Potentilla canadensis* L. (dwarf cinquefoil, a nectar plant for skippers), and *Quercus ilicifolia* Wangenh. (scrub or bear oak, food plant for *Hemileuca maia* Drury [eastern buck moth]); and a site with a seepage area with sedges for *Euphyes conspicua* W.H. Edwards (black dash). Areas with blooming plants (potential nectar sources) were also surveyed. When possible, surveys were conducted between 0900 and 1600 hrs and under favorable weather conditions (sunny, with temps ranging between 24–38 °C (75–100 °F) and wind speeds 16 kph (<10 mph). In subsequent years, common as well as uncommon butterfly species were noted when seen. Researchers spent much of the field season, from late March until mid-October, collecting data on the life history and habitat use of *S. idalia*, and so spent a great deal of time in the grassland habitat noting presence of Lepidoptera species. At a number of roadside mud puddles near open areas, puddling behavior was observed often and presented an opportunity to identify congregating butterflies. On a few occasions, Lepidoptera specimens were inadvertently collected in traps set out for collection of other insect fauna (e.g., pan traps set for bees, pit-fall traps set for beetles). Voucher specimens were taken for many of these species and have been deposited in the State Museum of Pennsylvania collection.

Results

Three hundred and eighteen Lepidoptera species were recorded from FTIG during this study, including 81 species of butterfly and 237 species of moth (Supporting Table 1 [available online at http://dx.doi.org/

10.1656/N621.s1]). Four butterfly species of special concern were found at FTIG: *Hesperia leonardus* Harris (Leonard's skipper), frosted elfin, black dash, and eastern regal fritillary. An unexpected species, *Danaus gilippus* Cramer (queen), was also reported, though no voucher specimen was taken for verification. A single *D. gilippus* was seen 2 August 2002 (M.S. Swartz pers. observ.), but not collected, and thus this record cannot be verified. *Danaus gilippus* feeds on *Asclepias* spp. (milkweed), which is abundant at FTIG (B. Ferster, unpubl. data). This species has also recently been found in New Jersey (Moskowitz 2001), and these records may indicate the beginnings of a range expansion. However, it may instead have been an escapee from a butterfly house not far from FTIG (Hershey, Dauphin County, PA). *Anartia jatrophae* Johansson (white peacock) was also an unexpected find for this area. This butterfly feeds on verbenas (Verbenaceae) as larvae, plants that are widespread at FTIG. Three moth species of special concern were found: *Datana ranaeceps* Guerin-Meneville (hand-maid moth), *Zale* sp. 1 nr. *lunifera* (Pine Barrens zale), and *Anisota stigma* Fabricius (spiny oakworm moth). Restricted access to collection sites on this busy military installation limited collection efforts and precluded sufficient survey of microlepidoptera.

Discussion

Fort Indiantown Gap is a large military training facility in south-central Pennsylvania (Fig. 1), with one of the largest tracts of native-plant dominated grassland in the Northeast. Not surprisingly, the site supports a diverse Lepidoptera community. Lepidoptera are holometabolous species with complex life histories that include a voraciously herbivorous juvenile stage and a nectar-feeding adult stage. Butterfly and moth populations are expected to be more diverse where plant diversity is higher, and where habitat disturbance is limited (Kocher and Williams 2000). Habitat and plant diversity at FTIG are high because disturbance to grassland areas is limited (Latham et al. 2007). These disturbances (such as track vehicle training and small accidental fires) differ in frequency from the more frequent disturbances experienced by grassland habitats that are managed and maintained by yearly mowing. It is likely the unique nature and periodicity of the disturbances that result from military training activities at FTIG that maintain diverse habitats and diverse plant and lepidoptera communities here.

Lepidoptera species listed by the Natural Heritage Program as critically imperiled (S1) (spiny oakworm moth, frosted elfin, hand-maid moth, eastern regal fritillary, and Pine Barrens zale), or vulnerable (S3) in the commonwealth of Pennsylvania (Leonard's skipper) were found. The spiny oakworm moth uses oaks, which are common in wooded areas here, as a host plant. The frosted elfin is a widespread species that is rare in all areas (Shephard 2005). Its host plant, yellow wildindigo can be found at FTIG in

open wooded areas, although not in large numbers. A hand-maid moth was an unexpected find here. Until this collection, this species was considered historic (i.e., extirpated) in the state (SH). The hand-maid moth requires mixed hardwood forests, hardwood-pine mixes, and scrubland-grassland-woodland mixes. Larvae are known to use *Lyonia* spp. (staggerbushes) and *Leucothoe racemosa* (L.) Gray (fetterbush) as larval foodplants. It appears that at FTIG hand-maid moth is using *Lyonia ligustrina* (L.) DC (maleberry) as a host plant (D. Schweitzer, NatureServe, Port Norris, NJ, pers. comm.). The hand-maid moth is sometimes referred to as the post-burn *Datana* because succession plays a critical role in determining its habitat and occurrence (Wagner 2005). It may persist at FTIG because of the periodic burning that occurs here. Leonard's skipper feeds on perennial grasses including *Schizachyrium scoparium* (Michx.) Nash (little bluestem), a plant that is abundant in the open, grassland areas at FTIG. The population of eastern regal fritillary here is likely the last remaining population of the subspecies (Williams 2001), and we suggest here that it should be afforded greater attention and protection than it currently receives. This species may be tied to grassland habitat that no longer exists as it once did except here. The presence at FTIG of these rare species underscores the importance of large protected and properly managed parcels of otherwise uncommon features of the landscape of the Northeast. It is likely that the periodic disturbances that result from military training at FTIG (such as large track vehicles and small accidental fires) are inadvertently the types of disturbances that maintain healthy grassland ecosystems in the Northeast. Track-vehicle disturbance may mimic the disturbances once caused by now extinct megafauna—iron bison, as it were. Small fires might be similar to those once set by Native Americans and later by European settlers in order to clear areas to improve wildlife forage and for other purposes. The frequency of disturbance that each parcel might experience at FTIG (5 years or more, B. Ferster, unpubl. data) differs greatly from the types and frequency of disturbance (yearly fall mowing) that managed open habitat routinely undergoes, and more closely approximates the historically natural mechanisms of grassland regulation. Consequently, future research should focus on understanding the dynamics of these disturbances on biodiversity. The rich lepidopteran biodiversity observed at FTIG may prove to be a useful benchmark for such studies.

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