Densities of Wild Lupine and Karner Blue Butterflies After Reconductering the Cobb to Brickyard Line: 2007



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Michigan Natural Features Inventory

The Karner blue butterfly (*Lycaeides melissa samuelis* Nabokov) is a small silvery-blue colored butterfly that specializes on wild lupine (*Lupinus perennis*) (Rabe 2001; Figures 1 and 2). Historically, this butterfly inhabited the sandy, oak savannah areas of eastern Minnesota and northeastern Iowa extending east to New York, Massachusetts, and New Hampshire. Their range overlaps specifically with the northern edge of the wild lupine range (Swengel and Swengel 2005). The increase in agriculture and urban development has resulted in the fragmentation of oak savannahs and the suppression of fires which caused open savannahs to become closed forest habitats. Considering that wild lupine is a fire dependent species, both wild lupine and Karner blue butterfly populations have declined dramatically. The Karner blue butterfly is now a federally endangered species and a threatened species in Michigan (United States Fish and Wildlife Service 2003).

In an effort to restore and increase populations of this rare species partnerships and collaborations have been formed to manage and maintain their unique habitat. Because utility or highway rights-of-way (ROW) are typically maintained in an early stage of succession (i.e., tree growth is prevented) they can provide important habitat for species that specialize in savannahs or prairies. The Karner blue butterfly and wild lupine have been documented along a portion of the ROW of the ITC Transmission Company, in Muskegon and Newaygo Counties, Michigan. In 2005 a 4.07-mile section of ITC's ROW was reconductored (metal poles replaced with wooden poles). In collaboration with Environmental Consulting and Technology (ECT), the Michigan Natural Features Inventory (MNFI) conducted post-reconductoring population surveys and population monitoring for the Karner blue butterfly and wild lupine. Population surveys focused on the previously disturbed 4.07-mile section of the ROW. Through this monitoring we will be able to determine the level of disturbance and recovery related to the reconductering of the powerline.

Study Area

The area that we surveyed was a 4.07-mile portion of the ITC transmission line starting just north of the Muskegon County Sewage Reclamation Area (east-central Muskegon County) and continuing into the southwest corner of Newaygo County. Specifically, the Township 10 North, Range 15 West, Sections 1,2,11 and Township 11 North, Range 14 West, Section 31. Previous research at this site separated the 4.07 mile into 3 sections (Table 1).

Table 1.

Section	Start	End
A	Northern End	Maple River Tributary
В	Maple River Tributary	Mosquito Creek
C	Mosquito Creek	Southern End

Methods

We surveyed during both flight periods of the Karner blue butterfly life cycle using methods established and standardized by the Michigan Department of Natural Resources and Michigan Natural Features Inventory (MNFI). Because the exact flight periods of the Karner blue butterfly vary by as many as 2 weeks from year to year we maintained contact with other researchers conducting conspecific work in the same region. We were then able to time our surveys to capture the peak of the flight period (i.e., time with the most butterflies present).

Following the standardized procedures for conducting surveys for this rare species, we limited our surveys to between 800 hours and 1800 hours, when temperatures were above 60° F, with no cloud cover or rain, and when winds were less than 20 miles per hour. We collected data on the location of every Karner blue butterfly observed using Garmin map76 units. We also mapped the patches of lupine along the ROW using the Garmin map76 units. We recorded data and completed data forms separately for each of the 3 sections of the ROW.

Results

Joelle Gehring, Jennifer Olson, and Brandon Noel of MNFI surveyed for the Karner blue butterfly in Sections A, B, and C of the Cobb Brickyard sites on May 30, 2007 (first flight) (Figures 3, 4, 5, and 6) and on July 18, 2007 (second flight) (Figures 7, 8, 9, and 10). Both surveys were successfully completed with appropriate weather conditions and within the designated optimum survey time period.

First flight

Section A

The survey was conducted between 1020 and 1205 hours. Weather conditions were ideal for conducting the survey with low winds, clear skies, and a mean temperature of 77 ° F. Lupine was flowering and abundant and we detected 100 Karner blue butterflies (Figure 11 and Table 2). The gender ratio was approximately equal which suggests that we met our goal of surveying at the peak of the first flight. Thirty-nine males were observed, 30 females, and 31 unknown. The wild lupine had a distribution pattern of five.

Section B

The survey was conducted between 1210 and 1350 hours. Weather conditions were ideal for conducting the survey with low winds, clear skies, and a mean temperature of 82 ° F. Lupine was flowering and abundant and we detected 61 Karner blue butterflies (Figure 12 and Table 2). Twenty-three males were observed, 15 females, and 23 unknown. The wild lupine had a distribution pattern of four.

Section C

The survey was conducted between 1610 and 1750 hours. Weather conditions were ideal for conducting the survey with low winds, clear skies, and a mean temperature of 86 ° F. Lupine was present and flowering but not as abundant as the other sections. We detected 12 Karner blue butterflies (Figure 13 and Table 2). Two males were observed, five females, and five unknown. The wild lupine had a distribution pattern of one.

Table 2.

Karner blue	No. of males	No. of females	No. of unknown	No. of total
butterflies			gender	
Section A	39	30	31	100
Section B	23	15	23	61
Section C	2	5	5	12

Second flight

Section A

The survey was conducted between 925 and 1125 hours. Weather conditions were ideal for conducting the survey with low winds, clear skies, and a mean temperature of 74 ° F. Lupine had completed its flowering stage. We detected 74 Karner blue butterflies (Figure 14 and Table 3). Twenty-eight males were observed, 35 females, and 11 unknown.

Section B

The survey was conducted between 1128 and 1325 hours. Weather conditions were ideal for conducting the survey with low winds, clear skies, and a mean temperature of 81 ° F. Lupine had completed its flowering stage. We detected 85 Karner blue butterflies (Figure 15 and Table 3). Forty-one males were observed, 31 females, and 13 unknown.

Section C

The survey was conducted between 1500 and 1700 hours. Weather conditions were acceptable for conducting the survey with medium winds, partially cloudy skies, and a mean temperature of 82 ° F. Lupine had completed its flowering stage but was still low in density. We detected 28 Karner blue butterflies (Figure 16 and Table 3). Five males were observed, 15 females, and 8 unknown.

Table 3.

Karner blue	No. of males	No. of females	No. of unknown	No. of total
butterflies			gender	
Section A	28	35	11	74
Section B	41	31	13	85
Section C	5	15	8	28

Conclusion

The ROW of the ITC Transmission Company, in Muskegon and Newaygo Counties, Michigan is still providing habitat for the Karner blue butterfly and its host plant, wild lupine, despite 2005 reconductoring activities. In the 2006 surveys ENSR International documented a total of 22 Karner blue butterflies during the first flight period and 60 butterflies during the second flight period (Hart and Groves 2006). In collaboration with Environmental Consulting and Technology (ECT), the Michigan Natural Features Inventory (MNFI) successfully conducted 2007 population surveys and detected 173 Karner blue butterflies during the first flight and 187 during the second flight period.

These numbers are significantly higher than the 2005 levels. The higher densities in the second flight period are consistent with the life cycle of the Karner blue butterfly, as the overwintering eggs are more likely to die than the freshly laid eggs of the first flight butterflies. The fresh eggs provide the individuals for the population of the second flight butterflies.

Literature Cited

- Rabe, M. 2001. Special animal abstract for Lycaeides melissa samuelis (Karner blue). Michigan Natural Features Inventory. Lansing, MI 6 pp.
- Hart, L. and M. Groves. 2006. Letter to Robert Schultz, subject: Wild Lupine Density and Karner Blue Butterfly Survey at Cobb to Brickyard Line 2006. ENSR, international. September 14, 2006.
- Swengel, A. and S. Swengel. 2005. Long-term population monitoring of the Karner blue (Lepidoptera: Lycaenidae) in Wisconsin, 1990-2004.
- United States Fish and Wildlife Service. 2003. Final recovery plan for the Karner blue butterfly (*Lycaeides melissa samuelis*). Dept. of Interior, U.S. Fish and Wildlife Service, Fort Snelling, MN.

Figure 1. Karner blue butterfly. Photo credit: Mary Rabe



Figure 2. Wild Lupine in flower from Cobb to Brickyard line 2007. Photo Credit: Joelle Gehring



Figure 3. Aerial image of Karner blue butterfly (blue dots) survey observations and wild lupine areas (purple areas) on 30 May 2007 (all Sections) Cobb to Brickyard Line.

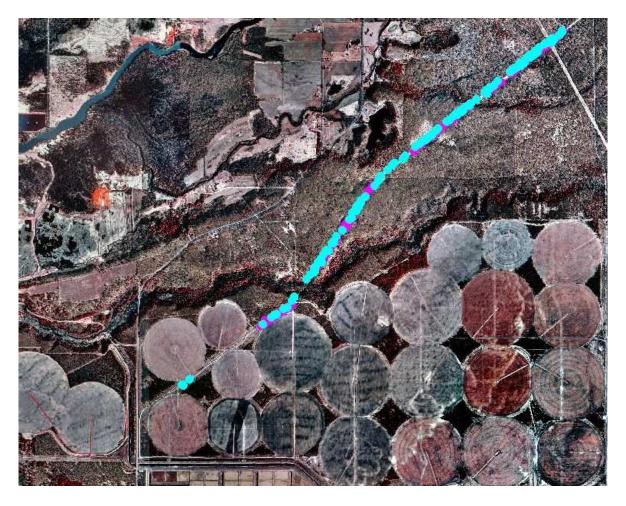


Figure 4. Aerial image of Karner blue butterfly (blue dots) survey observations and wild lupine areas (purple areas) on 30 May 2007 (Section A) Cobb to Brickyard Line.

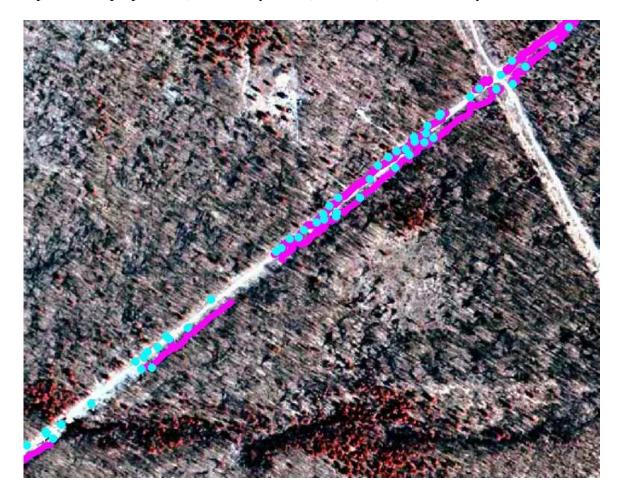


Figure 5. Aerial image of Karner blue butterfly (blue dots) survey observations and wild lupine areas (purple areas) on 30 May 2007 (Section B) Cobb to Brickyard Line.

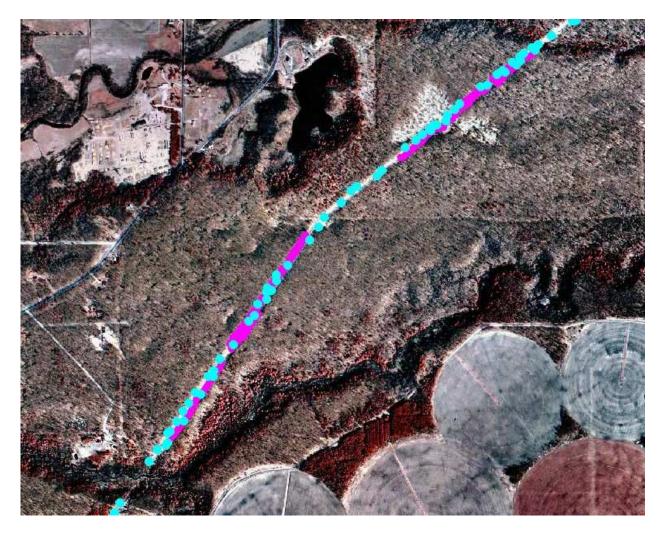


Figure 6. Aerial image of Karner blue butterfly (blue dots) survey observations and wild lupine areas (purple areas) on 30 May 2007 (Section C) Cobb to Brickyard Line.

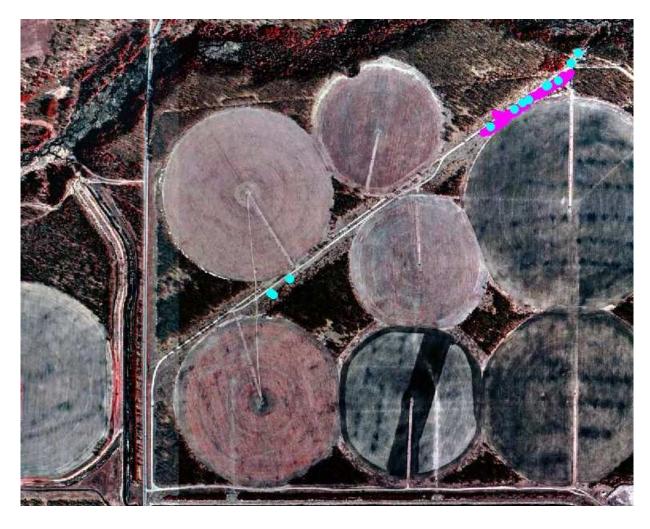


Figure 7. Aerial image of Karner blue butterfly (blue dots) survey observations and wild lupine areas (purple areas) on 17 July 2007 (all Sections) Cobb to Brickyard Line.

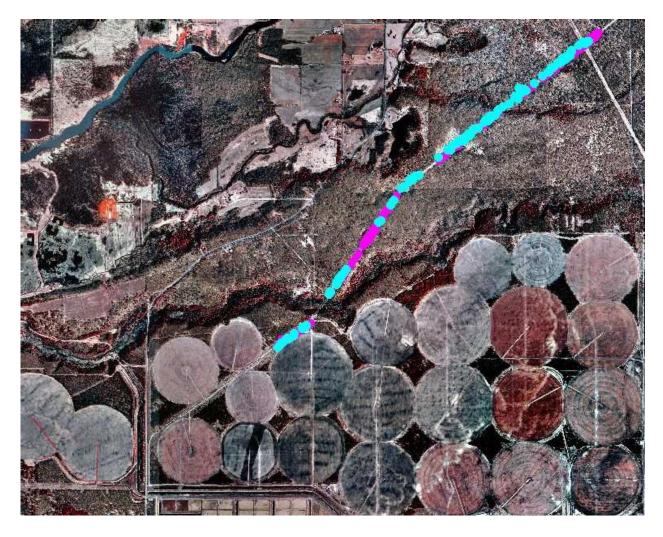


Figure 8. Aerial image of Karner blue butterfly (blue dots) survey observations and wild lupine areas (purple areas) on 17 July 2007 (Section A) Cobb to Brickyard Line.

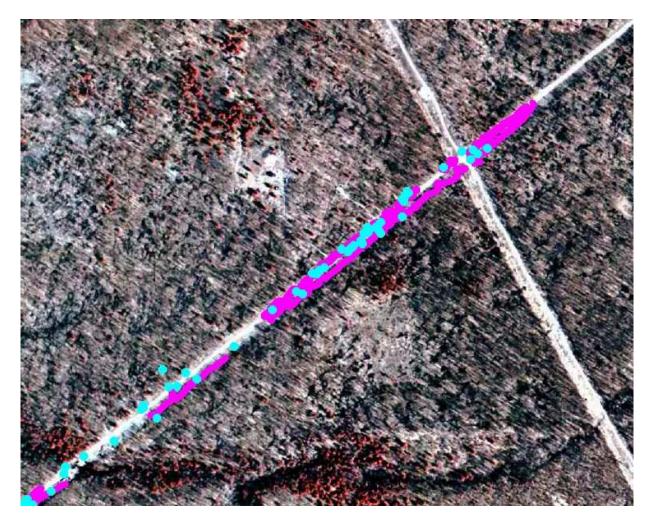


Figure 9. Aerial image of Karner blue butterfly (blue dots) survey observations and wild lupine areas (purple areas) on 17 July 2007 (Section B) Cobb to Brickyard Line.

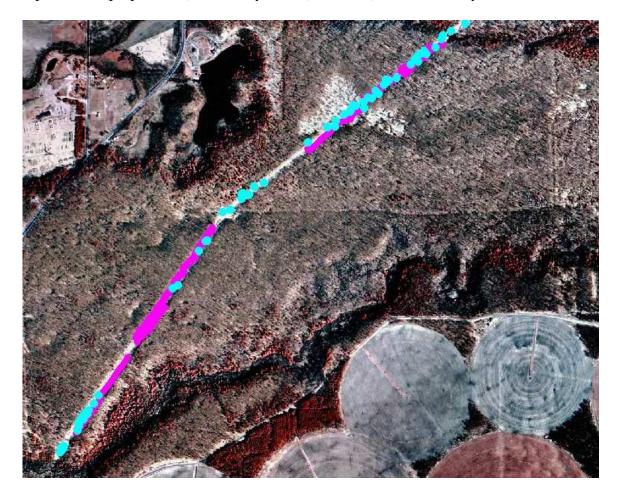


Figure 10. Aerial image of Karner blue butterfly (blue dots) survey observations and wild lupine areas (purple areas) on 17 July 2007 (Section C) Cobb to Brickyard Line.

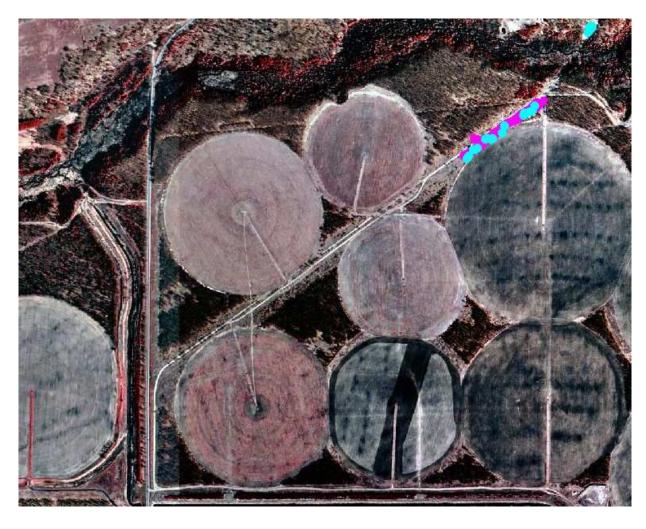


Figure 11. Datasheets from 30 May 2007 (Section A) Karner blue butterfly survey Cobb to Brickyard Line.

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Fill out this section after the survey has been comp	leted		
KBB Present?: NO Why? (see codes and cir	rcle all that apply) L N	w s	
YES X Certainty of location: >9!	5% (location gos'd*) X	80 - 95% 20 - 80% 0 - 209	% UNKN
		20 30% 2 30% 2 20	
JRVEYOR AND LOCATION INFORMAT			
Survey date: 2007-05-30	Time from: 10120 to: 1210	SITENAME: Section Sources	code: FMIUS
Surveyors (principal surveyor first, include first & la	st name):	Okon & Joelle Gehring	
TOWNSHIP: TIM RANGE:	R14W	SECTION: 31+ 32	QUARTER SECTION:
OWNERSHIP:		QUAD CODE: #30863/	
Weather (see codes page): Begin Temp: 75°	Begin Wind code:	2 Begin Sky code: 0	
End Temp:90 *	End Wind code:	4 End Sky code: O	
E CONDITION INFORMATION			
	and a	ETA KINNI	t indicates 66 feet ROW
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Has the area been disturbed? (burn, cut, planted):			1 March 1 100
Other threats to the area? (ORV, Mechanical, Hors			war traffic of
_ight: open_Xpartialfilteredshade	20	Moisture: moist (mesic) dry-mesic/	1000 1 -01 6
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Total number of KBB adults:	Survey effort: Time spent in opening	Notes, observations, etc.:	
39 30 31 90%	% of area surveyed		
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PINE OCCURRENCE			
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Overall distribution pattern (see codes): 5		~	45 V (A)
	n of	Caterpillar feeding damage (circ	
Estimated% of lupine blooming or in seed:/	0% Ants present_	NO MANN Evidence of Browse	: not much, very

Transcription	Number	

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	number of plants and blooming?	oms where possibl	e.	
species hawkweed	Yes No	Distribution	Notes, observations, etc.	
dewberry	X	abundant	Action of the last	
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HER SPECIES PRESENT				
ist other species observed at this site. Note espe	ecially listed species and p Number	otential predators.		
pecies:	Observed	Notes, observa	tions, etc.	
black swallow tail	25			
black swallow tail	~18		many forcement by comme	THE VIEW REDU
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etch the boundary of the area visited	Mark vour survey	route or area	KRR () and luning (• ¥ 0)	OCCURRANCES SI
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Figure 12. Datasheets from 30 May 2007 (Section B) Karner blue butterfly survey Cobb to Brickyard Line.

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Fill out this section after the survey has been comp	leted		-		
KBB Present?: NO Why? (see codes and ci	rcle all that apply) L N	w s			
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ociality of todaton.	on (location special)				
URVEYOR AND LOCATION INFORMA	TION		2 7 7 7		
Survey date: 2007 - 05 - 30	Time from: 12:10 to: 1:50p	M SITENAME:	Section Son	urcecode: F	MIUS
Surveyors (principal surveyor first, include first & la	st name):	Olson & =	soelle Guchi	ring	
TOWNSHIP: TIN FION RANGE:	RI4W/RI5W	SECTION: 3/	11	QUARTER	SECTION:
OWNERSHIP:		QUAD CODE:	4308	7631	
Weather (see codes page): Begin Temp: 80° End Temp: 84°F	Begin Wind code:	Begin Sky End Sky	code:	_	
TE CONDITION INFORMATION					
Use space provided on back to sketch the area su	noved		ETA	report hed	lieutes 66 foot Ro
	00.3			y y	THE PER CONTROL AND
Type of opening (ROW, clearing, field, barrens, lav	1 1	Size of oper	ling:		
Vegetation surrounding opening (wooded, agricult	W. W	Fransmission	company	maintains	ROW of mountary
Has the area been disturbed? (burn, cut, planted):	5.0.1 1	1/	conquery.	7.100.01.8.12.2	DE STORE
Other threats to the area? (ORV, Mechanical, Horselight: open partial filtered shade		Moisture: moist (m	nesic) doum	esic X dry (xeric	of this prese
Ground cover description (Density, % bare soil, %		bott soil	55% cm	Tacs 1 /5%	5 Fords 10% Ferry
Ground cover description (Density, % Date soil, %	grassrioibriam,		0		1000
WOODY VEGETATION ENCROACHMENT: Tree/shrub/stump species and form	Height	Distribution	Notes	,	
red oak	0.5 m	5%	abundans	t	
Sassafras	Im	2%	scattere	d	
white oak	D. Sm	1 %	Sparse		
70V1 C			4		
EVOTICS ENODOACHMENT	Distribution	Notes			
EXOTICS ENCROACHMENT Species	Distribution	, doing			
spotes knapweed	3 To scatt	ever not a	increachiv	ig much	
garlie mustand	170 spars	e near	Steerp	piles mea	~ fributory to
Q			-		
		Miles a			
ARNER BLUE BUTTERFLY OCCURRE	NCE				
Mark occurrence on map using a to indicate and		I Nation			
Total number of KBB adults: % of opening Male Female Unknown occupied	Survey effort: Time spent in opening /	hr. 40mins	, observations, et	U	
23 15 23 60%	% of area surveyed8				
"If the location(s) were gps'd, fill out this section, o					
Type of unit: Games	Unit number: 675	map 76			
Waypoint name/# (when using Garmin)		File name (when	using Trimble)		
OPTIONAL: Latitude	Longitu		January VA		_
FEATURE INFORMATION (mandatory) Point : <	12.5 m in both dimensions	Line: >12.5 m in o	one dimension	Polygon: >12.5m i	n both dimensions
Source Feature (circle one): Single Source EO					Line Polygon
JPINE OCCURRENCE					
Map lupine distribution. Use a ● for scattered plan	its, an X for clumps, and cir	cle (0) dense areas	5		
Overall distribution pattern (see codes):4	= resultant fil, ly	The second secon			
Estimated % of area covered: 20 %		Caterpilla	ar feeding damage	e (circle) Y N	1
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Transcription Number	

NECTAR SPECIES PRESENT

List nectar species observed at this site. Note the number of plants and blooms where possible.

Species

Species: Possible dusted skipper black swallowtail	Number Observed	Notes, observations, etc.
black swallowtail		

Sketch the boundary of the area visited. Mark your survey route or area, KBB () and lupine (> x 0) occurrences and note other pertinent information.

Figure 13. Datasheets from 30 May 2007 (Section C) Karner blue butterfly survey Cobb to Brickyard Line.

			The second section of the second
Fill out this section after the survey has been complete KBB Present?: NO Why? (see codes and circle		w s	
YES_X_ Certainty of location: >95%	(location gps d')	80 - 95% 20 - 80%	0 - 20% UNKN
JRVEYOR AND LOCATION INFORMATION	ON-		
Survey date: <u>2007-05-30</u> Tir	me from: 4:14 to: 5:50	SITENAME: Section	Sourcecode: F MIUS
Surveyors (principal surveyor first, include first & last	name):	Olson & Joelle 1	Sehring
TOWNSHIP: TION RANGE:	RI5W	SECTION: 2 £ /	QUARTER SECTION:
DWNERSHIP: SECTION C		QUAD CODE: 43086	631
Weather (see codes page): Begin Temp: 85°F End Temp: 86°F	Begin Wind code: 4 End Wind code: 6		
TE CONDITION INFORMATION			
Use space provided on back to sketch the area surve	ved	ET	c report indicates 66 foot Res
Type of opening (ROW, clearing, field, barrens, lawn)	01	Size of opening:	7 +
type of opening (ROW, clearing, field, barrens, lawn) Vegetation surrounding opening (wooded, agriculture		and assignificant	fields no signs of
Has the area been disturbed? (burn, cut, planted):		ussion company mainta	1 1100
Other threats to the area? (ORV, Mechanical, Horses	0 1	DA 177.	
Light: open X partial filtered shade	3050539		y-mesic dry (xeric)
Ground cover description (Density, % bare soil, % gra		born 5011, 740 20	155, 10% fort, 5% farm
WOODY VEGETATION ENCROACHMENT: Tree/shrub/stump species and form	Height	Distribution Note	es
red oak	,5 m	Scattered	
white oak	.5 m	scattered	
50552-805	-5 m	Scattered	
sand cherry	.5m	SPANSI	
EXOTICS ENCROACHMENT	Distribution	Notes	
Species	0 1 1		
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autumn olive	- SERVAST		
	·		
ARNER BLUE BUTTERFLY OCCURREN	CE		
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Total number of KBB adults: % of opening		. 5 hrs Notes, observations	s, etc.:
Male Female Unknown occupied 2 5 5 5	Survey effort: Time spent in opening 1 % of area surveyed 70	76_	
*If the location(s) were gps'd, fill out this section, other	rwise leave blank	value	
Type of unit:	Unit number: CPS YMA		
Waypoint name/# (when using Garmin)	Para Section 1	File name (when using Trimble	3)
OPTIONAL: Latitude	Longitu		
FEATURE INFORMATION (mandatory) Point : <12. Source Feature (circle one): Single Source EO			
IPINE OCCURRENCE			
AND ADDRESS OF THE PROPERTY OF		10000	
Man luning distribution. Use a & for craftered elente	an X for clumps and cir	cle (0) dense areas	
Map lupine distribution. Use a • for scattered plants,	an x for clumps, and cir	cle (0) dense areas	
Map lupine distribution. Use a ● for scattered plants, Overall distribution pattern (see codes)	an × for clumps, and cir	cle (0) dense areas Caterpillar feeding dar	mage (circle) Y (N)

	PRESENT

	number of plants and bloo Blooming?		NAME OF THE OWNER O
Species	Yes No	Distribution	Notes, observations, etc.
milk weed	_ X	patchy	along og fields
Corressis	X	Sparse	0 0
hawkweed	X	Sparse	
dewberry	×	scottered	
goldenrod	X	patchy	
sweet clover	X	sparse	along an firld
moren vetch	X	sparse	J 0
yarrow	- - · · · · · · · · · · · · · · · · ·	sparce	
hoary alyssum	- X	sparse	10(2) (2010) 42 (-111)
11 0 11	- /- - - - - - - - - -	1	
Helium Mrus Spe		patchy	

OTHER	CDECIES	PRESENT

Number Observed	Notes, observations, etc.
280	
23	
· -	
	Observed 200

Sketch the boundary of the area visited. Mark your survey route or area, KBB () and lupine ($\bullet \times 0$) occurrences and note other pertinent information.

Figure 14. Datasheets from 17 July 2007 (Section A) Karner blue butterfly survey Cobb to Brickyard Line.

	100 mm	
Fill out this section after the survey has been	00000 4 POLIS (CALO)	
	and circle all that apply) L N W S	
YES_X_ Certainty of locati	n: >95% (location gps'd*) X 80 – 95% 20 –	80% 0 - 20% UNKN
JRVEYOR AND LOCATION INFO	MATION	
Survey date: 2007-07-18		Sourcecode: FMIUS
Surveyors (principal surveyor first, include fir	t&last name): Item few Olson &	Joelle Echrina + Brandon Noel
		4 32 QUARTER SECTION:
OWNSHIP: /// RAM	1110	308631
	70°F Begin Wind code: Begin Sky co	
Veather (see codes page): Begin Temp:_ End Temp:		
End remp	Elia Willa code Elia Sky cod	
TE CONDITION INFORMATION	See May data forms	
Jse space provided on back to sketch the a	ea surveyed.	
Type of opening (ROW, clearing, field, barre		
Vegetation surrounding opening (wooded, a		9
Has the area been disturbed? (burn, cut, pla	GIO 3590004000 VCO 314402	Parameter Company of the
Other threats to the area? (ORV, Mechanica		
Light: open partial filtered sha		sic) dry-mesic dry (xeric)
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WOODY VEGETATION ENCROACHMEN	: Height Distribution	Notes
Tree/shrub/stump species and form		
		
	-	-
		
		-
EXOTICS ENCROACHMENT Species	Distribution Notes	
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RNER BLUE BUTTERFLY OCCU	RRENCE	
Mark occurrence on map using a to indica	e an occurrence	
otal number of KBB adults: % of of Male Female Unknown occu		bservations, etc.:
28 35 11 4	000	
20 33 11 7	% of area surveyed	
'If the location(s) were gps'd, fill out this sec		
	Unit number:	ing Trimble)
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OPTIONAL: Latitude	V (2 (1 (1 (1 (1 (1 (1 (1 (1 (1	
	nt : <12.5 m in both dimensions Line: >12.5 m in one	
Source Feature (circle one): Single Source	O Multi-Source EOConceptual Feature Ty	pe (circle one): Point Line Polygon
PINE OCCURRENCE Sea	May data forms	
	d plants, an × for clumps, and circle (0) dense areas	
CHICATOR PROTECTION CONTRACTOR CO		
Estimated % of area covered:		eeding damage (circle) Y N
Estimated % of lupine blooming or in seed:	TANKAN TA	Evidence of Browse:
Comments:	The product	

NECTAD	CDECIEC	PRESENT

nectar species observed at this site. Note the r	Blooming?		
cies	Yes No	Distribution	Notes, observations, etc.
spotted knapwcad	X	abundant	
butterfly weed	X	Sparse	Se state and the second of the
black-eyed susan	V -	1	-
P1 /		Spanse	-
Howeving spenge	_ X	scattered	9-11-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-
horsemint'	×	Sparse	
St. Johnswort	X	Datchy	
1		1-0	- b
bergamot		Sparse	near creek
Phlox sp.		patchy	
		0	The second secon
R SPECIES PRESENT			
ther species observed at this site. Note espec		otential predators.	
ies:	Number Observed	Notes, observa	ations ato
1 1 1	Observed	140166, 0036146	340110, 610.
d-spotted purple			
merican copper	10_	-	
nknown skipper	5		
known white	<u>15</u>	4	
EVENNII NIVETTE	-10		
monarch	_		

Sketch the boundary of the area visited. Mark your survey route or area, KBB () and lupine ($\bullet \times 0$) occurrences and note other pertinent information.

Figure 15. Datasheets from 17 July 2007 (Section B) Karner blue butterfly survey Cobb to Brickyard Line.

Fill out this section after the survey has been completed	
	ill that apply) L N W S
YES_X_ Certainty of location: >95% (I	ocation gps'd*) 80 - 95% 20 - 80% 0 - 20% UNKN
JRVEYOR AND LOCATION INFORMATION	
Survey date: 2007-07-18 Time	from: 11:28 to: 11:25 pm SITENAME: Section Sourcecode: F MIUS
Surveyors (principal surveyor first, include first & last na	me): Joelle Gebring + Jennifer Olson + Brandon Noel
TOWNSHIP: // N /10 N RANGE: /	4/W SECTION: 31/1 QUARTER SECTION:
OWNERSHIP:	QUAD CODE: 4/3 U 8 6 3 /
Weather (see codes page): Begin Temp: 12°F	Begin Wind code: Begin Sky code:
	End Wind code: 1 End Sky code: 7
E CONDITION INFORMATION 3 @	e May dotta
Use space provided on back to sketch the area surveye	d.
Type of opening (ROW, clearing, field, barrens, lawn):_	Size of opening:
Vegetation surrounding opening (wooded, agriculture, ε	stc.):
Has the area been disturbed? (burn, cut, planted):	
Other threats to the area? (ORV, Mechanical, Horses, e	rtc.)
ight open partial filtered shade	Moisture: moist (mesic) dry-mesic dry (xeric)
Ground cover description (Density, % bare soil, % grass	s/forb/fern):
WOODY VEGETATION ENCROACHMENT:	Height Distribution Notes
Tree/shrub/stump species and form	
EXOTICS ENCROACHMENT Species	Distribution Notes
opedeo	
-	
·	
· · · · · · · · · · · · · · · · · · ·	
·	
RNER BLUE BUTTERFLY OCCURRENCE	
Mark occurrence on map using a to indicate an occur	rence
otal number of KBB adults: % of opening S	we spent in opening 2 hvs. Notes, observations, etc.:
113 23 11-07	0 - 11
71 31 15 7570 %	of area surveyed90%
If the location(s) were gps'd, fill out this section, otherw	
	nit number:
Vaypoint name/# (when using Garmin)	
DPTIONAL: Latitude	
FEATURE INFORMATION (mandatory) Point: <12.5	n in both dimensions Line: >12.5 m in one dimension Polygon: >12.5m in both dimensions
Source Feature (circle one): Single Source EO	Multi-Source EOConceptual Feature Type (circle one): Point Line Polygon
PINE OCCURRENCE Su	May doota
Map lupine distribution. Use a • for scattered plants, at	x for clumps, and circle (0) dense areas
Overall distribution pattern (see codes):	
Estimated % of area covered:	Cotomillar fooding downers (stretch V N
Estimated% of Jupine blooming or in seed:	- 1/200 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -
Comments:	Take present.

Transcription Number	
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Page 2 of 2

NECTA	n n	nra	100	DDE	CTA	-
NIC I A		~	11-3-	~~~	- 1	a e

ecies	Blooming? Yes No	Distanting.	N. C. St. St. St. St. St. St. St. St. St. St
	Yes No	Distribution	Notes, observations, etc.
Goldenrod spp.	_ <u>X</u>	Sparse	
bergamet "	_ <u> </u>	Sparse	
black-eyed susan	χ	scattered	
daisies	X	sparse	
hawkweed	× -	sparse	
St. Johnswort		Scattered	
putterfly weed	l X	patchy	
have bell	- -	1-0-	
		Spars2	THE RESERVE OF THE PROPERTY OF
spotted knapweed	_	Patchy	
	9.	, v	

OTHER SPECIES PRESENT

Species:	Number Observed	Notes, observations, etc.
Buckeye	_ /	
monarch	_ 4	The first term of the control of the
American copper	_ 10_	*
umown skipper	_ _5	
unknown white		
black swallowtail	_ 8	
Eastern tailed blue	2	

Sketch the boundary of the area visited. Mark your survey route or area, KBB () and lupine (> X 0) occurrences and note other pertinent information.

Figure 16. Datasheets from 17 July 2007 (Section C) Karner blue butterfly survey Cobb to Brickyard Line.

Transcription Number___

OWNERSHIP: Weather (see codes page): Begin Temp: 1°F Begin Wind code: 4 Begin Sky code: 2 End Temp: 73°F End Wind code: 3 End Sky code: 1 TE CONDITION INFORMATION Use space provided on back to sketch the area surveyed. Type of opening (ROW, clearing, field, barrens, lawn): Size of opening: Vegetation surrounding opening (wooded, agriculture, etc.): Has the area been disturbed? (burn, cut, planted): Other threats to the area? (ORV, Mechanical, Horses, etc.)	F MIU + Breadon Moel ARTER SECTION:
Survey date: 2007-07-18 Time from: 3:00 to: 5:00 SITENAME: Setter Sourcecode: F Surveyors (principal surveyor first, include first & last name): 2016 Section: 2 + 11 QUA OWNERSHIP: QUAD CODE: 4308631 Weather (see codes page): Begin Temp: 21°F Begin Wind code: 4 Begin Sky code: 2 End Temp: 23°F End Wind code: 3 End Sky code: 1 FE CONDITION INFORMATION Use space provided on back to sketch the area surveyed. Type of opening (ROW, clearing, field, barrens, lawn): Size of opening: Vegetation surrounding opening (wooded, agriculture, etc.): Has the area been disturbed? (burn, cut, planted): Other threats to the area? (ORV, Mechanical, Horses, etc.) Light: open_ partial_ filtered_ shade_ Moisture: moist (mesic)_ dry-mesic_ dry Ground cover description (Density, % bare soil, % grass/forb/fern): WOODY VEGETATION ENCROACHMENT: Height Distribution Notes EXOTICS ENCROACHMENT Distribution Notes	+ Brandon Noel
Surveyors (principal surveyor first, include first & last name):	+ Brandon Noel
OWNSHIP: /o // RANGE: 15W SECTION: 2 + // QUAD CODE: 4308631 Weather (see codes page): Begin Temp: 21°F Begin Wind code: 4 Begin Sky code: 2 End Temp: 73°F End Wind code: 3 End Sky code: 4 ECONDITION INFORMATION See Space provided on back to sketch the area surveyed. Type of opening (ROW, clearing, field, barrens, lawn): Size of opening: // Agestation surrounding opening (wooded, agriculture, etc.):	
WNERSHIP: //eather (see codes page): Begin Temp: 21°F Begin Wind code: 4 Begin Sky code: 2 End Temp: 73°F End Wind code: 3 End Sky code: 4 E CONDITION INFORMATION See Space provided on back to sketch the area surveyed. // ype of opening (ROW, clearing, field, barrens, lawn): Size of opening: // egetation surrounding opening (wooded, agriculture, etc.): // last the area been disturbed? (burn, cut, planted): // wither threats to the area? (ORV, Mechanical, Horses, etc.) // ight open partial filtered shade Moisture: moist (mesic) dry-mesic dry // wooddy VEGETATION ENCROACHMENT: Height Distribution Notes EXOTICS ENCROACHMENT Distribution Notes	ARTER SECTION:
WNERSHIP: Jack Peather (see codes page): Begin Temp: 13°F Begin Wind code: 4 Begin Sky code: 2 End Temp: 13°F End Wind code: 3 End Sky code: 2 End Temp: 13°F End Wind code: 3 End Sky code: 4 ECONDITION INFORMATION See May Clastical Code See space provided on back to sketch the area surveyed. Size of opening (ROW, clearing, field, barrens, lawn): Size of opening: Size of opening: Size of opening: Size of opening: Size of opening: Size of	
Begin Sky code: 2 End Temp: 13°F Begin Wind code: 3 End Sky code: 2	
se space provided on back to sketch the area surveyed. ype of opening (ROW, clearing, field, barrens, lawn): segetation surrounding opening (wooded, agriculture, etc.): as the area been disturbed? (burn, cut, planted): ther threats to the area? (ORV, Mechanical, Horses, etc.) gight open partial filtered shade	
se space provided on back to sketch the area surveyed. ype of opening (ROW, clearing, field, barrens, lawn): gegetation surrounding opening (wooded, agriculture, etc.): as the area been disturbed? (burn, cut, planted): ther threats to the area? (ORV, Mechanical, Horses, etc.) ght: open partial filtered shade Moisture: moist (mesic) dry-mesic dry-mound cover description (Density, % bare soil, % grass/forb/fern): WOODY VEGETATION ENCROACHMENT: Height Distribution Notes EXOTICS ENCROACHMENT Distribution Notes EXOTICS ENCROACHMENT Distribution Notes	
se space provided on back to sketch the area surveyed. ype of opening (ROW, clearing, field, barrens, lawn): gegetation surrounding opening (wooded, agriculture, etc.): as the area been disturbed? (burn, cut, planted): ther threats to the area? (ORV, Mechanical, Horses, etc.) ght: open partial filtered shade Moisture: moist (mesic) dry-mesic dry-mound cover description (Density, % bare soil, % grass/forb/fern): WOODY VEGETATION ENCROACHMENT: Height Distribution Notes EXOTICS ENCROACHMENT Distribution Notes EXOTICS ENCROACHMENT Distribution Notes	
ype of opening (ROW, clearing, field, barrens, lawn): segetation surrounding opening (wooded, agriculture, etc.): as the area been disturbed? (burn, cut, planted): ther threats to the area? (ORV, Mechanical, Horses, etc.) ght: open partial filtered shade	
egetation surrounding opening (wooded, agriculture, etc.): as the area been disturbed? (burn, cut, planted): ther threats to the area? (ORV, Mechanical, Horses, etc.) ight: open partial filtered shade Moisture: moist (mesic) dry-mesic dry iround cover description (Density, % bare soil, % grass/forb/fern): WOODY VEGETATION ENCROACHMENT: Height Distribution Notes EXOTICS ENCROACHMENT Distribution Notes EXOTICS ENCROACHMENT Distribution Notes	
as the area been disturbed? (burn, cut, planted):	
ight: open partial filtered shade Moisture: moist (mesic) dry-mesic dry-mesi	
round cover description (Density, % bare soil, % grass/forb/fern): WOODY VEGETATION ENCROACHMENT: Height Distribution Notes Tree/shrub/stump species and form EXOTICS ENCROACHMENT Distribution Notes Species	
WOODY VEGETATION ENCROACHMENT: Tree/shrub/stump species and form Height Distribution Notes EXOTICS ENCROACHMENT Species Distribution Notes	ry (xeric)
EXOTICS ENCROACHMENT Distribution Notes	
EXOTICS ENCROACHMENT Species Distribution Notes	
Species	
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Species	
RNER BLUE BUTTERFLY OCCURRENCE	
RNER BLUE BUTTERFLY OCCURRENCE	THE RESIDENCE OF THE PARTY OF T
RNER BLUE BUTTERFLY OCCURRENCE	
RNER BLUE BUTTERFLY OCCURRENCE	
RNER BLUE BUTTERFLY OCCURRENCE	
ark occurrence on map using a to indicate an occurrence	
otal number of KBB adults: % of opening Survey effort: Notes, observations, etc.: Male Female Unknown occupied Time spent in opening 2 hvs.	
5 15 8 3% % of area surveyed 70%	
f the location(s) were gps'd, fill out this section, otherwise leave blank	
ype of unit: Unit number:	
/aypoint name/# (when using Garmin) File name (when using Trimble)	
PTIONAL: Latitude Longitude	
EATURE INFORMATION (mandatory) Point: <12.5 m in both dimensions Line: >12.5 m in one dimension Polygon: >1	12.5m in both dimensions
ource Feature (circle one): Single Source EO Multi-Source EOConceptual Feature Type (circle one): Point _	Line Polygon
PINE OCCURRENCE See May data	
ap lupine distribution. Use a • for scattered plants, an × for clumps, and circle (0) dense areas	
verall distribution pattern (see codes):	
stimated % of area covered: Caterpillar feeding damage (circle) Y	r N
stimated% of lupine blooming or in seed: Ants present Evidence of Browse:	

NECTAR SPECIES PRESENT

Species	Blooming? Yes No	Distribution	Notes, observations, etc.
	Tes No	100 CONTRACTOR (100 CONTRACTOR)	Notes, observations, etc.
horsemint	- X	patchy	
Spotted Knapweed	X	patchy	
goldenrod SPP,	X	sparse	
91 11 11	· -	7	A CONTRACTOR OF THE CONTRACTOR
		spouse	
aster sp.	_ X	patchy	
Corcepsis	X	Sparse	
St. Johnswort		7	
		Spanse	1
flowering spurge	_ X	Scattered	
hoavy alysoun	X	patchy	The second secon
D11 0		1 1 6	
Phlox Sp. Helian thas Sp.	- ->	patchy	

OTHER SPECIES PRESENT

American copper			
Eastern tailed blue	10	No. of the last of	
black swallowfail	5		
sulphur spp, monarch	2		

Sketch the boundary of the area visited. Mark your survey route or area, KBB () and lupine $(\bullet \times 0)$ occurrences and note other pertinent information.