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

Prepared by:
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2007 - 26
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 reconducted (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>
<thead>
<tr>
<th>Section</th>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Northern End</td>
<td>Maple River Tributary</td>
</tr>
<tr>
<td>B</td>
<td>Maple River Tributary</td>
<td>Mosquito Creek</td>
</tr>
<tr>
<td>C</td>
<td>Mosquito Creek</td>
<td>Southern End</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Karner blue butterflies</th>
<th>No. of males</th>
<th>No. of females</th>
<th>No. of unknown gender</th>
<th>No. of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section A</td>
<td>39</td>
<td>30</td>
<td>31</td>
<td>100</td>
</tr>
<tr>
<td>Section B</td>
<td>23</td>
<td>15</td>
<td>23</td>
<td>61</td>
</tr>
<tr>
<td>Section C</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Karner blue butterflies</th>
<th>No. of males</th>
<th>No. of females</th>
<th>No. of unknown gender</th>
<th>No. of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section A</td>
<td>28</td>
<td>35</td>
<td>11</td>
<td>74</td>
</tr>
<tr>
<td>Section B</td>
<td>41</td>
<td>31</td>
<td>13</td>
<td>85</td>
</tr>
<tr>
<td>Section C</td>
<td>5</td>
<td>15</td>
<td>8</td>
<td>28</td>
</tr>
</tbody>
</table>

**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**


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.
KBB and LUPINE SURVEY FORM

Fill out this section after the survey has been completed.

KBB Present: X NO Why? (see codes and circle all that apply) L N W S

YES X Certainty of location: >95% (location gsp/d) X 80 – 95% 20 – 80% 0 – 20% UNKN

SURVEYOR AND LOCATION INFORMATION

Survey date: 2021-05-20 Time from: 10:30 am to: 1:30 pm SITENAME: Section A Source code: F M10 S

Surveyors (principal surveyor first, include first & last name): Frederick Olson & Nicole Garverick

TOWNHSHIP: T1N RANGE: R14W SECTION: 31 QTR: 32 QUAD CODE: #3038831

Weather (see codes page): Begin Temp: 75° Begin Wind code: L Begin Sky code: 0

End Temp: 80° End Wind code: 4 End Sky code: 0

SITE CONDITION INFORMATION

Use space provided on back to sketch the area surveyed.

Type of opening (ROW, clearing, field, barren, lawn): ROW Size of opening: Single paced 2.55 meters wide

Vegetation surrounding opening (wooded, agriculture, etc.): wooded

Has the area been disturbed? (burn, cut, planted): YES - transmission company maintains ROWs of nearby vegetation - Y

Other threats to the area? (CRV, Mechanical, Horses, etc.): ORV and other motorized vehicles - Y

Light: open X partial filtered shade

Ground cover description (Density, % bare soil, % grass/succulent): 35% bare soil, 50% grass, 15% succulent, 5% trees

WOODY VEGETATION ENCROACHMENT: Height Distribution Notes

White oak

red oak

hickory

sycamore

EXOTICS ENCROACHMENT: Species

spotted sumac

garlic mustard

KARNER BLUE BUTTERFLY OCCURRENCE

Mark occurrence on map using a X to indicate an occurrence

Total number of KBB adults: 39 Male 30 Female 81 Unknown 90% % of opening occupied

Survey effort: Time spent in opening 1 hr 15 min % of area surveyed: 70%

Notes, observations, etc.:

*If the location(s) were gsp'd, fill out this section; otherwise leave blank.

Type of unit: Garmin

Unit number: GPS map 46

Waypoint name/ID (when using Garmin): A

File name (when using Trimble): B

OPTIONAL: Latitude

Longitude

FEATURE INFORMATION (mandatory) Point: <12.5 m in both dimensions Line: >12.5 m in one dimension Polygon: >12.5 m in both dimensions Source Feature (circle one): Simple Source ED Multi-Source ED Conceptual Feature Type (circle one): Point Line Polygon

LUPINE OCCURRENCE

Map lupine distribution. Use a X for scattered plants, an X for clumps, and circle (O) dense areas

Overall distribution pattern (see codes): 5

Estimated % of area covered: 30%

Estimated % of lupine blooming or in seed: 70% Ants present: no mounds Evidence of Browse: not much

Comments:
NECTAR SPECIES PRESENT

<table>
<thead>
<tr>
<th>Species</th>
<th>Blooming</th>
<th>Yes</th>
<th>No</th>
<th>Distribution</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>buckwheat</td>
<td></td>
<td>X</td>
<td></td>
<td>scarce</td>
<td></td>
</tr>
<tr>
<td>dewberry</td>
<td></td>
<td></td>
<td>X</td>
<td>abundant</td>
<td></td>
</tr>
<tr>
<td>cowvetch</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OTHER SPECIES PRESENT

<table>
<thead>
<tr>
<th>Species</th>
<th>Number Observed</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>wood sorrel</td>
<td>~5</td>
<td></td>
</tr>
<tr>
<td>black swallowtail</td>
<td>~10</td>
<td></td>
</tr>
</tbody>
</table>

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 12. Datasheets from 30 May 2007 (Section B) Karner blue butterfly survey Cobb to Brickyard Line.
KBB and LUPINE SURVEY FORM

Fill out this section after the survey has been completed.

KBB Present? YES X NO ___ Why? (see codes and circle all that apply) L N W S

Certainty of location: >95% (location good) X 80 - 95% 20 - 80% 0 - 20% UNKN

SURVEYOR AND LOCATION INFORMATION

Survey date: 02/17/2020 Time from: 12:10 to 1:50pm

SITENAME: Section 8 Sourcecode: F MIUS

Surveys (principal surveyor first, include first & last name): Muriel Block "Shelle" Jenkins

TOWNSHIP: T 11 S RANGE: R 14 W/ R SW SECTION: 31/7 QUARTER SECTION: 8

OWNERSHIP: QUAD CODE: 43C0B61

Weather (see codes page): Begin Temp: 40°F Begin Wind code: 4 Begin Sky code: 4

End Temp: 81°F End Wind code: 4 End Sky code: 4

SITE CONDITION INFORMATION

Use space provided on back to sketch the area surveyed.

Type of opening (ROW, clearing, field, barrens, lawn): Row Size of opening: 4

Vegetation surrounding opening (wooded, agriculture, etc.): wooded

Has the area been disturbed? (burn, cut, planted): yes - electric transmission company maintains ROW of medium

Other threats to the area? (ORV, Mechanical, Horses, etc.): ORV traffic

Light: open X partial filtered shade

Ground cover description (Density, % bare soil, % grass/forb/turf) 20% bare soil 55% grass 15% mis 10% forbs

WOODY VEGETATION ENCOMMACHMENT:

Tree/shrub/stump spaces and form

red oak

basswood

white oak

EXOTICS ENCOMMACHMENT:

Species

spotted garlic mustard

Notes: ETC report indicates 66’ foot road

KARNER BLUE BUTTERFLY OCCURRENCE

Mark occurrence on map using o to indicate an occurrence

Total number of KBB adults:

Male Female Unknown

12 15 23

% of opening occupied: 60%

Survey effort: Time spent in opening 1 hr 40 mins

% of area surveyed: 80%

*If the location(s) were gas’d, fill out this section, otherwise leave blank

Type of unit: Germany Unit number: 692 sigp 76

Waypoint name# (when using Garmin) File name (when using Trimble)

OPTIONAL: Latitude Longitude

FEATURE INFORMATION (mandatory) Point: <12.5 m in both dimensions Line: >12.5 m in one dimension Polygon: >12.5 m in both dimensions

Source Feature (circle one): Single Source EO Multi-Source EO Conceptual Feature Type (circle one): Point Line Polygon

LUPINE OCCURRENCE

Map lupine distribution. Use a • for scattered plants, an X for clumps, and circle (0) dense areas.

Overall distribution pattern (see codes): 4

Estimated % of area covered: 80% Caterpillar feeding damage (circle) Y

Estimated % of lupine blooming or in seed: 10% Ants present: no major Evidence of Browse: little bit not much

Comments:
### NECTAR SPECIES PRESENT

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

<table>
<thead>
<tr>
<th>Species</th>
<th>Blooming?</th>
<th>Distribution</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>hawksweed</td>
<td>X</td>
<td>abundant</td>
<td></td>
</tr>
<tr>
<td>dewberry</td>
<td>X</td>
<td>scattered but abundant</td>
<td></td>
</tr>
</tbody>
</table>

### OTHER SPECIES PRESENT

List other species observed at this site. Note especially listed species and potential predators.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number Observed</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>possible dusted skipper</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>black swallowtail</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Sketch the boundary of the area visited. Mark your survey route or area, KBB ( ) and lupine ( o 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.
KBB and LUPINE SURVEY FORM

Fill out this section after the survey has been completed.

KBB Present: NO \( \times \) Why? (see codes and circle all that apply): L N W S

\( \times \) Certainty of location: >95% (location good) 80 - 95% 20 - 80% 0 - 20% UNKN

SURVEYOR AND LOCATION INFORMATION

Survey date: 1/17/20
Time from: 1:45pm to 5:15pm
SITENAME: Section
Survey Code: F
QUAD CODE: 30863

TOWNSHIP: TION
RANGE: 15SW
SECTION: 2 & 11
QUARTER SECTION:

Weather (see codes page): Begin Temp: 75°F Begin Wind code: 4
End Temp: 67°F End Wind code: 0

SITE CONDITION INFORMATION

Use space provided on back to sketch the area surveyed.

Type of opening (ROW, clearing, field, barrens, lawn): ROW
Size of opening: 

Vegetation surrounding opening (wood, agriculture, etc.): woods and agricultural field

Has the area been disturbed? (burnt, cut, planted): yes - tranformed was a mine

Other threats to the area? (ORV, Mechanical, Horses, etc.): vehicle traffic - low risk

Light open X partial filtered shade

Ground cover description (Density, % bare soil, % grass/forb/fern): 45% bare soil, 40 moss, 10% fern, 5% forb

WOODY VEGETATION ENCROACHMENT:
Treatable/stump species and form:

red oak
sassafras
sand cherry

EXOTICS ENCROACHMENT:
Species:
california laurel

KARNER BLUE BUTTERFLY OCCURRENCE

Mark occurrence on map using circle to indicate an occurrence.

Total number of KBB adults:
Male: 5 Female: 5 Unknown: 5

\% of opening occupied: 5 \%

Survey effort:
Time spent in opening: 1.5 hrs
\% of area surveyed: 70 \%

Notes, observations, etc.:

*If the location(s) were good, fill out this section, otherwise leave blank

Type of unit: Karmin
Unit number: CPS map 75

Waypoint name\# (when using Garmin):
File name (when using Trimble):

OPTIONAL: Latitude: Longitude:

FEATURE INFORMATION (mandatory): Point: <12.5m in both dimensions Line: >12.5m in one dimension Polygon: >12.5m in both dimensions
Source Feature (circle one): Single Source EO Multi-Source EO Conceptual Feature Type (circle one): Point Line Polygon

LUPINE OCCURRENCE

Map lupine distribution. Use a \( \cdot \) for scattered plants, an \( \times \) for clumps, and circle (0) dense areas.

Overall distribution pattern (see codes):

\( \cdot \) 3\% Caterpillar feeding damage (circle) Y

Estimated % of area covered: 3\%

Estimated % of lupine blooming or in seed: 50\% Ants present: no

Evidence of Burning:

Comments:

Page 1 of 2
**NECTAR SPECIES PRESENT**

<table>
<thead>
<tr>
<th>Species</th>
<th>Blooming?</th>
<th>Distribution</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>milkweed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>corncob</td>
<td>X</td>
<td>sparse</td>
<td>along ag fields</td>
</tr>
<tr>
<td>hawkweed</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>droopy</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>goldened</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sweet clover</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agave</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yarrow</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>horse alfalfa</td>
<td>X</td>
<td>sparse</td>
<td></td>
</tr>
<tr>
<td>Helen's hair</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OTHER SPECIES PRESENT**

<table>
<thead>
<tr>
<th>Species</th>
<th>Number Observed</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>wood satyr</td>
<td>~20</td>
<td></td>
</tr>
<tr>
<td>black swallowtail</td>
<td>~8</td>
<td></td>
</tr>
<tr>
<td>unknown skippers</td>
<td>~3</td>
<td></td>
</tr>
<tr>
<td>orange sulphur</td>
<td>~1</td>
<td></td>
</tr>
</tbody>
</table>

*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 14. Datasheets from 17 July 2007 (Section A) Karner blue butterfly survey Cobb to Brickyard Line.
**KBB and LUPINE SURVEY FORM**

**SURVEYOR AND LOCATION INFORMATION**

Survey date: **2021-07-19**  
Time from: **9:25** to **11:25**  
SITE NAME: **Section A**  
Source Code: F  
QUAD CODE: **4308631**

Surveyors (principal surveyor first, include first & last name): 

**Site Condition Information**

Use space provided on back to sketch the area surveyed.

Type of opening (ROW, clearing, field, barrens, lawn):  
Vegetation surrounding opening (wooded, agriculture, etc.):  
Has the area been disturbed? (burn, cut, planted):  
Other threats to the area? (DRY, Mechanical, Herbivores, etc.):  
Light: __ open __ partial __ filtered __ shade  
Soil moisture: moist __ mesic __ dry __ xeric  
Ground cover description (Density: % bare soil, % grass/fornfern):  

**WOODY VEGETATION ENCROACHMENT**

<table>
<thead>
<tr>
<th>Height</th>
<th>Distribution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXOTICS ENCROACHMENT**

<table>
<thead>
<tr>
<th>Species</th>
<th>Distribution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**KARNER BLUE BUTTERFLY OCCURRENCE**

Mark occurrence on map using a **X** to indicate an occurrence

<table>
<thead>
<tr>
<th>Total number of KBB adults:</th>
<th>% of opening occupied</th>
<th>Survey effort: Time spent in opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male: 28</td>
<td>40%</td>
<td>2.15 hours</td>
</tr>
<tr>
<td>Female: 35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown: 11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If the location(s) were gpa'd, fill out this section, otherwise leave blank

Type of unit:  
Waypoint name # when using Garmin:  
File name when using Trimble:  
OPTIONAL: Latitude:  
Longitude:  

**FEATURE INFORMATION** (mandatory)  
Point: <12.5 m in both dimensions  
Line: >12.5 m in one dimension  
Polygon: >12.5 m in both dimensions

Source Feature (circle one): Single Source EC  
Multi-Source EC  
Conceptual Feature Type (circle one):  
Point  
Line  
Polygon

**LUPINE OCCURRENCE**

Map lupine distribution: Use a **O** for scattered plants, an **X** for clumps, and circle (0) dense areas

Overall distribution pattern (see codes):  
Estimated % of area covered:  
Caterpillar feeding damage (circle):  
Estimated % of lupine blooming or in seed:  
Ants present:  
Evidence of Browse:
**NECTAR SPECIES PRESENT**

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

<table>
<thead>
<tr>
<th>Species</th>
<th>Blooming?</th>
<th>Distribution</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>spotted beaupre</td>
<td>X</td>
<td>abundant</td>
<td></td>
</tr>
<tr>
<td>butterfly weed</td>
<td>X</td>
<td>sparse</td>
<td></td>
</tr>
<tr>
<td>black-eyed susan</td>
<td>X</td>
<td>scattered</td>
<td></td>
</tr>
<tr>
<td>flowering sponge</td>
<td>X</td>
<td>sparse, patchy</td>
<td></td>
</tr>
<tr>
<td>horsemint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Johnswort</td>
<td>X</td>
<td>sparse</td>
<td>near creek</td>
</tr>
<tr>
<td>bergamot</td>
<td>X</td>
<td>sparse</td>
<td></td>
</tr>
<tr>
<td>Phlox sp.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OTHER SPECIES PRESENT**

List other species observed at this site. Note especially listed species and potential predators.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number Observed</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>red-spotted purple</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>American copper</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>unknown skipper</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>known white</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>monarch</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>yellow swallowtail</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>black swallowtail</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

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 15. Datasheets from 17 July 2007 (Section B) Karner blue butterfly survey Cobb to Brickyard Line.
KBB and LUPINE SURVEY FORM

Fill out this section after the survey has been completed

KBB Present? NO Why? (see codes and circle all that apply) L N W S
YES X Certainty of location: >95% (location gps’d*) X 80 – 95% 20 – 80% 0 – 20% UNKN

SURVEYOR AND LOCATION INFORMATION

Survey date: 20.7.07-18 Time from: 11:30 to 12:30 pm SITENAME: Section Source code: F MIUS
Surveyors (principal surveyor first, include first & last name): Sticksel T. Olsen X
TOWNSHIP: N N RANGE: 14 W SECTON: QUARTER SECTION:

Weather (see codes page): Begin Temp: 18°F Begin Wind code: Begin Sky code:
End Temp: 82°F End Wind code: End Sky code:

SITE CONDITION INFORMATION

See map later

Use space provided on back to sketch the area surveyed.

Type of opening (ROW, clearing, field, barrens, lawn): Site of opening:
Vegetation surrounding opening (woody, agriculture, etc.):
Has this area been disturbed? (burn, cut, planted):
Other threats to the area? (GRV, Mechanical, Horses, etc.)

Light open partial filtered shade

MOSSY VEGETATION ENCROACHMENT:
Treeshrub/stump species and form

Height Distribution Notes

EXOTICS ENCROACHMENT
Species

Distribution Notes

KARNER BLUE BUTTERFLY OCCURRENCE

Mark occurrence on map using a X to indicate an occurrence

Total number of KBB adults:
Male Female Unknown % of opening occupied
41 31 13 45%

Survey effort:
Time spent in opening 2 hrs.
% of area surveyed 90%

Notes, observations, etc.

*If the location(s) were gps’d, fill out this section, otherwise leave blank
Type of unit:
Waypoint name/# (when using Garmin) File name (when using Trimble)
OPTIONAL: Latitude Longitude

FEATURE INFORMATION (mandatory) Point: <12.5 m 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 EO Conceptual Feature Type (circle one): Point Line Polygon

LUPINE OCCURRENCE

Map lupine distribution. Use a * for scattered plants, an X for clumps, and circle (O) dense areas

Overall distribution pattern (see codes):
Caterpillar feeding damage (circle) Y N
Estimated % of area covered:
Estimated % of lupine blooming or in seed:
Ants present:
Evidence of Browse:
Comments:
### NECTAR SPECIES PRESENT

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

<table>
<thead>
<tr>
<th>Species</th>
<th>Blooming?</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goldenrod spp.</td>
<td>X</td>
<td>sparse</td>
</tr>
<tr>
<td>bergamot</td>
<td>X</td>
<td>sparse</td>
</tr>
<tr>
<td>black-eyed susan</td>
<td>X</td>
<td>scattered</td>
</tr>
<tr>
<td>daisies</td>
<td>X</td>
<td>sparse</td>
</tr>
<tr>
<td>hawkweed</td>
<td>X</td>
<td>scattered</td>
</tr>
<tr>
<td>St. Johnswort</td>
<td>X</td>
<td>patchy</td>
</tr>
<tr>
<td>butterfly weed</td>
<td>X</td>
<td>sparse</td>
</tr>
<tr>
<td>harebell</td>
<td>X</td>
<td>patchy</td>
</tr>
<tr>
<td>spotted knapweed</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

### OTHER SPECIES PRESENT

List other species observed at this site. Note especially listed species and potential predators.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number Observed</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>buckeye</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>monarch</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>American copper</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>unknown skipper</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>unknown white</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>black swallowtail</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Eastern tailed blue</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

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.
KBB and LUPINE SURVEY FORM

Fill out this section after the survey has been completed

KBB Present: YES  X  NO  X

Why? (see codes and circle all that apply)  L  N  W  S

Certainty of location:  >95% (location GPS'd)  X 80 – 95%  20 – 80%  0 – 20%  UNKN

SURVEYOR AND LOCATION INFORMATION

Survey date: 2007-07-18  Time from 07:00 to 08:00

SITENAME: Section 2

Source code: F  S

Surveyors (principal surveyor first, include first & last name):

TOWNSHIP: 10N

RANGE: 15W

SECTION: 2 + 11

QUARTER SECTION:

OWNERSHIP:

QUAD CODE: 4304631

Weather (see codes page):

Begin Temp: 81°F  Begin Wind code: 4

Begin Sky code: 8

End Temp: 83°F  End Wind code: 3

End Sky code: 1

SITE CONDITION INFORMATION

See May data

Use space provided on back to sketch the area surveyed.

Type of opening (ROW, clearing, field, barren, 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 (xeric)

Ground cover description (Density, % bare soil, % grass/forb/fern):

WOODY VEGETATION ENCROACHMENT:

Height  Distribution  Notes

Tangle/stub/stump species and form

EXOTICS ENCROACHMENT:

Species

Distribution  Notes

KARNER BLUE BUTTERFLY OCCURRENCE

Mark occurrence on map using a to indicate an occurrence

Total number of KBB adults:

Male  Female  Unknown

% of opening occupied

Survey effort:

Time spent in opening 2 hrs.

% of area surveyed 70%

Notes, observations, etc.:

*If the location(s) were GPS'd, fill out this section, otherwise leave blank

Type of unit:

Waypoint name/ID

File name (when using Trimble)

OPTIONAL: Latitude  Longitude

FEATURE INFORMATION (mandatory)

Point: <12.5 m in both dimensions Line: >12.5 m in one dimension Polygon: >12.5 m in both dimensions

Source Feature (circle one): Single Source EO  Multi-Source EO  Conceptual Feature Type (circle one): Point  Line  Polygon

LUPINE OCCURRENCE

See May data

Map lupine distribution. Use a • for scattered plants, an X for clumps, and circle (O) for dense areas

Overall distribution pattern (see codes):

Estimated % of area covered:

Caterpillar feeding damage (circle) Y  N

Estimated % of lupine blooming or in seed:

Ants present: Y  N

Evidence of Browse:

Comments:
### NECTAR SPECIES PRESENT

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

<table>
<thead>
<tr>
<th>Species</th>
<th>Blooming</th>
<th>Yes</th>
<th>No</th>
<th>Distribution</th>
<th>Notes, observations, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>horse erinostem</td>
<td>X</td>
<td>2</td>
<td></td>
<td>patchy</td>
<td></td>
</tr>
<tr>
<td>spotted knapweed</td>
<td>X</td>
<td>3</td>
<td></td>
<td>patchy</td>
<td></td>
</tr>
<tr>
<td>goldencrod spp.</td>
<td>X</td>
<td>10</td>
<td></td>
<td>sparse</td>
<td></td>
</tr>
<tr>
<td>butterfly weed</td>
<td>X</td>
<td>10</td>
<td></td>
<td>sparse</td>
<td></td>
</tr>
<tr>
<td>aster sp.</td>
<td>X</td>
<td>5</td>
<td></td>
<td>sparse</td>
<td></td>
</tr>
<tr>
<td>coreopsis</td>
<td>X</td>
<td>10</td>
<td></td>
<td>scattered</td>
<td></td>
</tr>
<tr>
<td>St. Johnswort</td>
<td>X</td>
<td>2</td>
<td></td>
<td>patchy</td>
<td></td>
</tr>
<tr>
<td>flowering spurge</td>
<td>X</td>
<td>2</td>
<td></td>
<td>sparse</td>
<td></td>
</tr>
<tr>
<td>heavy althaea</td>
<td>X</td>
<td>5</td>
<td></td>
<td>sparse</td>
<td></td>
</tr>
<tr>
<td>Phlox sp.</td>
<td>X</td>
<td>2</td>
<td></td>
<td>patchy</td>
<td></td>
</tr>
<tr>
<td>Arnica sp.</td>
<td>X</td>
<td>2</td>
<td></td>
<td>sparse</td>
<td></td>
</tr>
</tbody>
</table>

### OTHER SPECIES PRESENT

List other species observed at this site. Note especially listed species and potential predators.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>cabbage white</td>
<td>15</td>
</tr>
<tr>
<td>American monarch</td>
<td>10</td>
</tr>
<tr>
<td>Eastern tiger swallowtail</td>
<td>10</td>
</tr>
<tr>
<td>Sulphur spp.</td>
<td>2</td>
</tr>
<tr>
<td>Monarch</td>
<td>2</td>
</tr>
</tbody>
</table>

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