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- Tiple, A.D., A. M. Khurad, and R. L. H. Dennis. 2009. Adult butterfly feeding-nectar flower associations: constraints of taxonomic affiliation, butterfly, and nectar flower morphology. *Journal of Natural History* **43**:855-884.
- Tolson, P. J. 1997. Microhabitat analysis of selected sand barren areas in the Kitty Todd Preserve, Oak Openings, Lucas County, Ohio: evaluation for potential for reintroduction of the Karner blue butterfly. Report to the Ohio Department of Natural Resources, Division of Wildlife, Columbus, Ohio.
- Turlure, C., H. Van Dyck, N. Schtickzelle, and M. Baguette. 2009. Resource-based habitat definition, niche overlap and conservation of two sympatric glacial relict butterflies. *Oikos* **118**:950-960.
- U.S. Environmental Protection Agency. 2006. Great Lakes ecosystems. Oak Openings site conservation plan. U.S. Environmental Protection Agency, Chicago, Illinois. Available from <http://www.epa.gov/ecopage/upland/oak/oakopen.html> (accessed April 2010).
- Van Dyck, H., A. J. Van Strien, D. Maes, and C. A. M. Van Swaay. 2009. Declines in common, widespread butterflies in a landscape under intense human use. *Conservation Biology* **23**:957-965.
- Van Swaay, C., M. Warren, and G. Lois. 2006. Biotope use and trends of European butterflies. *Journal of Insect Conservation* **10**:189-209.
- Vogel, J. A., D. M. Debinski, R. R. Koford, and J. R. Miller. 2007. Butterfly responses to prairie restoration through fire and grazing. *Biological Conservation* **140**:78-90.





























Table 2. Summary of explanatory variables' influence on lupine stems (lupine stems/1 m<sup>2</sup>), flowering plant stems (flowering plant stems/1 m<sup>2</sup>), and flowering plant richness (number of flowering plant species/1 m<sup>2</sup>) resulting from a Poisson regression analysis. Significant variables are elevation (m), lupine-flowering plant distance (m) (distance), percent cover of litter (cover litter), percent cover of bare ground (cover bare), vegetation density (dm) (veg density), and leaf litter depth (litter depth).  $e^b$  is a multiplicative factor by which the presence of the variable increases lupine stems, flowering plant stems, or flowering plant richness. For example, for each unit increase in elevation, number of lupine stems is multiplied by  $e^{0.4137}$  or 1.512.

<i>Variable</i>	<i>b</i>	<i>SE</i>	<i>df</i>	<i>Wald X<sup>2</sup></i>	<i>p</i>
Lupine stems					
elevation	0.4137	0.042	1	97.23	<0.0001
distance	-0.1958	0.018	1	118.36	<0.0001
cover litter	0.0076	0.0021	1	13.14	0.0003
cover bare	-0.0448	0.005	1	80.03	<0.0001
veg density	-0.1205	0.0229	1	27.62	<0.0001
flowering plant richness	-0.2622	0.0673	1	15.18	<0.0001
litter depth	-0.0736	0.0176	1	17.51	<0.0001
Flowering plant stems					
distance	-4.1188	0.7322	1	31.65	<0.0001
Flowering plant richness					
distance	-3.4138	0.8335	1	16.78	<0.0001

Table 3. Butterfly feeding at each site by flowering plant species. A dash (—) indicates the species was found within the site but was never sampled in a quadrat therefore density cannot be reported.

Site	Flowering plant species	Minutes feeding	% total feeding	Density (stems/1 m <sup>2</sup> )
	<u>Scientific name</u>	<u>Common name</u>		
1	<i>Baptisia tinctoria</i>	wild indigo	0	—
	<i>Euphorbia corollata</i>	flowering spurge	0	—
	<i>Helianthus divaricatus</i>	woodland sunflower	0	—
	<i>Hieracium gronovii</i>	hairy hawkweed	0	—
	<i>Lithospermum caroliniense</i> <sup>a</sup>	hairy puccoon	0	—
	<i>Tephrosia virginiana</i>	goat's rue	0	—
	total species 6			
2	<i>Achillea millefolium</i>	common yarrow	0	—
	<i>Asclepias tuberosa</i>	butterfly weed	0	—
	<i>Erigeron strigosus</i>	lesser daisy fleabane	0	—
	<i>Euphorbia corollata</i>	flowering spurge	4.45	17.57
	<i>Krigia virginica</i> <sup>a</sup>	dwarf dandelion	0	$\bar{x}=0.07$ SE=0.07
	<i>Liatris squarrosa</i> <sup>b</sup>	scaly blazing star	20.88	82.43
	<i>Polygala polygama</i> <sup>a</sup>	racemed milkwort	0	—
	total species 7			
3	<i>Asclepias tuberosa</i>	butterfly weed	16.78	100
	<i>Baptisia tinctoria</i>	wild indigo	0	—
	<i>Coreopsis tripteris</i>	tall coreopsis	0	—
	<i>Erigeron strigosus</i>	lesser daisy fleabane	0	—
	<i>Euphorbia corollata</i>	flowering spurge	0	$\bar{x}=0.08$ SE=0.05
	<i>Helianthus divaricatus</i>	woodland sunflower	0	$\bar{x}=0.46$ SE=0.19
	<i>Saponaria officinalis</i> <sup>c</sup>	soapwort	0	—
	<i>Solidago juncea</i>	early goldenrod	0	$\bar{x}=0.05$ SE=0.05
	total species 8			
4	<i>Asclepias tuberosa</i>	butterfly weed	12	100
	<i>Erigeron strigosus</i>	lesser daisy fleabane	0	—
	<i>Euphorbia corollata</i>	flowering spurge	0	—
	<i>Helianthus divaricatus</i>	woodland sunflower	0	$\bar{x}=0.04$ SE=0.04
	<i>Hieracium gronovii</i>	hairy hawkweed	0	—
	<i>Hypericum perforatum</i> <sup>c</sup>	St. John's wort	0	—
	<i>Polygala polygama</i> <sup>a</sup>	racemed milkwort	0	—
	<i>Rosa carolina</i>	pasture rose	0	—
	<i>Solidago juncea</i>	early goldenrod	0	—
	total species 9			

<sup>a</sup>State threatened (Ohio), <sup>b</sup>Potentially threatened (Ohio), <sup>c</sup>Non-native



Table 4. Feeding at each site by butterfly species.

Site	Butterfly species		Minutes feeding	Flowering plant species
	<u>Scientific name</u>	<u>Common name</u>		
1	<i>Danaus plexippus</i>	monarch	0	
	<i>Everes comyntas</i>	eastern tailed-blue	0	
	<i>Megisto cymela</i>	little wood satyr	0	
	<i>Satyrium liparops</i>	striped hairstreak	0	
	total species 4			
2	<i>Colias eurytheme</i>	orange sulfur	10	flowering spurge, scaly blazing star
	<i>Erynnis baptisiae</i>	wild indigo duskywing	11	scaly blazing star
	<i>Lycaena phlaeas</i>	American copper	0	
	<i>Megisto cymela</i>	little wood satyr	0	
	<i>Papilio troilus</i>	spicebush swallowtail	4.33	scaly blazing star
	<i>Vanessa virginiensis</i>	American lady	0	
total species 6				
3	<i>Danaus plexippus</i>	monarch	3.50	butterfly weed
	<i>Erynnis horatius</i> or <i>Erynnis baptisiae</i>	Horace's or wild indigo duskywing	0	
	<i>Papilio cresphontes</i>	giant swallowtail	0	
	<i>Papilio troilus</i>	spicebush swallowtail	12.28	butterfly weed
	<i>Speyeria cybele</i>	great spangled fritillary	1	butterfly weed
total species 5				
4	<i>Celastrina neglecta</i>	summer azure	0	
	<i>Colias eurytheme</i> or <i>Colias philodice</i>	orange or clouded sulfur	2	butterfly weed
	<i>Erynnis baptisiae</i>	wild indigo duskywing	0	
	<i>Megisto cymela</i>	little wood satyr	0	
	<i>Satyrium titus</i>	coral hairstreak	0	
	<i>Skipper</i> sp.	—	0	
	<i>Speyeria cybele</i>	great spangled fritillary	10	butterfly weed
total species 7				

Table 5. Management activities at each site during three time frames. Management began in 1988 at site 1, 1996 at sites 3 and 4, and 2001 at site 2. The first time frame (1988-2009) therefore, includes all recorded management activities. The second time frame (2001-2009) represents management in the last 8.7 years and the last time frame (2006-2009) represents the most recent management activities. Seeding events refer to the distribution of native plant seed into a site. Woody species removal includes both mechanical and chemical methods to remove woody plants. Total is the sum of all management activity.

<i>Time frame</i>	<i>Site(s)</i>	<i># of burns</i>	<i># of mowing events</i>	<i># of seeding events</i>	<i># of years with woody species removal</i>	<i>Total</i>
1988-2009*	1	11	1	6	7	25
	2	0	1	5	4	10
	3 and 4	2	0	0	10	12
2001-2009*	1	3	1	4	5	13
	2	0	1	5	4	10
	3 and 4	2	0	0	5	7
2006-2009*	1	1	0	2	2	5
	2	0	1	1	1	3
	3 and 4	2	0	0	3	5

\*Through 1 August 2009