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BUTTERFLY COMMUNITIES IN RESIDENTIAL LANDSCAPES OF CENTRAL PENNSYLVANIA

RICHARD H. YAHNER [1]

ABSTRACT - Abundance and habitat relationships of butterfly communities were examined at 15 sites divided into three different types of residential areas (n = 5 sites/type) in central Pennsylvania from May-September 1997. Seventeen species were noted at the 15 sites, with the two most abundant being non-native, cabbage whites (*Pieris rapae*, 69.2% of total) and orange sulfurs (*Colias eurytheme*, 10.0%). The most abundant native species was the monarch (*Danaus plexippus*, 7.5%). More butterfly species (n = 13 species) but a lower than expected number of individual butterflies of all species combined ($P < 0.05$) occurred in residential areas with established (homes > 30 years old) and native overstory trees than in the two other types of residential areas. Total species richness of butterflies was positively correlated with the number of homes per site (i.e., smaller lot size) ($P < 0.05$). On the other hand, the total number of butterflies of all species combined and the total number of cabbage whites were negatively correlated with the number of yards containing native overstory trees ($P < 0.05$). Compared to forested or agricultural landscapes in central Pennsylvania, the diversity and abundance of butterflies were relatively low in residential areas. In residential landscapes, however, a diverse butterfly community was characteristic of older, established neighborhoods characterized by smaller lot size and native overstory tree species. The planting of gardens containing both nectar sources and hostplants for butterflies will likely enhance their diversity and abundance in residential areas.

INTRODUCTION

Butterflies are beautiful, aesthetic insects common to a variety of habitats, such as transmission rights-of-ways, woodlots, and farmlands, in Pennsylvania and throughout northeastern United States (e.g., Bramble et al. 1997, 1999; Yahner 1996, 1999). The conservation of butterflies is of concern because some populations have experienced major declines over the past few decades as a result of habitat loss and fragmentation, loss of native host and nectar plants, and use of insecticides (Cushman and Murphy 1993, Iftner et al. 1992, Kremen et al. 1993). Species restricted in distribution to only a remnant of their former habitat are of fundamental interest to biologists from a conservation perspective (Panzer et al. 1997). Residential areas are a highly modified landscape for butterflies because of the presence of homes, roads, sidewalks, and manicured lawns, thereby providing potential

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habitats for a range of non-native butterflies or native species that differ in dependency on remnant habitats (Panzer et al. 1995, 1997). Thus, in this study, my objective was to determine abundance and habitat relationships of butterfly communities in three types of residential areas of central Pennsylvania.

FIELD-SITE DESCRIPTION

I selected 15 study sites in the general vicinity of State College, Centre County, Pennsylvania, which encompassed approximately a 10 x 10 km area; study sites were at least 1 km apart and included five each of three types of residential areas: 1) established residential areas (homes > 30 years old) characterized by abundant mature overstory (> 12 cm dbh), native trees [e.g., oaks (*Quercus* spp.)]; 2) established residential areas (homes > 30 years old) on abandoned farmland or old fields and characterized by abundant, non-native overstory trees; and 3) recently established residential areas (homes < 10 years old) on abandoned farmland or old fields and devoid of overstory trees. Home gardens were common in many of the study sites but wildflowers were relatively uncommon, except in the established residential areas. All study sites were at least 0.5 km from a wooded area greater than 1 ha.

METHODS

I arbitrarily established a 250 m transect parallel to a street at each study site. Each transect was visited seven times between 1000 and 1700 hours; seasonal time periods were spaced at 2- to 3-week intervals, beginning late May and continuing through early September. These times corresponded to peak seasonal and diurnal activity periods of butterflies and skippers (Sparrow et al. 1994; Sutton 1994; Yahner 1996, 1999).

During each visit to a site, I counted butterflies along the transect while walking slowly (approximately 2.4 km/h; Yahner 1996, 1999) and frequently stopping. The location and number of butterflies observed at each study site were recorded within a 25 m lateral distance of the transect (modified from Pollard 1977, Britten et al. 1994). The transect was then walked in the opposite direction to increase the likelihood of observing rare, inconspicuous, or previously undetected butterflies (Yahner 1999). Time required to traverse each transect was approximately 15 minutes. The observed versus expected number of butterflies of all species combined and the mean number of cabbage whites (scientific names are given in Table 1) were compared among the three types of residential areas using G-tests for goodness-of-fit (Sokal and Rohlf 1995).

In addition, I noted five habitat variables at each site in early July. These included (1) the number of homes, and the number of homes that (2) used lawn fertilizer with weed killer, (3) did not use lawn fertilizer with weed killer, (4) contained yards with native overstory trees, and (5) contained yards with non-native overstory trees. Each of the five habitat variables were correlated to total species richness of butterflies, total number of butterflies of all species combined, and total number of the most common butterfly species (cabbage whites, orange sulfurs, and monarchs) using simple correlation analyses (Sokal and Rohlf 1995). Data were transformed (logarithmic or square root) prior to analyses.

RESULTS AND DISCUSSION

Abundance of Butterflies in Residential Areas

I recorded 201 individual butterflies of 17 species at the 15 study sites in the three types of residential areas during the seven visits

Table 1. Number of butterflies per species, number of butterflies of all species combined, and species richness at 15 study sites combined in three types of residential areas (n = 5 sites/type), Centre County, PA, during seven visits combined from May-September 1997.

	Type of Residential Area			
Species	Native Overstory Trees	Non-native Overstory Trees	Recent	Total
Cabbage White (*Pieris rapae*)	28	62	49	139
Orange Sulfur (*Colias eurytheme*)	2	6	12	20
Monarch (*Danaus plexippus*)	3	4	8	15
Peck's Skipper (*Polites peckius*)	2	1	3	6
Eastern Tiger Swallowtail (*Papilio glaucus*)	0	1	3	4
Spicebush Swallowtail (*Papilio troilus*)	2	0	1	3
Little Wood-Satyr (*Megisto cymela*)	2	0	0	2
Juvenal's Duskywing (*Erynnis juvenalis*)	1	0	1	2
Black Swallowtail (*Papilio polyxenes*)	0	0	2	2
European Skipper (*Thymelicus lineola*)	1	0	0	1
Common Wood-Nymph (*Cercyonis pegala*)	1	0	0	1
Clouded Sulfur (*Colias philodice*)	1	0	0	1
Meadow Fritillary (*Boloria bellona*)	1	0	0	1
Horace's Duskywing (*Erynnis horatius*)	1	0	0	1
Northern Pearly-Eye (*Enodia anthedon*)	1	0	0	1
Silver-Spotted Skipper (*Epargyreus clarus*)	0	1	0	1
Red Admiral (*Vanessa atalanta*)	0	1	0	1
No. All Species Combined	46	76	79	201
Species Richness	13	7	8	17

combined (Table 1). More butterfly species occurred in established residential areas with native overstory trees (n = 13 species) compared to established residential areas with non-native overstory trees (n = 7 species) or recently established residential areas (n = 6 species). The three most abundant species at all sites combined during the study were two non-native species, the cabbage white (n = 139 individuals, 69.2% of total) and the orange sulfur (n = 20, 10.0%), and a native species, the monarch (n = 15, 7.5%). Thus, nearly 80% of the total individuals observed were non-native.

The observed versus expected number of individual butterflies of all species combined differed among the three types of residential areas ($G = 10.6$, d.f. = 2, $P < 0.001$). Fewer individual butterflies of all species combined were found in the established residential area with native overstory trees (n = 46 butterflies, 22.9% of total; $G = 10.5$, d.f. = 1, $P < 0.05$), whereas the number of butterflies observed did not vary from expected in both the established residential area with non-native overstory trees and the recently established residential area (n = 76 and 79 butterflies, 37.8% and 39.3%; $P > 0.10$).

The observed versus expected number of cabbage whites also varied among the three types of residential areas ($G = 13.6$, d.f. = 2, $P < 0.001$), with more cabbage whites than expected in the established residential area with non-native overstory trees (n = 62, 44.6%; $G = 7.6$, d.f. = 1, $P < 0.05$). Conversely, fewer cabbage whites were observed than expected in the established residential area with native overstory trees (n = 28 individuals, 20.1% of total; $G = 36.3$, d.f. = 1, $P < 0.001$). Cabbage whites typically are abundant in disturbed areas, such as residential areas and farmlands (Iftner et al. 1992; Yahner 1999a, b). The observed versus expected number of orange sulfurs and monarchs did not differ among the three types of residential areas ($P > 0.05$).

Habitat Relationships of Butterflies in Residential Areas

Two habitat variables were associated with butterfly variables. The number of homes was positively correlated with total species richness of butterflies ($r = 0.59$, d.f. = 13, $P < 0.05$). On the other hand, the total number of butterflies of all species combined and the total number of cabbage whites were negatively correlated with the number of yards containing native overstory trees ($r > -0.55$, d.f. = 13, $P < 0.05$). Thus, residential sites with small lot sizes favored more species of butterflies, whereas less wooded, larger lots with non-native tree species benefited the non-native cabbage white.

Nectar sources at the 15 study sites were relatively uncommon because of mowing and herbicide use (Yahner 1997a, b). The most common nectar sources were dandelion (*Taraxacum officinale*), white clover (*Trifolium repens*), hop clover (*Trifolium* spp.), yellow wood-

sorrel (*Oxalis stricta*), common chickweed (*Stellaria media*), and lesser stitchwort (*Stellaria graminea*). Virtually all homes, however, had some type of ornamental flower garden; most gardens consisted of flowering plants not used by butterflies as a nectar source. In contrast, nectar sources are relatively more abundant along logging roads in forested landscapes, wooded edges in agricultural landscapes, and transmission rights-of-ways (Bramble et al. 1997, 1999; Yahner 1996, 1997a, b; 1999). I observed only four instances of nectar use of flowering plants by butterflies, including a European skipper and Peck's skipper on white clover, an orange sulfur on dandelion, and a cabbage white on the ornamental flower called blue pin cushion (*Scabiosa caucasica*).

Host plants for the two abundant non-native butterfly species, cabbage whites and orange sulfurs, also were relatively common in most residential areas of my study. For example, many homeowners had gardens, which contained cabbage, broccoli, and other crops as host plants for cabbage white caterpillars (Gochfeld and Burger 1997). Clover (e.g., *Melilotus* sp.) was common in many lawns, which served as a host plant for orange sulfur caterpillars.

In conclusion, compared to forested or agricultural landscapes in central Pennsylvania, the diversity and abundance of butterflies were relatively low in residential areas. The number of individual butterflies in forested landscapes, for instance, was about 5.5 times greater than in residential landscapes (Yahner 1996, 1999). In residential landscapes, however, a diverse butterfly community is characteristic of older, established neighborhoods characterized by smaller lot size and native overstory tree species. Furthermore, although residential landscapes are likely to have little impact on the conservation of imperiled species, these landscapes can potentially support a diverse assemblage of butterfly species and, hence, increase the aesthetic experience of the landscape for humans. Regardless of the type of residential area, encouraging homeowners to plant gardens containing both nectar sources and host plants for butterflies will likely enhance their diversity and abundance (Gochfeld and Burger 1997, Yahner 1997a, b).

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