

Wisconsin Statewide Karner Blue Butterfly
Habitat Conservation Plan

2010 - 2019

For

Application to Renew
Federal Fish and Wildlife Permit TE010064-5

Public Review Draft

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KBB HCP Partners User Guide



Wisconsin Karner Blue Butterfly
Habitat Conservation Plan
Updated 2009

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Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Chapter 1. Introduction

This chapter explains the need for updated and streamlining the Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan (HCP) and the improvements that distinguish this updated HCP from the original HCP.

☞ Overview

- ◆ Relationship of Updated HCP to Original HCP
- ◆ Reasons for Updating the Original HCP and HCP User's Guide
- ◆ Voluntary (Unregulated) Landowner Category Update
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☞ HCP Improvements: Revisions and Clarifications

A. Overview

Relationship of Updated HCP to Original HCP: This updated HCP is being submitted in 2009 with an application to the US. Fish and Wildlife Service (FWS) to renew the incidental take permit that has been in place since September 27, 1999. The HCP was updated to comprehensively incorporate numerous adaptive management and streamlining improvements that have been realized through experience, new data and research.

This HCP updates Chapter 2 of the original Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement (EIS) (March 2000) (WDNR 2000); Chapter 2 described the original HCP. This updated version of the HCP is a stand alone document and not part to a combined HCP/EIS as was the original HCP. Thus, this updated HCP replaces the original HCP and does not include the associated National Environmental Policy Act (NEPA) document. NEPA requirements for the updated HCP are being met through the development of an environmental assessment (EA) related to the FWS's issuance of an Endangered Species Act, as amended in 1973, (ESA) section 10 (a)(1)(B) incidental take permit for implementation of the

HCP. The original HCP/EIS still functions as a reference document for the updated HCP as it provides background information on all the HCP features and includes greater detail on the rationale and vision of the HCP Partners in designing this unique program during the period of 1994-1999.

The original HCP was developed from 1994-1999. *The HCP was written with 10 years in mind and based on less knowledge than is available in 2009.* It was anticipated that the Kbb might be recovered within 10 years or be well on its way to recovery in that time frame. Due to the greater threats to the Kbb, particularly in the states east of Michigan, the prospect and timeframe of range-wide recovery is much less certain in 2009 than it appeared to be in 1999. Therefore, this HCP reflects longer term planning.

The original 1999 HCP (WDNR 2000) included numerous conservation and operational strategies, many of which were considered unique at the time along with extensive discussion of the intentions and objectives for those strategies. The original HCP predated the FWS's addendum to the HCP Handbook also known as 5-point policy guidance (USFWS, 2000) (**USFWS 2000**) and the Final Karner Blue Butterfly Recovery Plan (USFWS 2003). Areas of the FWS's addendum to the HCP Handbook that were particularly helpful to updating the HCP related to setting biological goals, adaptive management and monitoring.

Reasons for Updating the Original HCP and HCP's User Guide: There was a need to consolidate the conservation measures found in the original HCP for easy access by partners to make accessing information for various HCP activities (e.g., land management activities, amendments and training) less cumbersome and confusing. The original HCP included conservation measures and direct instructions embedded in the body of the HCP, some of which were also duplicated in a few soup-to-nuts guidelines found in Appendix F of that HCP, e.g. Wildlife Management Guidelines for the Karner Blue Butterfly and Forest Management Guidelines. How well and to what degree these adopted methods would work for such a diverse group of HCP Partners was somewhat unknown without actual experience implementing the conservation plan. With the Kbb waiting for partners' beneficial disturbance the plan was to move forward with implementing the HCP with its original set of conservation measures and a strong commitment to an active adaptive management approach which embraces continuous improvement.

As the original HCP was being implemented conservation measures were refined; separate stand-alone guidelines and protocols were developed, often leaving direct instructions in the body of the HCP obsolete. It was very cumbersome to amend guidelines and protocols woven throughout the body of the HCP. Therefore, in this updated version of the HCP, the direct instructions and detailed conservation measures have been removed from the text of the document, making this HCP more general, informative and to the point. The body of the updated HCP provides information HCP partners need to know to assist them in implementing their HCP commitments. All conservation measures and specific HCP implementation instructions have been consolidated

for easy access and are now contained in the updated HCP User's Guide (*Refer to Appendix E and the HCP webpage, <http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>*). The User's Guide is a compilation of all of the HCP's management and monitoring guidelines and protocols, the procedures the Wisconsin DNR (DNR) and IOC use in administering the HCP, and operating procedures for Partners.

Voluntary (unregulated) Landowner Category Update: The Voluntary (unregulated) Landowner Category is one of the most innovative and unique strategies of the HCP. . As part of their commitment to the HCP, partners pledged to encourage Karner blue conservation on private lands in the Karner blue range, including voluntary, non-partner participants, which they do via numerous education and outreach activities. The automatic permit coverage for the incidental take of Karner blues by landowners in the Voluntary Group, and partner outreach/education campaign form the backbone of the voluntary participation strategy. The strategy is based on the expectation that many small landowners will contribute willingly to conservation programs when they are able to do so voluntarily, without legal requirements or mandates. The success of this innovative approach was assessed 3 years into implementation of the original HCP. The DNR's 3-Year Report to the Service on the effectiveness of outreach, education, and voluntary participation in the original HCP (WDNR 2003) highlights many activities conducted by private landowner to further the conservation of the Karner blue.

The voluntary participation strategy has proven to be a huge success. The approach has done more than expand the Karner blue range, it has helped to break down fears and misconceptions about endangered species law while building trust between private landowners and government agencies. Generally, Wisconsin landowners are no longer apprehensive about regulatory implications when they hear the name Karner blue. In fact, many landowners now embrace the idea of Karner blue conservation and are eager to find ways they can encourage Karner blue populations on their land.

While it is difficult to quantify the overall impact of the voluntary participation strategy, it is easy to recognize the products of this pressure-free inclusion campaign and the general awareness it has brought to the state. Partners have carried their stewardship message to millions of people, many of whom have gone on to pursue conservation and outreach efforts of their own. The evidence is all around us, from the freshly planted lupine patch in a Waupaca county backyard to the annual Karner Blue Butterfly Festival in Black River Falls. Karner blue conservation has turned into a Wisconsin phenomenon.

In addition, the HCP's Voluntary (unregulated) Landowner Category has extended partnerships between private landowners and various Federal land conservation programs including the FWS's Partners for Fish and Wildlife Program, the Natural Resource Conservation Service's Wildlife Habitat Improvement Program (WHIP) and the Farm Services Agency's State Acres for Wildlife Enhancement (SAFE) programs. The Voluntary (unregulated) Landowner Category continues to be a conservation strategy in the updated HCP (*Refer to Chapter 5*).

The Role of Karner Blue Recovery in the Updated HCP. One of the most significant realignments of conservation focus in this HCP is the voluntary assistance of HCP Partners in the Kbb recovery program. Based on the HCP Partners' assessment of the first ten years of implementing the HCP and the potential for an unanticipated long-term extension of the HCP program, they realized that to successfully conclude their conservation program, they must engage in recovery efforts for the species. This was not the philosophy in 1999 when several partners did not desire to assist with recovery of the butterfly but would help conserve the species.

The DNR is involved in the Karner Blue Butterfly Recovery Program by virtue of its agency mission. Therefore, the DNR's HCP commitments include assisting the FWS in recovery of the Kbb.

Managers of DNR properties, including those designated for recovery, receive their incidental take authority through the same Section 10(a)(1)(B) incidental take permit as the other partners. Therefore, the DNR must implement the HCP and follow much the same conservation measures and reporting procedures as all partners. The additional recovery role of DNR includes taking measures to "feature and enhance" Kbb habitat on DNR recovery properties and to implement, in some cases, enhanced conservation and habitat restoration practices that go above and beyond managing with consideration for the Kbb. Inversely, the unique role of other HCP Partners is to provide voluntary support to the DNR and to the recovery properties where their help will further the DNR's efforts to achieve recovery goals. (*Refer to Chapter 6 for more detailed information regarding Karner blue recovery.*).

B. Adaptive Management in Action

When the FWS issued an incidental take permit in 1999 for implementation of the HCP, the DNR, 25 HCP Partners and the FWS started off with caution; aware that there were uncertainties about the species and the range, and cognizant that when more experience was gained about how the monitoring system would work and what it would teach them that they would have to (want to) make adjustments. That time came in 2003. Improvements to the following systems were the result:

Monitoring Strategy Revisited: The effectiveness and self-monitoring strategies were re-evaluated. Originally these monitoring strategies implemented by the HCP partners provided valuable and important information on the Karner blue and its distribution. However, partners realized they were not as efficient, useful or biologically insightful as was needed. They needed to adapt. To that end in 2003 the HCP Partners' Implementation Oversight Committee (IOC) established a Monitoring Improvement Team (MIT) to assess the monitoring program and as a result, many improvements to the monitoring program were identified and implemented.

Guidelines and Protocols Validated and Reorganized: The HCP guidelines and protocols were revised (where needed) and reorganized. The IOC sponsored an effort to validate existing

conservation measures and reorganize management guidelines. This effort was initiated by the Guideline-Repacking-Improvement-Team (GRIT) and resulted in the “HCP User’s Guide” discussed above in this chapter.

With the realization that the HCP would be needed beyond 10 years, many other strategies, systems and procedures were developed. New partner inclusion processes for Limited Partners and new Full Partners were developed to engage 11 new county and township roadway managers as Limited Partners and 3 new Full Partners. As construction projects were being planned, a construction guideline and associated protocols evolved; and new protocols were developed for vibratory cable plowing and emergency situations. Also, administrative and operating procedures were needed to better document and direct future IOC and DNR program staff. Efforts are planned to continue developing better procedures and training materials. The DNR’s Karner Blue HCP webpage (<http://dnr.wi.gov/forestry/karner/>) and the User’s Guide will play a large role in institutionalizing and deploying HCP guidance and direction for as long as the HCP is needed.

The Karner Blue High Potential Range (HPR) gets a scientific adjustment. The Kbb HPR and the recovery areas were greatly enhanced as the result of a Kbb probability model made possible with several years of Partner data.

In collaboration with the DNR’s Division of Forestry, a Karner blue butterfly probability model was developed by the *Forest Landscape Ecology Lab, Department of Forest Ecology and Management at the University of Wisconsin-Madison (Sickley and Mladenoff 2007)*. This model utilized several years of Partners’ Kbb habitat and Kbb presence and absence data that was not previously available.

In the original HCP the Kbb recovery areas were included in areas called Significant Population Areas (SPAs), which were included within larger Areas of Conservation Emphasis (ACEs). The SPAs and ACEs were replaced with Biological Recovery Zones (BRZs), which were derived from the Kbb probability model in combination with Kbb locations on recovery properties. BRZs are Kbb population based, more scientific and benefit from a great deal more Kbb data than was available when the ACEs and SPAs were mapped. (*Refer to Chapter 6 and Figure 6.10 Karner Blue Butterfly Biological Recovery Zones on p. 51*). A full report on the probability model and the current HPR and BRZ maps are available on the DNR’s HCP Webpage (<http://dnr.wi.gov/forestry/karner/>)(*Refer to Chapter 2 of this HCP for more detailed information on the Kbb HPR*).

Adaptive management shifts into high gear –The HCP’s Five-Point Plan. Following the efforts noted above, the HCP Partners soon realized that a significant amount of new information had been accumulated that could be used to evaluate the effectiveness of the HCP more broadly. The Partners soon realized that the HCP’s adaptive management strategy, while excellent in concept was a passive system not directly engaged to make improvements in the HCP. It would

need to become an active system employed as the foundation of the monitoring improvement process (and all HCP processes). Armed with a raft of new data, the HCP Partners adopted the 5-Point Plan for Continuous Improvement in 1996. The 5-Point Plan provides a broad framework and structured set of benchmarks or themes for setting goals for adaptive management. Significant efforts to improve the HCP have been guided by the HCP's 5- Point Plan (*Refer to appendix C*).

The Five Points of the Plan include:

1. **FOCUS** HCP implementation on recovery areas. Focus on what really matters; the biological needs of the Kbb. De-emphasize that which does not contribute to recovery.
2. **STREAMLINE** processes. Eliminate non-value added activities.
3. **IMPROVE PROTOCOLS AND GUIDELINES**, i.e. monitoring and management protocols and guidelines.
4. **RECOVER** the Kbb in Wisconsin (DNR actively involved and other Partners in a voluntary support role)
5. **EXTEND** the **TERM** of the permit: Develop 10-Year ITP RENEWAL proposal. Evaluate progress and move forward. If the HCP is necessary after 2019, this can be repeated.

The Five-Point Plan was adopted by the HCP Partners in 2006, not only as an approach to jumpstart needed improvements, but as a guide for continuous improvement into the future.

C. HCP Improvements: Revisions and Clarifications

Numerous clarifications, revisions and a few amendments have been made to the updated HCP as more was learned through experience implementing the original HCP. Numerous other activities and protocols that were not envisioned at the onset were developed and added, e.g. vibratory cable plowing protocol. Listed are most of the significant and necessary improvements in the updated HCP made from about 2004 to 2009:

Revisions

- **No Surprises -- Changed Circumstances:** Wildfires and Gypsy moth infestation were removed from changed circumstances. Wildfires were removed because, from experience, wildfires provided (unplanned) beneficial habitat disturbance and Gypsy moth infestation did not apply for a number of reasons including the lack of appropriate conservation measures in the HCP and the likelihood that partners would not engage in Gypsy moth control activities. In addition, because the Gypsy Moth Program is funded by the U.S. Forest Service, a more appropriate review of this program is through the ESA section 7 consultation process.
- **Certificate of Inclusion authorization** has been stepped down from the FWS to DNR via an amendment to the DNR's incidental take permit (ITP) TE010064-5.
- **New Partners** have been added (14) as sub-permittees in the ITP.

- **“Lands Included”** – Partners redefined their “lands included” in the HCP in their Species and Habitat Conservation Plans (SHCAs) to reflect changes in the adjusted Kbb HPR.
- **New partner recruitment:** The broad ITP/Implementing Agreement (IA)/HCP requirement to actively recruit (into the HCP) all the entities listed in the original HCP’s Appendix D has been discontinued. While partners are still committed to broad outreach and education, direct, active recruitment efforts are best conducted in Biological Recovery Zones (BRZs) where they may benefit recovery of the Kbb.
- **DNR’s Landowner Contact and Assistance Program** commitment is withdrawn due to the loss of funding. This need is being filled through external collaboration.
- **Kbb High Potential Range (HPR):** The Kbb HPR was adjusted using a Kbb Probability Model.
- **Kbb recovery focus:** SPAs & ACEs in the original HCP were changed to Biological Recovery Zones (BRZs); outreach & education and new partner recruitment will be focused in BRZs.
- **Inclusion/Deletion of Element Occurrences (EOs):** New Kbb EOs have been added to the DNR’s Natural Heritage Inventory Database and a number have been removed, resulting in changes to the Kbb High Potential Range.
- **Monitoring Changes:**
 - Streamlined monitoring: The approach to monitoring was changed to focus surveying efforts where Kbbs are, or are likely to be, in order to apply conservation measures. The large effectiveness monitoring program, which included monitoring in locations where Kbb occurrences were unlikely and where no management actions were planned, was discontinued.
 - Cause-Effect (C-E) Monitoring: The C-E monitoring for shifting mosaic activities was discontinued.
 - Compliance Audits: Compliance audits have evolved over time with experience. Audits once focused primarily on understanding where to find conservation measures and on documentation of management actions conducted in occupied Kbb habitat; today there is a greater emphasis on assuring that Kbb conservation measures are applied correctly and consistently.
- **All conservation measures** were (and continue to be) evaluated and updated as appropriate.
- **Measuring and reporting incidental take** has evolved. Take = take of occupied lupine habitat. Other adjacent habitat components such as nectar areas are not included in the measure of take. However, these areas are included in the compensatory mitigation formula for permanent take.
- **The Partner Inclusion Application process** (for new Full and Limited Partners) was developed, which includes a new partner orientation program.
 - The Limited (Local) Partner designation evolved from the concept in the original HCP of a simple partner group for entities that only apply “Best Management Practices”, e.g. mowing roadside rights-of-way.
 - The Species and Habitat Conservation Agreement (SHCA) templates for Full Partners and Limited Partners were updated.

- **County Forest Long Term Habitat Plans** are no longer mandatory for those who originally committed to them. County forest partners will do these conservation efforts regardless.
- **The Articles of Partnership (AOP)** were updated in 2009. The original AOP's goals were focused on drafting an acceptable HCP and receiving an incidental take permit, which were accomplished. New goals were developed to reflect the ongoing conservation program.
- **HCP Annual Report** – miscellaneous updates were made that reflected changes in definitions, nomenclature and clarifications, e.g. what constitutes take, change from SPA to BRZ, etc.
- **Land Transfers** – The necessity to report land transfers within 45 days that take place in a BRZ was eliminated. Instead, direct recruitment of conservation assistance from landowners in BRZs where assistance is needed to achieve recovery goals will occur.
- **Timber harvest** over snow covered frozen ground measure to minimize take was deleted. What is important is to avoid impact to lupine areas whenever harvest occurs.

Clarifications

- **Permanent take vs. short term (temporary) take:** Permanent take is defined in the HCP as an activity that precludes Kbb occupation for at least 5 years. Many construction projects may destroy habitat, but it will be replaced within 5 years. This temporary loss of habitat is only short-term take by definition. Mitigation requirements are detailed in the construction guidance.
- **No Net Loss of Habitat (NNLOH)** – measuring the primary goal of the HCP: This has been an elusive metric for nearly a decade. In 2009 the HCP Partners got a handle on this and metrics are being incorporated in the annual reporting and compliance audit processes beginning with reporting year 2010.
- **One-time-permittees** can receive incidental take authority via the FWS's incidental take permit issued to the DNR for implementation of the HCP, but are technically not HCP Partners; they do not provide ongoing beneficial disturbance or participate in any way as a Partner.
- **Automatic permit coverage – Voluntary (unregulated) Landowner Category:** Automatic permit coverage for take of the Kbb is provided to landowners in the Voluntary Group via the FWS's incidental take permit issued to the DNR for implementation of the HCP; the coverage remains active only as long as the ITP is in effect.
- **Commercial Forestry:** Initially, the DNR distinguished the difference between commercial and non-commercial forestry by ownership size (1000 acres). The HCP did not intend to require landowners that had land in excess of 1000 acres but were not managing the land primarily for the production of forest products (e.g., educational camps, Boy Scout or Girl Scout camps, recreational land) to obtain a certificate of inclusion. This group is included in the Voluntary Landowner category.
- **The voluntary category** is authorized to do permanent incidental take.

Other Improvements: New Additions, Deletions and Changes

- **A Comprehensive HCP User’s Guide** was developed as a web-based repository for all management and monitoring guidelines and protocols, and all administrative and operational procedures. HCP conservation measures, survey protocols and forms are now in the Users Guide on the DNR’s HCP webpage (<http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>) to help assist partners with high staff turnover rates to orient new staff to the HCP.
- **Construction Guideline** (New): At the onset, no partners had construction projects planned that would impact Kbb. In time this changed, so guidelines were developed. This guidance is being implemented provisionally as experience is gained using them. The guidance includes these features:
 - Habitat Restoration Protocol
 - Egg Salvage Protocol
 - Temporary Work Space – A mechanism to cover take of Kbb in temporary work space has been developed that does not require amending SHCAs.
 - A mitigation planning tool, and
 - Provisions for implementing minor and routine maintenance activities.
- **Emergence Model** A Kbb emergence model was developed to predict the onset and the peak of each flight.
- **An Emergency Guideline** was developed to provide guidance and contingencies in the event of serious emergencies that preclude management with consideration by definition.
- **A Communication Plan** has been developed and has since been improved consistent with the HCP’s 5-Point Plan.
- **Recovery actions have been integrated into the HCP**, e.g. management protocols for the DNR (a recovery partner) include conservation measures to “feature and enhancement” the Kbb; these measure require a higher level of restoration (seed mix) and post-restoration management to be used on recovery properties.
- **Recovery Program Report in HCP Annual Reports:** In as much as the DNR’s recovery properties receive their incidental take authority through the HCP, information from recovery properties will be included in the HCP’s annual report. This will not replace the DNR’s Bureau of Endangered Resources Section 6 Kbb Recovery Report to the FWS.

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Chapter 2. The Karner Blue Butterfly in Wisconsin

This part of the HCP includes information about the Karner blue butterfly and its location in Wisconsin. It is divided into the following sections:

- ☞ Importance of Conservation Measures to Karner Blue Butterflies in Wisconsin
- ☞ Elements of Karner Blue Butterfly Ecology
- ☞ Distribution and Abundance: Potential Karner Blue Butterfly Habitat
- ☞ Distribution and Abundance: Karner Blue Butterfly

A. Importance of Conservation Measures to Karner Blue Butterflies in Wisconsin

The disappearance and fragmentation of the pine and oak savanna habitats, through a variety of causes, has been a major contributor to the range-wide decline of the Karner blue butterfly (USFWS 1992a, 1992b; and works cited therein). In addition, natural plant succession in these habitats has eliminated Karner blue butterflies from some areas.

In locations other than Wisconsin and Michigan, the abundance of Karner blue butterflies has declined significantly. Karner blue butterflies have been extirpated from Iowa, Ohio, Ontario, Maine, Massachusetts, New Jersey, New Hampshire and Pennsylvania, appear to be extirpated in Illinois, and persist in only remnant populations in Minnesota, Indiana and New York (Iftner, *et al.* 1992; Baker 1994; Packer 1994; USFWS 1997). Karner blue butterfly reintroductions are ongoing in Ohio, New Hampshire and southeast Michigan. Population augmentations are being done in Indiana and New York. Due to the lack of viable populations of the butterfly in several states and the relative abundance of this species' populations in Wisconsin and Michigan, Wisconsin plays an important role in protecting Karner blue butterflies.

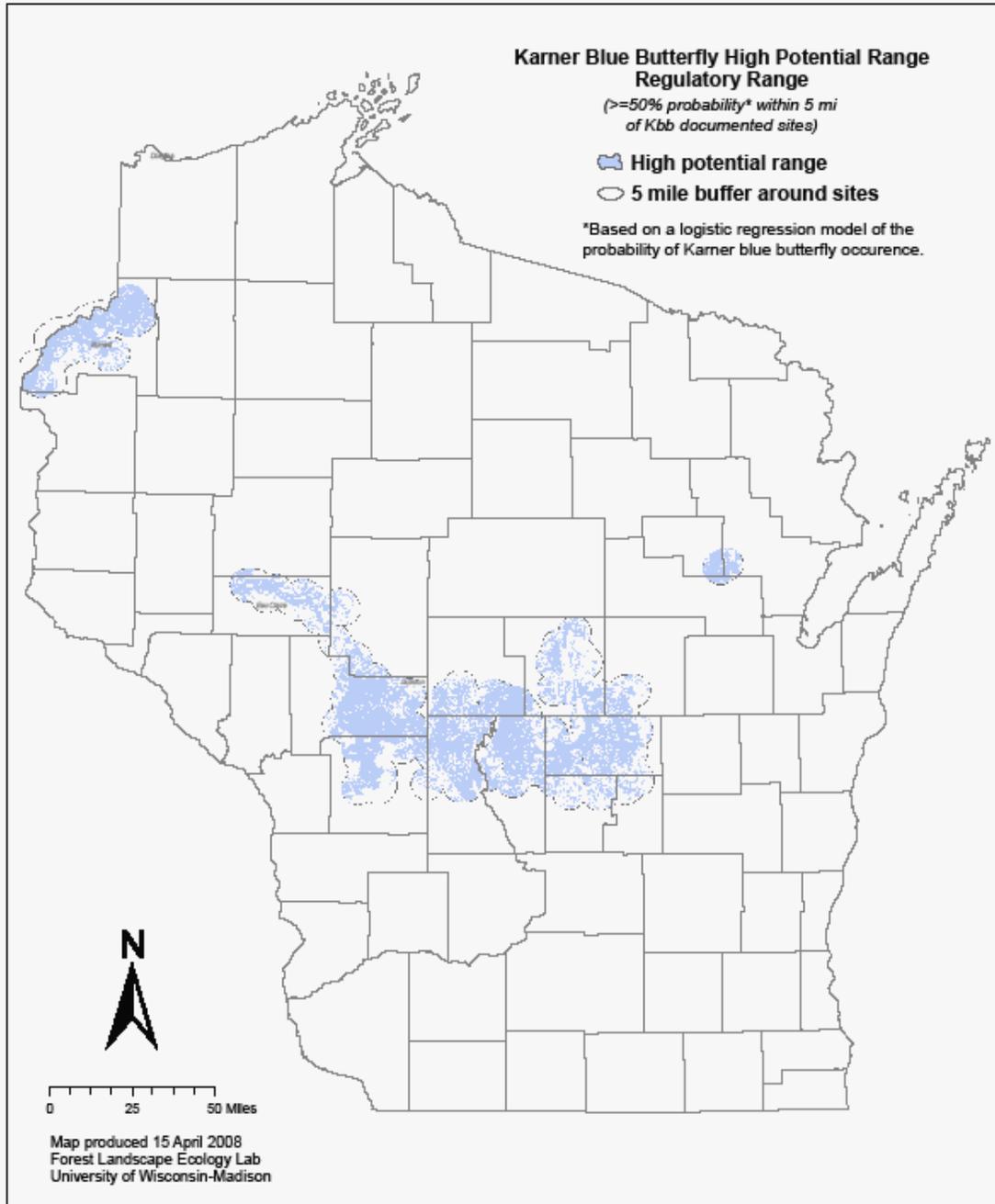
B. Elements of Karner Blue Butterfly Ecology

The Karner blue butterfly depends on the leaves of the wild lupine (*Lupinus perennis*) in its larval phase. The wild lupine in turn depends on periodic disturbance to allow it to succeed in the face of competing vegetation. This dynamic represents a unique paradox in endangered species protection and habitat conservation. (*Refer to Appendix A for detailed biological information on the Karner blue butterfly and its habitat.*)

C. Distribution and Abundance: Potential Karner Blue Butterfly Habitat

This section briefly describes the distribution and abundance of known and potential Karner blue butterfly habitat. Potential habitat is defined as habitat that will meet certain biotic and abiotic conditions to support wild lupine at any point in time. Known habitat is defined as those surveyed areas where wild lupine has been found and which can support Karner blue butterflies. Known-occupied habitat is an area that currently supports Karner blue butterflies in association with wild lupine.

To assist the HCP partners in predicting where potential Karner blue butterfly habitat may occur throughout the state, Geographic Information System (GIS) technology was used to develop a series of progressively more informed maps from 1995 through 2009. In February 2007 the HCP Partners adopted a new Karner Blue Butterfly High Potential Range (HPR) (*See Figure 2.10. below*) based on a probability model developed by the Forest Landscape Ecology Lab at the Department of Forest Ecology and Management at the University of Wisconsin-Madison. The most current HPR map can be found on the Karner Blue HCP Webpage: <http://dnr.wi.gov/forestry/karner/>

Figure 2.10. Karner Blue Butterfly High Potential Range

D. Distribution and Abundance: Karner Blue Butterfly

Prior to 1990, information on the current status of the Karner blue butterfly in Wisconsin was lacking. Only 36 historical occurrences were known from the state (e.g., there was a 1921 record from Menominee County; in the 1960s, Karner blue butterflies were reported from Burnett County in northwestern Wisconsin [Royer 1962, Shapiro 1969]).

Today, Karner blue butterfly populations in Wisconsin are concentrated across the central counties and in the far northwest on sandy soil areas of Burnett County (Table 2.10, page 47).

Wisconsin supports the largest and most widespread Karner blue populations worldwide. As of 2009, at least 305 Karner blue butterfly element occurrences in the DNR's Natural Heritage Inventory (NHI) database were believed to be extant (T. Hyde, Bureau of Endangered Resources, pers. comm.). An "element occurrence" is a discrete record of Karner blue butterfly occupation as tracked by the NHI; some occurrences may be combined into single populations or metapopulations pending further research on Karner blue butterfly dispersal and behavior. These 305 element occurrences are grouped into about fifteen large population areas. Based on NHI data, most of these larger populations are found on sizable contiguous acreages in central Wisconsin and are concentrated in five general regions of the state:

West-Central Wisconsin (southern portion)

(including Jackson County and Black River State Forests and Fort McCoy Military Reservation)

West-Central Wisconsin (northern portion)

(including Eau Claire and Clark County forests)

Central Wisconsin

(including Necedah National Wildlife Refuge, Sandhill State Wildlife Area, Volk Field Air National Guard Hardwood Air to Surface Gunnery Range, and throughout the northern half of Adams County on private lands)

East-Central Wisconsin

(including Hartman Creek State Park and Emmons Creek State Fishery Area and scattered across the largely agricultural landscape on several smaller public and private properties)

Northwest Wisconsin

(including Crex Meadows State Wildlife Area, Fish Lake State Wildlife Area, Governor Knowles State Forest and Burnett County Forest)

Table 2.10. Wisconsin Counties with Known Karner Blue Butterfly Occurrences (Based on NHI Data through 2007)

Burnett	Monroe	Waushara
Eau Claire	Wood	Waupaca
Clark	Juneau	Marquette
Jackson	Adams	**Chippewa
Menominee	Portage	**Barron
Oconto	**Dunn	**Polk
*Sauk	*Kenosha	Shawano
Green Lake	**Outagamie	

* Records in these counties have not been verified and likely do not exist.

** NHI records in these counties were investigated in 2007 and it was found that Kbb likely never occurred at these sites.

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Chapter 3. Land Conservation Strategies

This part of the HCP identifies acreages and land management measures contributed by the HCP Partners to benefit the Karner blue butterfly while maintaining a variety of land uses, including social and economic uses. This part is divided into the following five sections:

- ☞ Measuring Conservation in this HCP
- ☞ Acreages Included in the HCP and Categories of Management
- ☞ Partner Groups
- ☞ Broad Conservation Strategies
- ☞ Land Management Activities

Direct land management efforts represent a significant portion of the Wisconsin Karner blue butterfly habitat conservation efforts. These conservation efforts routinely enhance habitat and are not applied to management just on occupied habitat. Additional activities will also be necessary for the success of the HCP. For example, many Partners will help maintain a broad state wide distribution of Karner blue butterflies through public outreach and education efforts, which encourage participation in butterfly conservation.

Part A. Measuring Conservation in this HCP

Insect conservation efforts are based on different premises than traditional vertebrate conservation efforts. The Karner blue butterfly, like most insect species, has adapted to survive by producing relatively large numbers of eggs and large populations, with short life spans of individual animals and frequent generation turnovers. Most of the Karner blue butterfly's life is spent in the egg and larval stages. Natural mortality rates during these immature life stages are much greater than mortality rates observed for vertebrate animals. The survival strategy of the Karner blue butterfly relies on the success of overall populations rather than individual animals. To accommodate this strategy, a focus on habitat conservation and the success of populations -- rather than individuals -- is key to butterfly preservation (Scott 1986). Accordingly, the emphasis of this HCP moves away from the traditional measuring of the take of individual specimens of a listed species and toward managing for conservation of habitat and large populations.

Short-term Take. The long-term viability of Karner blue butterfly populations depends on habitat disturbance. Without periodic disturbance, natural woody succession shades out wild lupine and nectar plants and can passively eliminate Karner blue butterfly populations. Management of early successional habitat and creation of new habitat to replace habitat lost to

natural succession is therefore necessary. This reality underscores the need for managing landscapes for a dynamic, shifting mosaic of populations. Fortunately, *many* land management activities, such as those used in forest management and utility right-of-way maintenance, provide such disturbances.

In situations like this, take is best measured in the context of the overall balance of habitat loss to habitat gain; and temporary population declines to enduring population viability. It is not possible, in a defensible manner, to accurately express the take of individual Karner blue butterflies resulting from land management activities. Locations and numbers of individuals, particularly in the larval and egg stages, are usually unknown. Furthermore, similar activities can produce variable mortality rates. Although management activities may result in some mortality, the absence of short-term disturbance would result in greater long-term losses.

Definition: Short-term take is an impact to occupied Karner blue butterfly habitat resulting from land management or land use activities, which results in habitat disturbance that renews declining habitat and/or restores habitat to replace habitat lost to succession or as a result of a land use activity. Short-term take is conducted following approved conservation measures in the HCP in a manner to avoid and/or minimize harm to the KBB (e.g. through appropriate timing of activities, selective routing and siting of projects, etc.) and maintain, enhance, and/or restore KBB habitat.

Such short-term impacts allow Kbb survival and/or the restoration and reoccupation of the site within five years. Activities or projects that may fall within the definition of short-term take include, but are not limited to:

- mowing of roadside rights-of-way
- repairing roadside ditches to restore proper drainage
- roadside ROW improvements
- brush removal along utility corridors
- forest management practices
- conservation management, e.g. mowing and brushing for wildlife management, herbicide applications, prescribed burning, etc.
- pipeline and road construction, electrical and cable installations, and other construction and development projects that DO NOT cover or replace the habitat in a permanent manner (see definition of permanent take) and allow for habitat restoration and Kbb re-occupation within 5 years.

Permanent Take. Consequently, a more meaningful conservation measure is the *impact to habitat that precludes Karner blue butterfly occupation in the foreseeable future*. Examples of permanent take include paving or flooding existing occupied habitat. Activities are anticipated by some Partners (e.g. utility construction, flowage construction, road development, etc.) that could result in permanent take of occupied Karner blue butterfly habitat. If a Partner decides to move forward with any of these activities in the High Potential Range, surveys in the affected

areas will occur prior to the activity. If the potentially affected areas are found to be occupied, the occupied area will be avoided to the greatest extent practicable. If the occupied areas cannot be avoided and permanent take is anticipated, a mitigation plan, which must be approved by the DNR and the USFWS, will be developed. Mitigation will be encouraged to take place on recovery properties where long term Karner blue management is committed. ***Mitigation is required for all permanent take.*** Partners are encouraged to begin coordinating with the DNR and the USFWS as early as possible and prior to the permanent take to insure plans meet with agency approval. In cases where executed plans do not meet with the approval of the DNR and USFWS, remediation work by the Partner will be required.

Definition: Permanent take is an impact to Karner blue butterfly habitat, through land management or land use activities, that precludes Karner blue butterfly occupation. Such long-term impact involves taking that does not allow for the restoration and reoccupation of the site for a minimum of five years. Activities or projects that may fall within the definition of permanent take include, but are not limited to:

- construction of roadways and parking lots;
- construction of buildings or structures and associated facilities;
- other construction or development projects that cover or replace the habitat in a permanent manner (at least 5 years), such as an airport or a flowage; and
- residential housing developments. [Note: This category does not include a permanent or second home and associated structures that are owned or built by the owner for his or her own use. This provision applies only to those housing developments approved after the date of permit issuance.]

One-time Permittee. Permanent take by certain categories of non-partner landowners will be accounted for through the one-time permittee provision in the landowner participation plan outlined in Chapter 5 of the HCP (see pages 45-46).

Part B. Acreages Included in the HCP and Categories of Management

Table 3.11 (20-22) identifies total partner acreage included in the HCP. This acreage is a subset of the total acreage Partners own and manage (**821,963** of 2.03 million acres). To be listed in Table 3.11, the acres needed to be: (1) capable of supporting the Karner blue butterfly now or in the future (i.e., within High Potential Range and on appropriate sandy soils) and (2) chosen by the individual Partners for inclusion under the permit.

Appendix A of each individual partner's conservation agreement identifies the "lands included" by acreage and location that are subject to pre-management surveys and approved conservation measures identified in the HCP and/or the Partner's conservation agreement. The "lands included" are those lands in the High Potential Range, most of which are capable of supporting the Karner blue butterfly, primarily because they contain sandy soils. Partners will add acreage to this category if found to be occupied or have the high potential to become occupied. Partners can

receive permit coverage for acreage added to this category through a “land transfer” process, as defined by the DNR. Maps of included acreage will be updated by the Partners as needed.

The ITP will cover all partner-owned and managed lands in the state (a total of greater than 2 million acres), as well as all acreage included in the private and public voluntary status under the Landowner Inclusion Strategy (see Chapter 5 of the HCP for details of the landowner participation plan, pages 43-49).

Partners intend to manage the acreage identified for inclusion in the HCP with some level of positive consideration for the Karner blue butterfly. Management levels to benefit the Karner blue butterfly will vary across partner activities and economic goals. There are two distinct levels of focus:

- ☞ management *with consideration* for the Karner blue butterfly and its habitat, and
- ☞ management *to feature and enhance* the Karner blue butterfly and its habitat.

(Refer to Table 3.12 on page 22 for examples of activities for these two management categories.)

Management with Consideration for the Karner Blue Butterfly and its Habitat. This management category represents lands owned or managed by Partners on which consideration for the Karner blue butterfly and its habitat will be incorporated into routine land management activities. Acreage in this category may include an entire, dynamic landscape with only portions occupied by the Karner blue butterfly at any given time. Although consideration measures will vary according to the land, activity and Partner, the long-term biological goal of this management focus is for butterfly habitat gains to equal or exceed losses occurring through natural succession or otherwise. *(Refer to the HCP goal of No Net Loss of Habitat in Chapter 4 of the HCP.)*

Land management activities for HCP acres in this category will primarily reflect the individual land management goals of the Partner, e.g. maintaining access to utility rights-of-way to restore power after a storm, to harvest timber, to maintain roadside rights-of-way for safe use of roads, etc. However, the land manager will apply management for these objectives in ways that are considerate of the Karner blue butterfly and its habitat needs, i.e. the HCP management guidelines and protocols. The first step of consideration for the butterfly is to determine if Karner blue butterflies are present or absent on or near areas of planned activity. If an area is occupied, the Partner will follow the conservation measures outlined in the applicable HCP management protocols in the HCP User’s Guide. Conservation measures are designed to minimize impacts to Karner blues while providing necessary and beneficial disturbance to encourage habitat viability.

Management to Feature and Enhance the Karner Blue Butterfly and its Habitat. This management category represents lands that are owned or managed by Partners on which one of

the primary management goal is to feature Karner blue butterfly habitat or the broader barrens community that includes it. This may be accomplished through habitat management, enhancement, or restoration activities that promote wild blue lupine, nectar plants, microhabitat, or habitat heterogeneity for the Karner blue butterfly. As with the management with consideration level, these lands are managed with the biological goal and expectation that Karner blue habitat gains will equal or exceed losses. Additional measures are taken, however, to promote viable Karner blue butterfly populations despite potential economic costs.

Managing with consideration and managing to feature and enhance share in common the same management protocols. The greatest distinction is in the level of conservation in each focus. The most significant difference is seen in the options for habitat restoration described below. (*Refer to “Habitat Restoration Protocol” in the HCP User’s Guide in Appendix E.*)

Types of Karner Blue Butterfly Habitat Restoration

- **Habitat Replacement** *if Managing with Consideration*

Habitat Replacement restorations are conducted in response to construction, maintenance, management and repair activities and are meant to replace habitat lost as a result of these activities. These restorations are designed to provide the basic components (lupine and nectar plant requirements) of suitable Kbb habitat; and are **not** necessarily intended to restore optimal quality barrens flora.

- **Habitat Restoration** *if Managing to Feature and Enhance*

In restorations intended to feature and enhance Kbb’s, the creation of quality barrens and prairie habitat is also considered. Restorations of this type not only benefit Kbb’s, but also a broad range of associated barrens species. This type of restoration, like habitat replacement, is expected to meet basic lupine and nectar plant requirements for the Kbb. However, planting a diverse seed mix is strongly encouraged to provide as much benefit as possible to other barrens species.

Table 3.11. Partner Acres in the HPR Included in the HCP and Subject to Monitoring, Management and Reporting

Full Partners	Acreages Included in HCP		
	Mgmt. with Consideration	Mgmt. to Feature, Protect, & Enhance	Total
Forest Industry			
New Page Wisconsin System Inc	1,115		1,115
Plum Creek Timber Company	53,900		53,900
Johnson Timber Corporation - Futurewood	70		70
Wausau Paper Corp.	875		875
Wisconsin River Power Company	5,159		5,159
County Forests			
Burnett County	107,744		107,744
Clark County	134,638		134,638
Eau Claire County	27,270	730	28,000
Jackson County	28,900	6,100	35,000
Juneau County	18,911		18,911
Monroe County	6,844		6,844
Washburn County	295		295
Wood County	38,049		38,049
Wisconsin State Agencies			
Department of Natural Resources	48,994	17,347	66,341
Department of Transportation	8,052		8,052

Table continues on next page.

Table 3.11. Partner Acres in the HPR Included in the HCP and Subject to Monitoring, Management and Reporting, Continued

Full Partners	Acreages Included in HCP		
	Mgmt. with Consideration	Mgmt. to Feature, Protect, & Enhance	Total
Utility Managers			
Adams Columbia Electric Cooperative	1,951		1,951
Alliant Energy – WP&L	275,635		275,635
American Transmission Company, LLC	5,117		5,117
ANR Pipeline – TransCanada Corporation	764		764
Enbridge Energy Company, Inc.	353		353
Northwestern Wisconsin Electric Company	1,500		1,500
Oakdale Electric Cooperative	6,196		6,196
Polk-Burnett Electric Cooperative	1,889		1,889
Wisconsin Gas Company - WeEnergy	889		889
Wisconsin Public Service Corporation	4,724		4,724
Xcel Energy, Inc.	5,980	20	6,000
Limited (Local) Partners			
Adams County Highway Department	2,000		2,000
Adams, Town of (Adams County Wisconsin)	550		550
Burnett County Highway Department	856		856
Eau Claire County Highway Department	3,568		3,568
Foster, Town of (Clark County Wisconsin)	10		10
Juneau County Highway Department	852		852
Lincoln, Town of (Burnett County Wisconsin)	245		245
Millston, Town of (Jackson County Wisconsin)	480		480
Quincy, Town of (Adams County Wisconsin)	21		21
Swiss, Town of (Burnett County Wisconsin)	688		688
Waupaca County Highway Department	2,682		2,682
TOTAL ACRES INCLUDED IN HCP			821,963
Other Partners	Acreages Not Applicable		

Wisconsin Department of Agriculture, Trade and Consumer Protection
Thilmany, LLC

The figures shown in Table 3.11 (above) reflect partner lands known to be suitable to support Karner blue butterfly populations. Additional acreages owned by individual Partners may become included in the HCP at a later date, if information supports the suitability of those lands to maintain Karner blue butterflies.

Table 2.12. Examples of Activities Included in Each Management Category
(Note: Specific options may not be employed by all partners.)

Management with Consideration for the Karner Blue Butterfly and its Habitat	Management to Protect or Enhance the Karner Blue Butterfly and its Habitat
Biological Goal: Habitat gains equal or exceed losses and continue to provide habitat	Biological Goal: Habitat gains equal or exceed losses and continue providing habitat, but also extra steps to promote/maintain higher Karner populations, sacrificing some economic return
➤ Pre-management presence/absence surveys	➤ Pre-management presence/absence surveys
➤ Training of staff for Karner blue butterfly and lupine presence/absence	➤ Habitat assessment and suitability studies
➤ Alter timing of disturbance (mowing, harvest, herbicide applications, etc.)	➤ Monitor effects of management on Karner blue butterfly and associated habitat
➤ Limit or cease application of some pesticides	➤ Manage for habitat heterogeneity
➤ Managing forest types to maintain short lived, intolerant species; i.e. jack pine vs. red pine or white pine	➤ Stock timber stands less densely
➤ Maintain pine forest types with seed bed preparation, commercial harvest and natural regeneration from on site seed sources	➤ Create and maintain dispersal corridors to promote subpopulation connection
➤ Leave a scattered distribution of large diameter oak or long lived conifers to provide scattered shade across Karner blue butterfly habitats	➤ Participate in research projects related to population viability, habitat quality
➤ Incorporate forest stand inventory attributes to indicate lupine and/or Karner blue butterfly occurrence which will assist GIS planning and shifting mosaic scheduling	➤ Barrens restoration or conversion work (from forest)
➤ Avoid building new access roads or recreational trails through high Karner blue butterfly occupied habitat	➤ Planting lupine, nectar plants in new openings if necessary

Management with Consideration for the Karner Blue Butterfly and its Habitat

- Continue updating lupine occurrence map for partner lands. Refine association between Forest Habitat Type Classification System and wild lupine occurrence
- Use patch scarification rather than furrowing when establishing jack pine plantations

Management to Protect or Enhance the Karner Blue Butterfly and its Habitat

- Create or maintain long-term barrens habitat
- Participate in Karner Blue Butterfly Recovery Plan

Recovery-related Acreage. One of the Partners, the DNR, will be involved in federal recovery efforts for the Karner blue butterfly. In this instance, partner acreages committed to federal recovery may be the same as those intended for Management to Feature and Enhance the Karner blue butterfly or its habitat. See Chapter 6 of the HCP (pages 52-53) for more information on federal recovery efforts in Wisconsin.

Part C. Partner Groups

For planning and evaluation purposes, the HCP Partners are grouped into six categories based on the similarities in history and long-term management goals. The transportation group is further divided into two strata based on level of participation and involvement. These six groups are briefly discussed below and include:

Full Partner Groups

- ☞ Forest Industry
- ☞ County Forests
- ☞ State (DNR) Lands
- ☞ Utilities
- ☞ Transportation (WDOT)
- ☞ Other Partners

Limited (Local) Partner Group

- ☞ Transportation (county highway departments and townships)

Forest Industry. Members of this partner group manage land for forest products. Most of these Partners have manufacturing facilities in the state, which require a continuous source of wood fiber. Lands owned and managed by these companies provide a portion of this raw material.

County Forests. The County Forest program began in 1927 following passage of the County Forest Crop Law which authorized counties to create county forests. Under the current County Forest Law, 28 counties own approximately 2.25 million acres. Eight of these counties are HCP Partners.

County forests serve multiple purposes. Timber production, public recreation, wildlife and water quality protection all co-exist through mixed use management. The Karner blue butterfly occupies some county forest lands, giving continued opportunities to affirm the wildlife protection aspect of multiple-use.

State (DNR) Lands. Wisconsin recognized the need many years ago to protect, manage and provide for public use of its natural resources. Since 1876, Wisconsin has been acquiring land to meet state conservation and recreation goals. As of March 31, 2009, holdings amounted to more than 1.6 million acres. Properties owned by the State of Wisconsin carry many designations, including Wildlife Management Areas, Fisheries Management Areas, State Forests, State Recreation Areas, Wild Rivers and River ways,

State Parks, State Trails and State Natural Areas. The DNR continues to acquire, manage and conserve land according to statutory mandates and legislative programs.

Twenty-two of the properties owned or managed by the DNR are occupied by Karner blue butterflies. These butterfly populations occupy a total of approximately 1,200 acres of lupine habitat. Although five other DNR properties are believed to have the potential to support Karner blue butterfly populations, they are not known to be occupied.

The DNR intends to manage in excess of 66,000 acres of sandy soils either with consideration for or to feature the Karner blue butterfly and has included these lands in the HCP. The Karner blue butterfly is one of many considerations that must be integrated into the management of state lands. The success of these management efforts is measured in the ability of future generations to enjoy the same quality of environmental and recreational opportunities available today.

Utilities. This partner group manages easements for the construction and maintenance of: (1) overhead electrical transmission lines, and (2) underground electrical, gas and oil lines. Some of the transmission line corridors or rights-of-way (ROWs) have been in place since the early 1900s. Over the years, ROWs have been managed to reduce the growth of woody vegetation. For both overhead and underground lines, a clear ROW provides line access and reduces the likelihood of woody growth disrupting the line. In a few cases, the Partner owns the ROW for its utility line, but ROWs are predominantly easements from private landowners. These private landowners may have management issues separate from the utility company.

Transportation. The transportation group participates on two different levels:

- ☞ Full Partner (Wisconsin Department of Transportation)
- ☞ Limited (or Local) Partners (county highway departments and townships)

As one of the original Partners that developed and guided the implementation of the HCP, the Wisconsin Department of Transportation (DOT) is a Full Partner in the HCP. DOT is responsible for providing quality facilities and services for a variety of modes of transportation. Wisconsin's major investment is in the State Trunk Highway System, which began in 1918. Today, this system encompasses 130,000 acres of right-of-way (ROW). Depending on the type of road, remaining roadsides in ROW corridors range from twenty feet wide or less along the older highways to over 100 feet wide along some sections of interstate highways and other freeways. Medians provide additional vegetation, with widths generally varying between 40 and 60 feet wide.

State highway roadsides protect the highway facility by providing proper drainage and safe areas for errant or disabled vehicles. Roadsides sometimes accommodate utilities such as overhead or underground communication and power lines. Rest areas, waysides, scenic overlooks, historical markers and similar tourist amenities are also considered part of the highway roadside.

Limited (Local) Partners. In the HCP, the DNR and FWS committed to develop a standard process and concise and applicable conservation measures to ease evaluation of applications and issuance of Certificates of Inclusion (CI) for local governmental bodies engaged in road ROW/corridor maintenance. For the purposes of inclusion in the HCP, this type of entity is referred to as a “Limited Partner”. Limited Partners can be generally characterized as performing a limited suite of management activities typically resulting in short term take and subsequently, favorable habitat conditions. Conservation measures for their activities mostly fit into predefined best management practices. Limited Partners most often will have limited resources to apply to KBB conservation efforts. Therefore, Limited Partners will have abbreviated surveying and monitoring responsibilities, are not required to participate as full members on the HCP Team, nor are they required to subscribe to the Articles of Partnership or have a formal partner vote.

Other Partners. The Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) is also a Full Partner. They do not own or manage land and thus has a special role in the HCP. The DATCP's Bureau of Agrichemical Management pesticide and compliance programs carry out activities designed to protect endangered species from pesticide harm. These programs design, review and enforce pesticide use and labeling including the provisions of enforceable EPA Bulletins for pesticide labels. DATCP develops and provides pesticide protection guidelines for the KBB HCP, and responds to inquiries and complaints related to product use and misuse. The DATCP plays a key role in the landowner inclusion strategy discussed in Chapter 6 of the HCP (page 50).

Part D. Broad Conservation Strategies

The HCP Partners have worked on the land, managing the natural resources for many years. Respective land management goals have been shaped by certain values, as well as available amenities and commodities. Partners have developed strategies to allow for these benefits while integrating considerations for Karner blue butterfly habitat conservation. Such strategies have evolved from the observation and study of past management that was seemingly beneficial to the Karner blue butterfly.

Partners identified the following broad strategies as possible options for conserving and fostering the Karner blue butterfly:

- ☞ management for long-term habitat,
- ☞ management for a shifting mosaic of habitat,
- ☞ management for dispersal corridors, and
- ☞ compensatory mitigation strategies.

Each of these strategies is discussed below. Partners have chosen to apply one, several, or all of these strategies to their respective lands.

Management for Long-Term Habitat. For Partners who have so chosen, some lands will be designated for the long-term maintenance of Karner blue butterfly habitat. In this

context, long-term is defined as a period extending beyond the successional timeframe in which a site provides suitable Karner blue habitat following disturbance. The most common long-term habitat strategy will be barrens community restoration and management (as on several DNR properties). Areas not qualifying as barrens community, such as lupine habitat along road and utility corridors, may also be managed on a long-term basis through periodic mowing. Ongoing disturbance maintains an early successional community and is most often accomplished through fire or mowing rotation intervals of three to ten years, although evidence suggests longer rotations (e.g., 20-50 years) may provide excellent Karner blue butterfly habitat in many cases (e.g., in areas with very poor soils or areas affected by oak wilt). While mortalities within the local Karner blue butterfly population may occur in recently burned or mowed areas, reoccupation from surviving patches or adjoining populations may occur within one or two Karner blue butterfly generations.

Management for a Shifting Mosaic of Habitat. Forestry partners consider management opportunities to promote a shifting mosaic that will maintain Karner blue butterfly habitat in a diverse patchwork of forested stands in a slowly changing distribution over time across the larger landscape. Forest management with consideration for the Kbb is planned at the landscape level, but applied at the forest stand level to create or enhance habitat occupied by the Kbb. "Shifting mosaic" is a conservation strategy developed for application on any forest lands that are occupied by Kbb. The strategy is designed to provide a continued availability of Kbb habitat across the landscape by using a preplanned rotational harvesting pattern. As forest stands occupied by Kbb grow and mature they eventually shade out Kbb habitat. Local Kbb populations are normally extirpated through the process of natural succession unless other suitable habitat is available.

Under the shifting mosaic strategy, large blocks of forest surrounding an occupied Kbb site are divided into a series of smaller cutting units. Harvesting dates for these cutting units are staggered so that the Kbb population always has a recently cutover area within dispersal distance. The units are clear-cut, removing all overstory vegetation. This allows dormant lupine and nectar plants, if present in the soil seed bank, to regenerate and create habitat suitable for Kbb occupation. When a currently occupied site phases out of suitable habitat due to natural succession, the Kbb population can shift to another suitable site created through the shifting mosaic strategy. Management activities are likely to cause some incidental take of Kbb, but the renewed habitat that may result will more than offset the losses.

Likewise, the planned location of more permanent type openings such as log landings can be strategically incorporated into timber harvests to provide increased habitat potential. Based on the observations and experiences of land managers, such landings have provided excellent habitat patches that are occupied by the Karner blue butterflies. Linking landings with roads or trails, which can be designed into a timber sale or management activity, will provide potential corridors of habitat and a dispersal network for the Karner blue butterfly.

This is a long term strategy that can maintain and expand Kbb populations on a forest landscape indefinitely. It provides long term financial returns for the landowner while conserving Kbb habitat and populations. This provides a considerable incentive for private and industrial forest landowners to participate in Kbb conservation activities.

Management for Dispersal Corridors (including non-landowning Partners). For Partners who have chosen, some lands will aid in providing corridors or areas for Karner blue butterfly dispersal. These lands may be managed under terms of written easements rather than fee title ownership, as with many utility company rights-of-way. In these areas, Partners will carefully plan the timing of management practices such as mowing, cutting and chemical applications to promote healthy Karner blue butterfly habitat and populations. Where known Karner blue butterfly populations exist, Partners who are land managers (and not the landowner) would work closely with individual landowners, as appropriate, to promote and protect habitat in these areas.

Compensatory Mitigation Strategies. For Partners whose proposed activity results in permanent take of occupied Karner blue butterfly habitat, a mitigation plan designed to compensate for the habitat loss and adverse impacts to butterfly, is required. The mitigation plan will be consistent with the HCP Construction Guideline and applicable protocols (*refer to the HCP User's Guide in Appendix E.*). Mitigation can include habitat restoration and creation, and/or land acquisition for Karner blue butterfly habitat restoration and creation. Activities could range from sowing or planting of wild lupine and nectar plants to land banking of restored and occupied butterfly habitat. Other mitigation measures approved by the DNR and USFWS may be considered as well, such as long term habitat management. Mitigation plans must be approved by the DNR and the USFWS.

Part E. Land Management Activities

Partner groups often have similar long-term management goals. Many of the activities employed to achieve these goals could have an impact on the Karner blue butterfly or its habitat. Although specific application of land management activities may differ between Partners, there are commonalities in their relationship to the Karner blue butterfly. Each of the activities is discussed briefly below. These include:

- ☞ forest management,
- ☞ barrens, prairie and savanna management,
- ☞ recreational management,
- ☞ transportation management, and
- ☞ utility ROW management.

The HCP Partnership developed a number of modifications to conventional land management practices intended to benefit the Karner blue butterfly. The resulting management guidelines and protocols were based upon the best scientific and applied knowledge available. From 2000-2007 the Partners refined the management guidelines and conservation measures based on accrued knowledge from several years experience implementing the HCP. This resulted in the "HCP User's Guide". New knowledge

acquired through continued management experience, monitoring and research will be used in the HCP's adaptive management process.

As it pertains to the Partners, the ITP provides for the incidental take of the Karner blue butterfly, if the activity resulting in the take is conducted consistent with conservation measures, guidelines, or protocols included in the applicable conservation agreement, the DNR's Implementing Agreement with the USFWS, or is consistent with the HCP. Most Partners have agreed to follow the guidelines included in the HCP User's Guide (*See Appendix E of the HCP*). Some Partners have outlined specific and unique conservation measures in their conservation agreements, and will do a mix of what is in the HCP User's Guide and their own approach. All commitments, however, are clearly stated in the partners' individual conservation agreements, especially if they intend to manage differently than what is outlined in the HCP.

Because of the dynamic and evolving nature of the conservation effort -- with the often-changing science and conclusions based on partner experience and research -- it is anticipated that protocols and guidelines developed and included in the HCP and individual conservation agreements may need modification. New guidelines, protocols, or conservation measures may also be developed during the permit period. New or modified guidelines, protocols, or conservation measures will need approval by the DNR and the USFWS before being implemented.

1) Forest Management

A number of partner groups will be involved in forest management activities. These include the forest products industry, county forests, some utilities and the DNR. Forest management includes a variety of activities, such as:

- a) timber harvesting,
- b) stand improvement,
- c) forest road construction and openings management, and
- d) forest regeneration, including site preparation and maintenance.

Prior to performing any forestry activities in the High Potential Range, Partners will conduct pre-management surveys to determine Karner blue butterfly presence or absence. Where Karner blue butterflies are present, all forestry Partners will follow the "Forestry Management Guideline" and applicable management protocols in the "HCP User's Guide" (*see Appendix E of the HCP*) (*Refer to the DNR's HCP webpage for most current revision*) unless otherwise agreed to in their individual conservation agreements.

Consistent with the coverage and protections afforded Partners in the ITP and their individual conservation agreements for acts of contractors, conservation strategies -- when applicable -- will routinely be included in timber sale contracts. If employees harvest or manage timber, they will be directed to apply appropriate conservation measures.

Where forest road construction may result in permanent take, the Partner will follow the HCP's "Construction Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*).

Emergency situations arise such as forest fire suppression activities and wind damage that pose threats to public safety and impair road infrastructure that require immediate management action. In such cases Partners will follow the HCP's "Emergency Guideline". (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*). Where pre-planning and pre-management surveys are not possible and the emergency situation creates the need for immediate salvage cutting of damaged timber from windstorms, forest fires, flooding or insect and disease epidemics the Emergency Guideline will be followed and impact to known or suspected Kbb habitat will be avoided to the greatest extent practicable. Where salvage harvest is not an urgent matter, follow the HCP's Timber Harvest Protocol.

2) Barrens, Prairie and Savanna Management

Several Partners identified restoration or maintenance of native barrens habitat as an important land management goal. In this context, barrens includes the range of possibilities from nearly treeless sand prairie to oak/pine savanna to shadier oak/pine woodland -- all on dry, sandy soils. For some lands, the goal may be specifically to optimize Karner blue butterfly populations. For other lands, the goal may be to manage for a larger barrens ecosystem.

Barrens management tools include prescribed fire, mechanical management (such as timber cutting, tree-girdling and brush-hogging), selective herbicide treatment, native plant propagation, or grazing. The design and implementation of a management regime must be tailored to a given site, taking into account site size, context within the landscape, available equipment and personnel, naturally occurring defoliation by insects or disease, weather and a variety of other factors.

Many plants and animals native to disturbance-adapted communities, like barrens, depend on the ability to either survive the disturbance at some level or to recolonize from nearby undisturbed areas. Many sites are so dry that they require only very infrequent disturbance. Prior to performing any of these disturbance activities in the High Potential Range, Partners, such as the DNR, that have chosen this management goal will conduct pre-management surveys to determine the presence and location of occupied Karner blue butterfly habitat. Partners will use the HCP's "Conservation Management Guideline" and applicable management protocols to apply these various tools. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*).

3) Recreational Management

Many of the HCP Partners manage lands used by the public for recreation. Management of these recreational activities can be broken into three categories: (a) intensive development and maintenance, (b) less intensive development and maintenance and (c) public use.

Intensive Development and Maintenance (construction). Intensive construction includes such activities as building development, creation of flowages and laying of pavement or gravel for roads, parking lots, etc. Prior to development of recreational facilities in the High Potential Range, Partners will conduct a pre-management survey to determine if the site is occupied. If development of the facility may result in permanent take: (1) alternatives or other measures to avoid impacts to the occupied habitat will be considered, and (2) if a permanent take can not be avoided, the Partner will inform the DNR and the USFWS and prepare a mitigation plan for their approval. Partners will follow the HCP's "Construction Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

Less Intensive Development and Maintenance. Less intensive activities include development and maintenance of campgrounds, picnic areas, boat access, trails and similar facilities. A variety of maintenance activities, ranging from mowing picnic areas to spreading fresh gravel on hiking trails occur on some partners' lands. These activities will generally occur in already unoccupied and developed areas. Trails bordered by lupine and/or nectar plants can serve as Karner blue butterfly habitat and dispersal corridors. Maintenance of these trails (e.g., carefully timed brushing or mowing) can enhance population dynamics across landscapes and promote population connectivity and colonization of new openings. Bridle trails are not recommended in quality native habitats, due to many potential problems, including erosion and introduction of aggressive competing plants through manure. Prior to development or maintenance of recreational facilities in the High Potential Range, Partners will conduct a pre-management survey to determine if the site is occupied by Karner blue butterflies. Where Karner blue butterflies are present, Partner will follow the HCP's "Recreation Management Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

Public Use. A variety of public uses, ranging from hiking and bird watching to mountain biking and hunting, occur on some partner lands. Human traffic through occupied areas may result in some incidental take through inadvertent trampling. Heavy traffic through occupied habitat will be avoided through trail design and property management to avoid any serious impacts to Karner blue butterfly populations. Partners will take reasonable action to discourage or prohibit use of Kbb occupied habitat.

All management should be applied in a manner that does not specifically identify the habitat as Karner blue butterfly occupied habitat, unless it will serve as an educational component and the intent is to identify the area to provide education and the promotion of conservation efforts, while taking reasonable precautions to protect the habitat area.

4) Transportation Management

The Wisconsin DOT and eleven Limited Partners (either county highway departments or townships) are involved in transportation management.

Road Development. Prior to road construction in the High Potential Range, pre-management surveys will be conducted to determine if Karner blue butterflies are present. When surveys indicate that a Karner blue butterfly population occurs along or immediately adjacent to a right-of-way, Partners will follow the HCP's "Construction Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

Road Maintenance. Similar to the development of ROWs, the maintenance of ROWs may require minor disturbance of existing Karner blue butterfly or lupine habitat. DOT will conduct pre-management surveys in the High Potential Range to determine if Kbb are present; where Kbb occur these disturbances will be consistent with the HCP's "Corridor Management Guideline" and applicable management protocols found in the HCP User's Guide unless otherwise provided for in their individual conservation agreement.

County highway departments and townships (Limited Partners) will, at a minimum re-survey their ROW's for lupine habitat annually, consistent with the "Wild Lupine Survey Method on Road Rights-Of-Way (ROW) for Limited (Local) Partners"; and where lupine occurs on ROW's, management will follow the HCP's "Limited Partner Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

Emergencies resulting from storm damage and road flooding sometimes occur. In these cases, Partners will follow the HCP's "Emergency Guideline" to the greatest extent practicable. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

5) Utility ROW Management

The majority of ROWs included in the HCP are not partner owned, but are managed under easement. Management, therefore, may be subject to landowner approval. Utility ROW management maintains an open canopy through mowing and removal of woody vegetation. Disturbance caused by utility line construction may enhance the habitat for lupine and benefit the Karner blue butterfly in the long-term.

Construction of Overhead Transmission Lines. Utility transmission line construction is considered less detrimental to Karner blue butterfly habitat (in that there is minimal disturbance of the soil), when compared to pipeline construction activities. In new construction, an effort will be made to route around any Karner blue butterflies and lupine habitat areas.

Prior to starting construction activities in the High Potential Range, Partners will perform pre-management surveys to determine if Karner blue butterflies are present. When surveys indicate that a Karner blue butterfly population occurs along or immediately adjacent to a right-of-way, Partners will follow the HCP's "Construction Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

Construction of New Pipelines and Underground Transmission Lines. Pipeline and underground transmission line corridor construction sites are usually less than 100 feet wide and remain in a state of partial or complete defoliation for only a short period of time (3-4 months, on average).

Prior to starting construction activities in the High Potential Range, Partners will perform pre-management surveys to determine if Karner blue butterflies are present. When surveys indicate that a Karner blue butterfly population occurs along or immediately adjacent to a right-of-way, Partners will follow the HCP's "Construction Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

Maintenance and Repair of Overhead Transmission Lines. It may be necessary to disturb existing Karner blue butterfly or lupine habitat to facilitate line maintenance. These minor disturbances may enhance the growth of lupine and nectar plants and may indirectly benefit the Karner blue butterfly population.

Prior to beginning maintenance and repair activities in the High Potential Range, utility Partners will perform pre-management surveys to determine if Karner blue butterflies are present. When surveys indicate that a Karner blue butterfly population occurs along or immediately adjacent to a right-of-way, Partners will follow the HCP's "Corridor Management Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

Maintenance and Repair of Pipelines and Underground Transmission Lines. Pipeline and underground transmission line repair and maintenance activities in Karner blue butterfly habitat will follow procedures in the "Construction Guidelines" (*see HCP User's Guide in Appendix E*).

Prior to beginning maintenance and repair activities in the High Potential Range, Partners will perform pre-management surveys to determine if Karner blue butterflies are present. When surveys indicate that a Karner blue butterfly population occurs along or immediately adjacent to a right-of-way, Partners will follow the HCP's "Corridor Management Guideline" and applicable protocols for brush removal for clearance and access. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*); repairs will be consistent with the HCP's "Construction Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.*)

6) Special Emergency Circumstances.

Emergency operations may apply to any partner group. Emergencies related to storms and certain excavation damage to utilities occasionally result in power line tangling, leaking pipelines, downed trees blocking roads, flooding, wild fires. In these cases, Partners will follow the HCP's "Emergency Guideline" to the greatest extent practicable. *(Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage for the most current revisions.)*

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Chapter 4. Adaptive Management and Monitoring

This part of the HCP discusses the use of adaptive management by the HCP partners. It is divided into three main sections:

- ☞ Adaptive Management and Monitoring Strategies
- ☞ Monitoring and Surveying Procedures
- ☞ Research

Part A. Adaptive Management and Monitoring Strategies

Adaptive management can be defined as a formal, structured approach to dealing with uncertainty in natural resources management, using the experience of management and the results of research as an on-going feedback loop for continuous improvement. Adaptive approaches to management recognize that the answers to all management questions are not known and that the information necessary to formulate answers is often unavailable. Adaptive management also includes, by definition, a commitment to change management practices when determined appropriate.

The adaptive management strategy will focus on achieving two primary HCP monitoring goals: (1) to assess the effects of management activities on the Karner blue butterfly and its habitat and adjust conservation measures to better conserve the Kbb where data and research support the change; (2) to assess new biological, economic and policy information and adjust operational parameters, programmatic and administrative procedures. The first goal is traditional; the 2nd goal reflects the reality of 21st century economics and that circumstances will continue to change over time as new biological information is identified.

Part B. Monitoring and Surveying Procedures

(For detailed guidelines and protocols refer to appendix E of the HCP or for the most current version, the DNR's HCP webpage)

HCP monitoring is divided into three types:

- Compliance Monitoring
- Effects monitoring
- Effectiveness monitoring

Integrating the monitoring program into the adaptive management strategy is crucial in order to guide any necessary changes in management.

1. Compliance Monitoring

Compliance monitoring verifies that the DNR and all other partners are carrying out the terms of the HCP, the permit, the IA (for DNR) and individual conservation agreements (for all other partners).

Auditing partner performance and verifying conservation agreement compliance is a large part of the compliance monitoring program. Audits of HCP partners are individual, on-site evaluations of various aspects of partner performance under their conservation agreements. These audits are intended to provide information to the USFWS, the DNR, the HCP partnership and the general public to give assurance with respect to DNR and partner performance under the permit.

File and field audits are conducted to verify partner compliance with their conservation agreements. Compliance auditing is required because the DNR must have a procedure to gather the evidence to show that the HCP is being implemented as written and that the DNR is in compliance with the Implementing Agreement. In addition, summaries of auditing results over time may provide useful insights for adaptive management.

Compliance audits are not a regulatory witch-hunt, but a one-on-one spontaneous training/learning opportunity; continuous quality improvement. Partners have overwhelmingly demonstrated they want to do the right thing. The assumption is that partners are doing what they believe to be correct; the best they can do with what they understand, have been previously trained or how they interpret or understand the HCP. The purpose of these audits is to identify where a partner does not appear to understand how to implement the HCP or interpret and apply their conservation commitments, and then for the auditor to provide continuing education and training to the partner and/or partner's staff attending the audit.

Primary objective of audits

The auditor's primary objective is to make observations of performance characteristics to determine if the partner understands how to correctly implement the HCP. This includes conservation commitments in either the Implementing Agreement for DNR land managers or Species and Habitat Conservation Agreements (SHCA) for all other HCP partners. By complying with the conditions of the SHCA (or IA for DNR), the partner is also complying with the HCP and ITP.

Secondary objective

The secondary objective is to assess mistakes and misinterpretations of HCP required performance for trends in poor performance. The auditor will provide training if necessary. If the problem is the fault of the HCP, e.g. unclear protocol or direction, the auditor will improve the system at fault. If there should be serious infractions, corrective action may be required.

The auditing procedures and processes referred to in this section are the responsibility of both the FWS and the DNR; however the DNR has the lead role in implementing the audit process. The procedures and processes in this section are a DNR and partner process, intended to monitor partner performance for the purposes already described and are separate from USFWS actions that may be taken relative to regulatory oversight in administration and enforcement of the permit pursuant to the federal ESA. *For a detailed description of the administrative procedure for audits, refer to Appendix E of the HCP. The most current version of audit procedures and past audit summary reports can be viewed on the DNR's HCP webpage.*

2. Effects Monitoring

Effects monitoring evaluates the extent of the impacts on the Karner blue butterfly from the permitted activities.

- Short-term, minor impacts: A periodic measurement of incidental take measured in acres of Kbb occupied lupine habitat impacted will be derived from pre-management surveys and reported on annual reports. These impacts are related to routine management activities, which provide beneficial disturbance and/or very minor impacts to the local Kbb population. (Short-term take is further described in Chapter 3).
- Major impacts including permanent take: Permanent take is most often related to a construction activity. Post-construction monitoring is used in conjunction with habitat restoration following construction projects. The objective is to assess the status of the restoration to determine if the restoration objectives in the approved mitigation plan are being met. Habitat restorations can be related to compensatory mitigation plans required for permanent take or habitat replacement plans required by major construction projects where habitat is replaced following the construction activity. If appropriate and desired, this monitoring procedure can also be used for other restoration or habitat creation such as on a recovery property or other habitat project designed by Partners to feature the Karner blue butterfly.

This assessment of successful mitigation for construction activities will follow a similar evaluation as assessing the effects of management activities in C-E monitoring below. The criteria will be habitat based and correspond to the goals and objectives of each restoration plan.

- Cause and Effect monitoring: The objective here is to assess whether or not and to what degree HCP management activities provide benefits to Kbb habitat and ultimately to Kbb. Current management guidelines, protocols and conservation measures approved for use in the HCP are considered effective. New management methods or modified approaches may require testing and experience to assure the desired benefits to Kbb. Existing conservation measures may need evaluation and adjustments.

The biological conditions resulting from habitat disturbing land management activities will be assessed as needed or desired through Cause and Effect (C-E) surveys, which will directly translate into an active adaptive management process and improvements in management guidelines and conservation measures in management protocols.

Cause-Effect monitoring currently employs the Cause & Effect (C-E) Monitoring Protocol (Level 1 survey). This protocol is somewhat similar to a normal Level 1 survey, except that a more comprehensive habitat/vegetation assessment is required (not optional) for C-E surveys and they are performed both prior to and after the management activity being studied and in both first and second Kbb flight periods to assess nectar plant availability in both periods.

3. **Effectiveness Monitoring**

Effectiveness monitoring determines whether the effectiveness of the operating conservation program of the HCP is achieving the intended biological goals and objectives of the HCP. Effectiveness monitoring is broad in nature; designed to evaluate progress toward the intended primary biological HCP goal of No Net Loss of Habitat. Evaluating the operating conservation program and its progress toward the HCP intended biological goal will necessarily be assessed by a number of methods.

- **HCP's Primary Biological Goal**

No Net Loss of Habitat - Monitoring the HCP's biological goal. The objective of this monitoring is to evaluate progress toward the primary goal of the HCP and the overall effectiveness of the HCP program at providing benefit to the Kbb. Data are collected from a variety of sources most of which are supplied by partners in annual reports.

Biological Goal of the HCP: There will be **No Net Loss of Habitat (NNLOH)** as a result of partner activities in the KBB High Potential Range (HPR). This will be assessed as follows:

Expected Outcome #1: Permanent take and short-term take both of which may result in destruction or complete removal of habitat (related to construction) will be more than offset by successful habitat mitigation and habitat replacement (respectively).

Method of Measuring Outcome: Construction project plans (for major projects) and annual reports (for minor projects) will reflect habitat lost vs. habitat restored or replaced. Post-construction mitigation assessment reports will include the assessment of the success measures in the approved HCP's Construction Guideline as a means of gauging the success of the mitigation plan..

Expected Outcome #2: Partners will conduct activities consistent with approved and proven conservation measures in order to avoid and minimize take of the

Karner blue butterfly to the greatest extent practicable.

Method of Measuring Outcome: HCP Compliance Audits (compliance monitoring) will include an assessment of the conservation measures used by partners on a subset of activities conducted in occupied Karner blue butterfly habitat and be summarized in Compliance Audit Summary Reports.

Expected Outcome #3: Partners will seek out opportunities to create and manage a shifting mosaic of habitat for Kbb.

Method of Measuring Outcome: A system that will analyze (at a minimum) (1) average harvest, (2) allowable cut, and (3) age class distribution from 1-15 years (*system to be developed*) will guide Partners in guiding partners in managing to provide for a shifting mosaic.

- **Annual Report.** Annual reports provide data that can be considered in monitoring an adaptive management effort. The information contained in annual reports is consistent with the annual reporting condition required in the permit, the HCP, the IA and individual conservation agreements. Annual reports contain a variety of data, which can be used in all 3 types of monitoring. In addition, should information for further clarification be deemed necessary to implement an adaptive management approach, the DNR has authority through partners' conservation agreements to request other information as needed. At a minimum, annual reports will include the following elements:

1. An estimate of the annual incidental take (characterized as acres of Kbb occupied habitat) that occurred as a result of short-term and permanent take.
2. A summary of activities conducted by partners in occupied Kbb habitat including number of acres affected.
3. Any additional information determined necessary to assess the HCP's biological goal of NNLOH.
4. Results of lupine and Karner blue butterfly monitoring efforts including a summary of the data and updated maps as available.
5. A summary of official HCP monitoring training sessions including the dates and locations; and a list of the names, addresses and phone numbers of people who are certified to conduct Karner blue butterfly surveys.
6. New information that has been gained through scientific study or other assessment of management efforts that either (1) supports continued management, or (2) indicates a need to change management protocols.
7. A discussion of the adaptive management effort, including any management changes that have been made in response to new information.
8. A summary and discussion of the outreach and education that has occurred, including the approximate number of people reached through all means.
9. Total acres of partners lands included in the HCP that occur in the High Potential Range of the Karner blue butterfly.

10. The types and number of amendments (that do not involve Service approval) made to the Partners' SHCA's upon approval of the permittee.
11. A summary report of Partners' compliance audits.
12. The running total cumulative number of voucher specimens taken by date, gender and location of capture; mounted for educational purposes or sent to the Milwaukee Public Museum or other approved depository (along with label information), and current specimens under possession and control of the DNR including location stored and person responsible for safety and maintenance of those specimens. All specimens remain the property of the United States Government and must clearly be identified as such (refer to permit condition pertaining to collection of voucher specimens)
13. An updated list of DNR property managers and their contact information.
14. An updated list of HCP Partners including the original date of inclusion in the HCP, also reflecting transfers and name changes, along with the primary HCP implementation representatives to the DNR and their contact information.
15. And other information that the Service requests pertinent to tracking and understanding activities under the HCP.

Annual Reports are submitted to the DNR by each HCP partner and all affected DNR properties or area offices by March 1st each year.

Part C. Research

Acquiring new knowledge through research can be a part of or inform an active adaptive management process, and result in improvements in HCP implementation efficiencies and effectiveness, and improvements in management guidelines and conservation measures. Research results will be routinely shared with all HCP partners.

1. Recent research

- “Detecting the Presence of Wild Lupine Utilizing Large-Scale Remote Sensing Multi-spectrum Satellite Imagery”, Keith Rice and Jacob Hofman (UW Stevens Point), Wayne Hall (WDNR). Detecting wild lupine was proven feasible; however achieving high levels of lupine location accuracy in areas of low density of lupine may not be obtainable with this current technology.
- Kbb probability model: “Development of a Karner Blue Butterfly Probability Map for Use with the Habitat Conservation Plan”, Theodore A. Sickley and David J. Mladenoff (University of Wisconsin-Madison) (2007). The development of this model generated a large number of maps representing Kbb probability in Wisconsin. The research significantly narrowed the spatial focus of where Kbb are most likely to be found. Additionally, it led to defining biology-based recovery zones that replaced older less science based recovery areas.
- Kbb Emergence model: A degree-day emergence was developed by the Forest and Landscape Ecology Lab, Dept. of Forest and Wildlife Ecology at the University of Wisconsin-Madison with several cooperators. The model is currently being used to predict the onset and peak of each Kbb flight period. While this has proven to be a great improvement over the look-and-see method, additional work is planned.

- *(For more information about the model, refer to the Karner Blue Butterfly Emergence Model User's Guide in Appendix E).*

2. Pending research

- Continue research on the Kbb emergence model to refine and validate the model; and to better understand application of the model under broadly varying predictability related to year-to-year climate variation and within year climate swings.
- Continue to refine the Kbb probability model and Kbb High Potential Range as new Kbb presence and absence data are reported.

3. Objectives for Future Research

Additional research will be explored for a variety of reasons. In the adaptive management context in which the Wisconsin Karner Blue Butterfly HCP will be implemented, research will meet the following objectives:

- To obtain information needed to assess and improve effectiveness of conservation strategies.
- To obtain information needed to improve efficiencies and cost effectiveness of management activities, thereby reducing the costs of conservation and increasing participation.
- To obtain information needed to identify additional, viable management options to improve conservation effectiveness and cost effectiveness.

4. Research Program

Observation and analyses of monitoring data by professionals at DNR and among partners will fuel the adaptive management process. The HCP is fortunate to be the benefactor of research already being pursued or planned by other parties. Other research that may be beneficial will be pursued as its priority becomes more important and as funding becomes available. The HCP partnership will not take the lead on research that does not benefit HCP implementation efforts. Where HCP partners' research responsibilities may be complementary to the FWS's federal recovery responsibilities, the initiation and pursuit of research may depend on federal financial support or research cooperation.

5. Coordination of Research Proposals

Partners who wish to engage in research that may result in take of the Karner blue butterfly and which is not specifically described in the HCP will coordinate with the DNR and the FWS to obtain approval and authorization in advance of the research activity. *(Refer to Appendix E and the HCP Webpage (most current) for research proposal procedures).*

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Chapter 5. Participation Strategy and Outreach and Education

This part of the HCP discusses the Wisconsin Karner Blue Butterfly HCP partners' plans for involving additional landowners and land users in statewide conservation efforts. It is broken into three sections:

- ☞ an introduction and summary
- ☞ a description of a the non-partner participation plan
- ☞ an outreach, education and assistance strategy

It is believed that by involving additional participants in HCP implementation, the likelihood of successful conservation is greatly increased.

A. Introduction and Summary

This innovative approach to endangered resources conservation was designed to move the regulated community beyond compliance and into efforts to proactively apply conservation measures on the land while engaging in their land management activities. Congress, in establishing the incidental take permit (ITP) provision of the ESA expressed the hope that it would encourage creative partnerships between the public and private sectors and among governmental agencies in the interest of species and habitat conservation and provide a framework to permit cooperation between the public and private sectors. Those goals are achieved by this HCP that arose out of and was developed through a solid and diverse grassroots effort in Wisconsin.

The Karner blue butterfly is dependent on periodic disturbance regimes or management programs designed to assure that the habitat is not lost because of the natural succession of competing vegetation. Therefore, this conservation plan is designed to encourage disturbance activities to the habitat rather than prohibit them. To accomplish a disturbance and management regime statewide, this strategy has been developed with the design to include all Wisconsin landowners and land users that might affect the species, regardless of land size and use. The HCP creates a broad statewide partnership in conservation while realizing the limitation on resources to accomplish its objectives. The strategy seeks to incorporate conservation into everyday land management and on-going work. The HCP is built upon the extensive land ownership and a conservation commitment of the 37 partners identified in this HCP, but seeks to go beyond those partners to include the assistance and participation of other landowners, nonprofit groups, environmental and industrial organizations and a variety of governmental units.

This HCP, with its biological approach, focuses its efforts on geographic areas and activities, which provides the highest potential to sustain or enhance Karner blue butterfly habitat. The strategy seeks to reach all landowners and land users, but will vary in approach and process. The HCP's inclusion strategy includes:

1. A concept of non-voluntary participants that must formally apply for and receive a Certificate of Inclusion from the DNR because of the value their land and activities provide to conservation of the species; and
2. A provision for voluntary participants that receive ITP coverage, without further process, so as to encourage land management activities that may benefit the species; and
3. An extensive public outreach and education plan to reach all landowners and land users, and others, to describe the effort and encourage their cooperation and participation in this conservation effort; including a strong focus on landowners in recovery areas (called Biological Recovery Zones or BRZs); and
4. A recovery component that includes a direct role in recovery by the DNR, and a support role by all Partners who may have an opportunity to provide assistance in a variety of ways, e.g. direct outreach and education to landowners in recovery areas, financial or on the ground support for recovery monitoring, among other needs designated by the DNR's Wisconsin Recovery Working Group, Local Recovery Teams and recovery properties. (*Refer to Chapter 6. Recovery for more information*)

As applied to participation, this approach is designed to provide incentives for conservation through cooperative partnerships. It includes a notification system designed to inform landowners and land users, where possible and feasible, of the opportunities presented under this HCP. Finally, this plan has a geographical focus on the areas that have the highest potential to support the species and its habitat. (*See Figure 6.10, Karner Blue Butterfly Biological Recovery Zones on p. 53*). By this plan, the partnership intends to achieve the endangered species conservation goals while protecting the economic interests of non-federal landowners through this increasing partnership statewide.

B. Participation by Non-partners (New Partner Inclusion)

Recognizing a need for greater involvement in the HCP process, the partners developed a participation plan for non-partners. Details of this participation plan are outlined in this section. A flow chart for determining options for ITP coverage is included in Appendix D.

The participation plan addresses only *occupied* lands; those lands on which the Karner blue butterfly is present in any of its life forms. Non-partner efforts are intended to focus primarily on *voluntary, cooperative* efforts and participation. Nevertheless, requisite

participation based upon scientific considerations and the biological needs of the species is also a component of the plan. Inclusion in this HCP will provide the landowner or user with authorization (incidental take permit coverage) to incidentally take Karner blue butterflies while conducting lawful land management or land use activities. *Intentionally taking* Karner blue butterflies, regardless of location or activity, is still *prohibited* unless specifically authorized by the USFWS.

Non-partner participants are divided into two groups:

- ☞ **non voluntary**- non-partner landowners and land users that are required to obtain a Certificate of Inclusion (See pages 43-46). Landowners and land users in this category are within the High Potential Range, own or manage lands, and are engaging in activities that would take Karner blue butterflies should they be present.
- ☞ **voluntary**- non-partner landowners and land users that are *not* required to obtain a Certificate of Inclusion (See pages 46-49). Landowners and land users in this category will be covered in the HCP and ITP without further application or inclusion processes.

Non-voluntary Category (Certificates of Inclusion required)

Non-partner landowners and land users engaged in activities and in locations that may significantly affect the Karner blue butterfly are required to obtain a "Certificate of Inclusion" from the DNR, either as a single project applicant or as a partner. Through application to and review by the DNR, these landowners and land users may ultimately be covered under the ITP. Landowners or land users who do not meet the criteria to be included in the "Voluntary Category" are required to apply to the DNR, if they: (1) own land or engage in activities within the High Potential Range, and (2) are involved in the following activities or activities resulting in permanent take:

- ☞ right-of-way or corridor development and maintenance, or
- ☞ commercial forestry, or
- ☞ permanent take,

The ROW or corridor development and maintenance category includes all landowners, land users and other agencies or entities engaged in road or highway, railroad, utility, communication, power and pipeline development or maintenance . Participation from this group is required because the development of roadways or other corridor facilities may involve permanent take. Moreover, the maintenance regimes associated with right-of-way or corridor management provide the opportunity to encourage the continuation of Karner blue butterfly habitat and provide important dispersal corridors for the butterfly.

Participation by commercial forest owners is required because of the known Karner blue butterfly occurrences on such land, the flexibility these landowners and managers

may have in management and the benefits that may accrue to Karner blue butterflies through implementation of on-going forest management activities. Forest owners in this category must own in excess of 1,000 acres of forest land in Wisconsin. Forest owners who own 1,000 acres or less and those with greater than 1000 acres of land where the land is not primarily managed for the purpose of forestry (e.g. managed for recreation, as camps or lake associations) are considered "voluntary" participants and are not required to obtain a Certificate of Inclusion for coverage under the ITP (See pages 50-53). "Forest land" can include land in the Forest Crop, Woodland Tax, or Managed Forest Law classifications under the Wisconsin Tax Assessment Classification system for real property, as well as land that is designated as "Industrial Forest" by the DNR under its forest tax law programs.

Permanent take is an impact to Karner blue butterfly habitat through land management or land use activities, which precludes Karner blue butterfly occupation. Such long-term impact involves taking that does not allow for the restoration and reoccupation of the site for a minimum of five years. Activities or projects that may fall within the definition of permanent take include, but are not limited to:

- ☞ construction of roadways and parking lots;
- ☞ construction of buildings or structures and associated facilities;
- ☞ other construction or development projects that cover or replace the habitat in a permanent manner (at least 5 years), such as an airport or a flowage; and
- ☞ residential housing developments subject to subdivision plat (ch. 236, *Wis. Stats.*), certified survey (ch. 236, *Wis. Stats.*), or condominium (ch. 703, *Wis. Stats.*) approvals. [**Note:** This category does not include a permanent or second home and associated structures that are owned or built by the owner for his or her own use; landowners in this category are considered part of the voluntary category (see below). This provision applies only to those housing developments approved after September 27, 1999, the date of issuance of the first ITP for implementation of the HCP permit issuance.]

Landowners and land users not meeting the criteria for inclusion in the voluntary category that are involved in activities that result in permanent take of the Karner blue butterfly will be required to provide compensatory mitigation in a manner acceptable to the DNR and the USFWS. Mitigation may take the form of land, activities or monetary compensation. Mitigation in the form of land compensation may occur either on land owned or managed by the applicant, or on those of another. In-kind services or monetary compensation in the form of annual payments during the life of the ITP may also be used as mitigation to defray the implementation costs associated with mitigation.

Current HCP Partners who hold a Certificate of Inclusion are authorized to do incidental take in the course of their land management activities. However, authorization for permanent take is only issued upon approval of a mitigation plan consistent with the HCP Construction Guideline.

For those non-partners who do not manage land and only seek authority for permanent take for a single project, a "one-time permit" inclusion can be provided. For non-partners

who also manage land, ongoing conservation efforts such as those provided by HCP Partners may lessen the fees imposed on an applicant. (*Refer to the New Partner Inclusion Procedure in the HCP User's Guide in Appendix E.*) If ongoing management requires periodic disturbance resulting in take, these entities will be encouraged to become a HCP partner.

The Application process for coverage under the ITP for those in the Non-Voluntary category is described in the "Inclusion Procedure" in Appendix E and in the HCP User's Guide (*Refer to DNR's Karner Blue HCP webpage for most current version .*).

The requirements to request approval for permanent take can be found in the HCP's "Construction Guideline" and applicable protocols. (*Refer to Appendix E or the HCP User's Guide on the DNR's HCP webpage.*).

Voluntary Participation (Automatic Inclusion)

The voluntary non-partner participation category includes those landowners, land users, or activities that either (1) do not meet the criteria requiring a Certificate of Inclusion, i.e. those in the non-voluntary category who are involved in ROW or corridor development and management, commercial forestry or some types of permanent take for commercial or residential development (*see non-voluntary participation p. 46-47*), or (2) are listed as an exception to the requirement. Participation in the conservation effort by this group is voluntary; such an approach to endangered and threatened species conservation has historically been successful in Wisconsin. Activities that result in incidental take, including permanent take engaged in by landowners and managers in this category will be automatically covered by the ITP without further approval or process whether the Karner blue butterfly is incidentally taken or not. The exceptions are described below and include:

- ☞ Non-commercial Forestry Landowners
- ☞ Agricultural Community
- ☞ Non-subdivision Residential Development

Non-commercial Forestry Landowners (Voluntary Category). Non-commercial forestry landowners in this HCP are defined as landowners with 1000 acres or less, or those with greater than 1000 acres of land where the land is not primarily managed for the purpose of forestry (e.g. managed for recreation, as camps or lake associations).

Many of the forest land owners in the state; private and corporate have entered their land under the DNR's forest tax law management programs (Forest Crop, Woodland Tax, Managed Forest Land programs). These forest management programs distinguish commercial forestry as greater than 1000 acres, and non-commercial forestry as 1000 acres or less.

Agricultural Community (Voluntary Category). The inclusion of the agricultural community in the voluntary non-partner participation category is based on the experience

and knowledge of Karner blue butterfly habitat requirements and the location of historic Karner blue butterfly element occurrences. Most agricultural operations do not appear to support habitat for the Karner blue butterfly or present a threat to the continued existence or recovery of the Karner blue butterfly in Wisconsin. For the purpose of this strategy and exception "Agricultural lands, activities or use", shall have a similar meaning as that provided in s. 91.01(1), *Wis. Stats.*, which describes agricultural use to mean:

... beekeeping, commercial feedlots; dairying; egg production; floriculture; fish or fur farming; forest (except "commercial forest" as defined above) and game management; grazing; livestock raising; orchards; plant greenhouses and nurseries; poultry raising; raising of grain, grass, mint and seed crops; raising of fruits, nuts and berries; sod farming; placing land in federal programs in return for payments in kind; owning land, at least 35 acres of which is enrolled in the conservation reserve program under 16 USC 3831 to 3836; participating in the milk production termination program under 7 USC 1446(d); and vegetable raising.

Although agricultural agencies at the federal, state and county levels will be involved in this program, the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) will be the principal partner, through a memorandum of understanding with the DNR, orchestrating the efforts of the agricultural community. The DATCP has committed to working on request with the various growers organizations, as well as the owners and users of agricultural land, to assist in outreach, education and assistance related to pesticide use and informs the pesticide user community that issuance of a permit by the FWS for implementation of the HCP does not authorize an intentional take of the Karner blue butterfly. The DATCP will make follow-up contacts with agricultural landowners and other pesticide users to assure legal pesticide use. The DATCP, with input from agricultural businesses and growers groups, has produced recommendations for protecting Karner blue butterflies from pesticide injury on agricultural lands. These recommendations are part of the educational materials the DATCP is providing these groups to distribute to their members and clients. Where the DATCP works with individuals to develop a management plan, plans and affected sites will be periodically examined for workability and habitat health or butterfly occupancy.

Non-subdivision Residential Development (Voluntary Category). Another activity exempted from the requirement of obtaining a Certificate of Inclusion is small scale residential development. Landowners or persons building a permanent or seasonal home with associated structures, such as a garage or driveway, are not considered a threat to the continued existence of the Karner blue butterfly or its recovery.

Voluntary participation in conservation efforts, however, will be encouraged through outreach, education and assistance. Through this strategy, the partnership is confident that it will gain the cooperation of many non-partner landowners.

C. Outreach, Education and Assistance

The Outreach, Education and Assistance strategy is key to the effectiveness of the voluntary, non-partner segment of this conservation effort. As part of a non-regulatory approach, statewide public outreach, education and assistance programs will be conducted to foster partnerships and encourage conservation efforts on a voluntary basis. The Partners intend this outreach and education program to be user-friendly and non-threatening. In order to encourage cooperation in this conservation strategy, landowners and land users in the voluntary participation category must be given assurances that engaging in conservation efforts will not be disadvantageous. It is essential that landowners and land users be guaranteed that participation in conservation efforts will not result in restrictions due to the presence of the Karner blue butterfly. Therefore, persons in this category have assurances within the ITP for a period through (and beyond its duration, if the ITP is renewed) that there will be no restrictions on incidental take including permanent take nor on the use of the land with regard to the Karner blue butterfly. Otherwise, a landowner may be reluctant to engage in conservation efforts.

The objectives of this effort will be to:

- ☞ educate landowners, land users and others about the unique circumstances of Karner blue butterflies and landowners in Wisconsin;
- ☞ identify those who would engage in conservation activities for the Karner blue butterfly, whether voluntary or non-voluntary;
- ☞ offer the opportunity to become involved in this unique conservation effort to those who are willing; and
- ☞ seek to develop cooperative conservation alliances as described elsewhere in this section.

New Partner Recruitment of Landowners and Land Managers in the Non-Voluntary Category. Those landowners or land users, who require permit coverage, are offered an opportunity to participate in this HCP (and associated ITP coverage) through a variety of processes and mechanisms consistent with the “HCP Communication Plan”. *(Refer to Appendix D.)*

Landowners and land users who may incidentally take Karner blue butterflies will be subject to a variety of methods of public outreach, education, or assistance. HCP Partners and collaborative groups, field foresters, property managers, county offices, trade associations, environmental land trusts and other organizations, as well as other state and federal agencies representing particular interests or activities are aware of the HCP and have and will continue to communicate informational materials prepared by the DNR and the HCP partners to those affected. The DNR and HCP Partners will be responsible for providing information on the Karner blue butterfly to landowners or land users within Biological Recovery Zones who are not associated with such interests or activities.

Permanent take. It would be impossible to comprehensively anticipate all those that may be involved in a permanent take of Karner blue butterflies in the future. The Karner Blue HCP has been the subject of widespread outreach and education since 1995. With this broad awareness, information regarding inclusion requirements is widely available from cooperating consulting and engineering firms and regulators (e.g. the DNR Bureau of Endangered Resources, the DNR Office of Energy and the USFWS) who are often approached by affected parties. This information can also be accessed via the DNR's widely used HCP Webpage.

The outreach and education strategy has as its strongest geographic focus, those broadest biological population areas, which include Karner blue recovery properties at their core. These areas are called "Biological Recovery Zones" (BRZ) (*Refer to Figure 6.10 Karner Blue Butterfly Biological Recovery Zones on p.53*). Outreach and education commitments are not an annual, mandatory requirement of partnership. Not all partners will have the opportunity to provide outreach and education in BRZs. However, as goals in the BRZs are realized, the scope of voluntary efforts will extend to areas throughout Wisconsin.

Biological Recovery Zones (BRZ). As noted above, landowners and land users within BRZs will be subject to an outreach and education program designed to encourage conservation and provide information on plan requirements. Direct contacts will be made in BRZs where the recovery property can not achieve recovery goals within the property boundaries and seeks assistance from neighboring landowners. In addition to direct contacts, information will be distributed through the HCP webpage with the assistance of partners, participants and governmental agencies. Technical assistance, when available, will also be offered. The DNR, HCP Partners and other collaborators including the USFWS Partners for Fish and Wildlife Program will target areas with known occurrences or a high potential for continued populations for focused landowner contact and participation.

High Potential Range. The remainder of the Karner Blue Butterfly High Potential Range, which is outside of BRZs, as indicated in Figure 2.10 (page 12), covers a large area. Like the BRZ's, this category maintains a geographical focus, but of a lesser priority for outreach and education as there is less opportunity for long-term Kbb conservation outside the BRZs.

Landowners and land users within the High Potential Range, but outside of the BRZs will be subject to the outreach and education program designed to encourage conservation and provide information on plan requirements. Information will be distributed through the HCP webpage with the assistance of partners, participants and governmental agencies. Technical assistance, when available, will also be offered. Outreach and education will be primarily passive in this area.

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Chapter 6. Recovery of the Karner Blue Butterfly in the Wisconsin Statewide HCP

This chapter provides a discussion of the federal Karner blue butterfly recovery effort, the HCP partner's recovery role and distinguishes the practical and implementation differences. It is divided into the following sections:

- ☞ an overview of the relationship of federal recovery embedded in this HCP
- ☞ a brief discussion of DNR's participation in the federal Karner blue butterfly recovery program
- ☞ a discussion of HCP Partners' role in recovery efforts

A. Recovery and HCPs

The Federal ESA requires the USFWS to develop recovery plans for species listed as endangered or threatened, unless the Secretary of the Interior finds that such a plan will not promote the species conservation. The goal of recovery planning is to establish recovery goals, guidelines and funding priorities for restoring imperiled populations to viable levels into the indefinite future. The goal of the Karner Blue Butterfly Recovery Plan (2003) (Recovery Plan) is to establish viable populations of the Karner blue butterfly across its U.S. range so that it may be reclassified as threatened and eventually delisted.

The ESA further provides a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such . . . species. . . ." Habitat Conservation Plans (HCPs) under section 10(a)(1)(B) of the Act provide for partnerships with non-Federal parties to conserve the ecosystems upon which listed species depend, ultimately contributing to their recovery (USFWS July 2009).

B. Participation in the Federal Karner Blue Butterfly Recovery Program

HCP Partners Involved in Recovery. The DNR is currently the only HCP partner to have made a commitment to participate in Federal recovery efforts on lands they manage. Other partners are unable to commit for a variety of reasons including no land ownership, no Kbbs on their lands, long term financial implications, and legal obstacles to making a permanent commitment of lands for this purpose.

Table 6.10 (below) identifies specific DNR properties that will be involved in recovery efforts along with acreages both managed for and supporting the recovery effort. The acreage figures reflect the acreage of identified recovery sites that can potentially support the metapopulations on these properties. Additional sites and acreage may be added as needed to achieve population goals. The timetable for habitat restoration and the establishment of populations meeting the goal criteria will depend primarily on adequate funding and climatic conditions. A detailed listing by property of population goals is found in the Karner Blue Butterfly Recovery Plan (2003), Appendix B-12. Interested parties should refer to Appendix B of that Plan (http://ecos.fws.gov/docs/recovery_plan/030919.pdf) for details and a map illustrating the location and recommended recovery goals for each recovery unit.

Table 6.10 DNR Lands and Acreages Managed for Recovery

Property	Acreages			
	Management to Feature and Enhance			Total
	Long-term Habitat	Shifting Mosaic	Corridors	
Black River State Forest (including Dike 17 WA and Bauer Brockway Barrens SNA)	200	2,000		2,200
Crex Meadows and Fish Lake Wildlife Areas	325	9,675		10,000
Meadow Valley (federal) and Sandhill Wildlife Areas	700	2,300		3,000
Greenwood Wildlife Area	53	1,384		1,437
White River Marsh Wildlife Area	45	3,955		4,000
Emmons Creek Fisheries Area	150	500	3	653
Hartman Creek State Park	13	50		63
Total	1,486	19,864	3	21,353

C. The Role of Karner Blue Butterfly Recovery in the HCP

This HCP is uniquely designed with a complex and sometimes confusing multi-faceted recovery role that overlaps HCP implementation with active participation in the Federal Recovery Plan by the DNR on a subset of properties; that is, the DNR is actively involved in achieving recovery goals and managing Kbb populations in perpetuity. The DNR is also a HCP Partner as the legal mechanism for incidental take authority for both recovery and non-recovery activities that result in incidental take. In turn for incidental take authority, DNR recovery properties follow much the same conservation measures and ITP reporting requirements as all other Partners. No other HCP Partner currently has this dual role.

However, all HCP Partners, including the DNR voluntarily support the recovery effort through the HCP. While “achieving Kbb recovery” is not a written goal of the HCP, the HCP Partners realize the ultimate importance of Kbb recovery in Wisconsin and choose to support the recovery effort in voluntary ways that support those actively involved in the recovery effort. The Articles of Partnership (see Appendix C) describes the HCP Partners’ role, which includes, *“To assist in Karner blue butterfly recovery in Wisconsin. The HCP partners’ role in recovery can best be described as voluntary and a support role”*, and *“The Partnership in the implementation of the Conservation Plan has no direct responsibility to the Recovery Plan; however, an open and clear line of communication between the Karner Blue Recovery team and this Partnership will be maintained in a support role consistent with these Articles and for the exchange of technical information.”*.

Implementation of this HCP has already contributed to achieving several other Federal recovery goals identified in the Recovery Plan. These tasks include the development and distribution of educational and outreach materials, development of management guidelines (e.g., see Appendix E) and the collection of critical ecological data on the Karner blue butterfly and its habitat.

An important recovery support role for Partners will be to assist in recruiting landowner support for recovery:

- ☞ direct personal contacts focused on lands in BRZ’s where recovery goals may not be met without the assistance of landowners outside recovery property boundaries. All landowners will be encouraged to participate in conservation/recovery efforts on a voluntary basis.

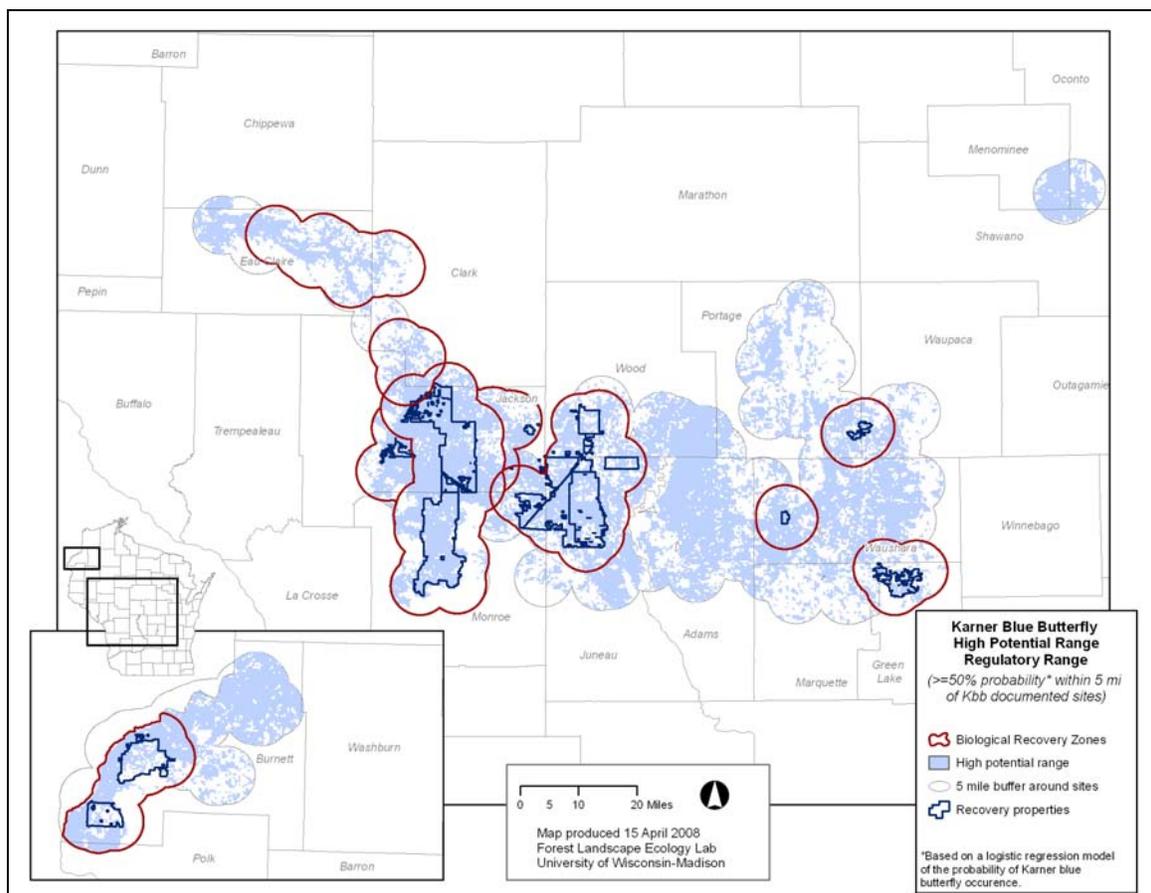
Participation by other public and private landowners is a welcome contribution to support designated recovery populations in particular, and statewide Karner populations in general. This participation and contribution is especially helpful in the Biological Recovery Zones (*See Figure 6.10 Karner Blue Butterfly Biological Recovery Zones on p. 53*) surrounding each recovery property. Biological Recovery Zones (BRZ’s) are areas including and around recovery properties (all) which constitute and/or support the same metapopulation as exists on and around the recovery property. This can include areas of known or high probability habitat such as dispersal corridors, living corridors, open habitat and forested land that has suitable Kbb habitat and could likely contribute to the recovery of viable Kbb metapopulation associated with the recovery property.

Other support opportunities for HCP Partners include:

- ☞ Land acquisition or conservation easements for recovery or long term maintenance. Based on the availability of funds, the DNR or other partners will consider acquiring land from voluntary sellers in areas suitable for application of management practices and recovery purposes.
- ☞ Land acquisition or conservation easements for conservation activities. The DNR and other partners may acquire land from voluntary sellers for conservation purposes, including the possibility of its use for a mitigation or mitigation banking strategy.

All HCP Partners may not have opportunities, landowner relationships or other connections, or economic resources to provide support, but many Partners may have an opportunity to provide assistance in a variety of ways, e.g. direct outreach and education to landowners in recovery areas, financial or on the ground support for recovery monitoring, among other needs identified by the DNR's Wisconsin Recovery Working Group, Local Recovery Teams and DNR, Federal and private recovery property managers.

Figure 6.10. Karner Blue Butterfly Biological Recovery Zones



Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Chapter 7. HCP Funding

A. Funding Overview

The strength of this unique statewide conservation plan is the commitment of conservation measures on large tracts of public and private land (partner lands) throughout the State of Wisconsin. The HCP partners and other cooperators have committed to continue to work together in a grassroots cooperative plan designed to assure the future of the Karner blue butterfly through their collective conservation efforts conducted while continuing their normal management and land use activities.

The participation plan of the HCP brings together tremendous resources of support. This conservation effort, therefore, differs from other HCPs, as does the approach to funding. The strength behind the guarantee of funding is not to be found in the detail of dollars that might be located in an escrow account, but rather in the DNR's and the HCP Partners' commitments outlined in the Implementing Agreement and individual Partner's conservation agreements.

Therefore, in this plan, there will be a continuing effort through funding mechanisms and sources identified below and through joint partnering efforts:

- ☞ With the guidance of the IOC, the DNR will continue to establish funding mechanisms needed to support the implementation of the HCP;
- ☞ The DNR will continue to include in its annual budget requests, funds to fulfill its obligations under the HCP and the Implementing Agreement (Refer to Chapter 8 of the HCP for staffing and support details). However, the DNR can only obligate state funds for future activities to administer the ITP and implement the HCP, after they are appropriated by the state legislature;
- ☞ The USFWS will continue to seek adequate funding to fulfill its administration and assistance commitments and meet its statutory requirements (e.g., assist with permit monitoring and oversight issues and provide assistance on permit and HCP implementation issues). The USFWS further agrees to assist in identifying and pursuing funding for activities in the HCP that contribute to the recovery of the Karner blue butterfly;
- ☞ The partners will continue existing collaborative efforts and will develop further funding opportunities as needed.

This partnership approach has worked successfully over the last 10 years to provide funding to effectively implement the HCP. However, if at any time in the implementation and administration of the HCP funding appears to be unavailable to meet the commitments, the DNR will consult with the USFWS to determine whether the HCP or ITP needs amendment or modification.

B. HCP Organizational Structure

Implementation Needs. To anchor the HCP implementation infrastructure, DNR will continue to provide a full-time, permanent employee as the HCP Coordinator. This position will be stationed in the Division of Forestry and will be supported by segregated forestry funds.

There continue to be several unknowns around this HCP:

- ☞ the uncertainty of state and federal funding,
- ☞ the fact that the ultimate number of partners is unknown, and
- ☞ the magnitude of different activities.

As a result, the diverse financial needs of implementing the HCP continue to require that:

- ☞ a variety of funding sources be available and
- ☞ the management of these funds be flexible.

Administrative costs to administer the ITP, to implement the HCP and to operate the adaptive management system will continue to be largely be born by the DNR's Forestry Division: jointly funded and supported by:

- ☞ Forestry Division general purpose revenue (GPR) and segregated forestry funds;
- ☞ in-kind support from various DNR staff through cross program cooperation negotiated through the Department's work planning process;
- ☞ in-kind support from partners' staff participating on the IOC and its working subcommittees; and
- ☞ non-refundable application and entry fees for future applicants requiring certificates of inclusion or partner status.

Partner Commitments. The main body providing partner support to the general implementation of the HCP will continue to be the partners' Implementation Oversight Committee (IOC). Operation of the IOC will be mostly self-funded with in-kind contributions of service and support of the IOC standing members. All partners are responsible to participate on the IOC during the course of the ITP. *(Refer to Chapter 8 for detailed information about the IOC.)*

Through individual conservation agreements, partners are committed to fund their management activities, which give consideration to, or enhance and favor the Karner blue butterfly and/or its habitat. Partners are likewise committed to fund required surveying and monitoring on lands they manage.

C. Implementation Process

Monitoring Impacts. Partners will continue to commit funds for biological monitoring needs, as outlined in Chapters 4 of the HCP. Recovery monitoring costs will be primarily born by the DNR. Funding sources include:

- ☞ DNR (will seek federal funding assistance);
- ☞ in-kind monitoring volunteered by partners and other cooperators; and
- ☞ possibly a portion of inclusion fees and in-kind services from future applicants.

Each Partner will continue to support their required surveying and monitoring of lands entered into the management strategies under the conservation agreement. The funding to support pre-management surveying and monitoring related to partners' normal management activities is the responsibility of each partner. Each partner is obligated to perform this monitoring by their commitment in their conservation agreement. Verification that this obligation has been met will be part of the compliance auditing process.

Compliance Auditing. Compliance auditing (a.k.a. compliance monitoring) satisfies the USFWS' and the public's "need to know" that the parties involved are honoring their agreements. This form of monitoring will continue to primarily be the responsibility of the DNR.

Funding Commitments for the HCP's Conservation Program. Land management activities that result in the positive and necessary disturbances required for Karner blue butterflies to persist are inherent in each partner's normal land use activities. This is the very thing that has allowed the Karner blue butterfly's continued persistence on the Wisconsin landscape. A detailed description of funding commitments to perform existing normal work is irrelevant since these are the normal activities which would otherwise occur on the landscape. It is necessary and desirable that partners continue these activities when the ITP is renewed. For those situations where normal work will be modified, and the modifications result in additional costs, the partners are committing to funding additional in-kind effort as reflected in their conservation agreements.

Collection and Management of Funds, Fees and Fines. The state legislature approved a mechanism for the DNR to collect and manage funds from certain groups. HCP related funds deposited in this account will be approved for use by the IOC and the DNR.

Data Management and Analysis. The DNR will be responsible for coordinating and providing most data management and GIS activities. Funding will come from: DNR through work planning; commitments from some partners; outside sources; and may use a portion of inclusion fees from future applicants.

Research. Research priorities are identified in Chapter 4 of the HCP (pages 40-41). The HCP is fortunate to be the beneficiary of research already being pursued or planned by other parties. The DNR's Division of Forestry has invested a considerable amount of money for research.

Observation and analysis of monitoring data will continue to fuel the adaptive management process. Other research, which may be beneficial, will be pursued as its priority becomes more important and as funding becomes available. Commitments of large sums of funding for additional research are not being made. However, at the discretion of the IOC and the DNR, the partnership may make use of a portion of inclusion fees from future applicants and in-kind services.

Some research is fundamental to the federal recovery process (Refer to the Karner Blue Butterfly Recovery Plan 2003) and may also benefit the HCP. The HCP Partnership will look to the USFWS and its recovery partners to help support research in this category.

Training. Training staff who are implementing the HCP may take a variety of forms, depending on the ultimate audience and demand. Funding for, or in-kind training services may be provided by one or more of the following:

- ☞ the DNR - Bureaus of Endangered Resources, the Division of Forestry and the HCP Coordinator;
- ☞ the DNR regional and area offices;
- ☞ the HCP Partners that have committed to internal and some external training in their conservation agreements;

The partners may also make use of a portion of inclusion fees from future applicants and in-kind services for training.

D. Additional Conservation Efforts

Outreach and Education. An important element of the HCP is the effort to spread broad awareness and understanding of the Karner blue butterfly and the opportunities to participate in this HCP. Coordination and basic outreach will be funded by the DNR.

Education may take a variety of forms, depending on the ultimate audience and demand. This will be provided by one or more of the following:

- ☞ the DNR Bureaus of Endangered Resources ,the Division of Forestry and the HCP Coordinator;
- ☞ the DNR Regional and Area offices and Customer Service Centers;
- ☞ the DNR Bureau of Communication and Education;
- ☞ HCP Partners that have committed to outreach and education measures in their conservation agreements;
- ☞ the existing cooperative relationships with organizations like The Nature Conservancy, Wisconsin Woodland Owners Association, Audubon Society and Sierra Club; and
- ☞ the extended cooperative partnerships which will be developed with organizations such as UW-Extension, county land conservation agencies, tree farm families and others.

As with training, the partners may make use of a portion of inclusion fees from future

applicants and in kind services for education and outreach.

Public Awareness. It is anticipated that there will continue to be a great deal of interest and inquiry around this HCP effort. Much of this could be academic or otherwise not directly related to recruiting additional conservation efforts. Funding for public awareness in the form of public relations will primarily be the responsibility of the DNR. Funding will continue to come primarily from the Division of Forestry Where the DNR feels it is appropriate, the IOC will be consulted for advice or assistance.

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Chapter 8. Implementation Organization

This part of the updated HCP describes the HCP partners' commitments to institutional arrangements for implementation of the HCP. It is divided into eight sections:

- ☞ DNR Organizational Structure for Implementation
- ☞ DNR-Partner Conservation Agreements
- ☞ Implementation Oversight Committee (IOC)
- ☞ Future Applications for Partner Status or Participation
- ☞ Permit Period
- ☞ Permit Amendments
- ☞ Permit Renewal
- ☞ USFWS "No Surprises" Policy

A. DNR Organizational Structure for Implementation

The lead programs for the HCP within the DNR will continue to be the Land Division's Bureau of Endangered Resources and the Division of Forestry. The focal position will be a full-time, permanent HCP Coordinator, stationed in the Bureau of Forestry, who will provide general project management and leadership within the DNR, coordination and facilitation for both the DNR and the Implementation Oversight Committee (IOC), planning, process design, development and training, as well as related duties. The DNR commits to provide a variety of other staff that will support the project as needed.

As the lead applicant for the Incidental Take Permit (ITP), the DNR will act as the permit administrator. In this capacity the DNR, among all other partners, will have the final authority and responsibility for decisions related to the ITP, although the agency will routinely seek advice from the partners and the Implementation Oversight Committee (IOC). In matters related to the implementation of the HCP, the DNR will share responsibility with the partners, most often through the IOC. This team, which represents the diverse interests of the partnership, is described below (pages 59-66). The IOC will operate within the Articles of Partnership (see Appendix C) and will act as an advisor to the DNR. However, as the permit holder, the DNR will be responsible for final decisions to assure the ITP is complied with and is not jeopardized.

Authority. The DNR has agreed to act as the lead applicant and permit administrator in accordance with any federal ITP issued. The DNR acts in this capacity under the authority of ss. 23.09 and 23.11, *Wis. Stats.*, regarding DNR's general powers; and 29.415, *Wis. Stats.*, the state endangered species law and s. 29.175, *Wis. Stats.*, regarding the protection and regulation of nongame species.

The DNR's implementation of the HCP is structured by an Implementing Agreement between the DNR and the USFWS. The agreement defines the roles and responsibilities of the DNR regarding implementation of the HCP and integration of other landowners or users, including the partners, with the DNR to obtain coverage under the ITP. The HCP and the Implementing Agreement are complementary to each other.

HCP partners, other than the DNR (lead applicant and co-partner), receive coverage under the ITP through their binding contracts with the DNR. These binding contracts, called Species and Habitat Conservation Agreements (conservation agreements), are supplementary to the Implementing Agreement. All are to be implemented and administered consistent with the HCP and the ITP. Any incidental take of Karner blue butterflies, then, must be consistent with the HCP, the conservation agreements or the Implementing Agreement, the ITP and other applicable federal and state laws.

The processes for addressing unforeseen or extraordinary circumstances, amending the HCP and ITP if necessary, reviewing implementation of the HCP and funding are discussed in this HCP and more briefly in the Implementing Agreement. A comprehensive definition of responsibilities for implementation of the conservation program is also included in the Implementing Agreement.

DNR Commitments. For the duration of the permit, the DNR, in addition to its conservation and recovery commitments under the HCP, will provide staff and fund one permanent, full-time employee to administer the ITP on behalf of the DNR and to coordinate implementation of the HCP. The coordinator will be responsible for both coordination of the DNR-owned lands' prescribed management activities with DNR property managers (and other conservation measures committed to by DNR in the implementation agreement) and the collective implementation of the HCP, including compliance audits of HCP partners.

The DNR's Division of Forestry will provide funding for the HCP Coordinator's salary and other expenses related to the position, including supplies, travel, information, communication and meeting expenses for HCP partner meetings. The DNR will share in some of the administrative and operational needs of the IOC and the partnership.

The DNR will provide or seek funding for DNR support services as needed to fulfill its obligations and commitments in implementing the HCP and administering the ITP.

Assurances. Public entities typically do not have complete control in decision making regarding the allocation and dedication of public monies. Through a variety of planning processes, however, they have an opportunity for justifying activities, such as those needed to implement the HCP. The first of those is the *Property Master Planning Process* as governed by Chapter NR 44, Wis. Adm. Code. This process provides for the logical and progressive planning of objectives and activities for management on state-owned, DNR-managed lands.

To the greatest extent possible, *work planning* also ensures the DNR will implement the HCP on DNR-managed lands. Work planning is an official operating procedure in the manual code (synonymous with standard operating procedures) that all DNR programs establish in conjunction with the state's biennial budget process. The development of *County Forest 10-Year Plans* supports the implementation of the HCP on County Forests much the same way as DNR master plans do on DNR lands.

B. DNR-Partner Species and Habitat Conservation Agreements (Conservation Agreements)

The Wisconsin Karner Blue Butterfly HCP partners are guided in their participation by binding Species and Habitat Conservation Agreements (conservation agreements). Templates of a conservation agreement for Full Partners and another for Limited Partners are included in Appendix D. These agreements have been entered into by and between each partner and the DNR. Once the Partner has an agreed upon conservation agreement, the DNR will issue the Partner a Certificate of Inclusion. The conservation agreements form the basis of the DNR's application for the statewide incidental take permit (ITP). With the ITP, the DNR will implement and oversee the statewide Karner blue butterfly conservation program, involving the partners and other landowners and users in the state.

Each conservation agreement is consistent with and tailored to the resources, capabilities and commitments of individual partners. Each partner's conservation agreement addresses and details:

- ☞ the lands and activities included in the conservation effort;
- ☞ the obligations of partners to modify land management or land use activities as a result of adaptive management; and
- ☞ the monitoring, reporting and auditing responsibilities the partners agree to conduct and be subject to during the length of the commitment;
- ☞ any additional conservation efforts a partner intends to engage in;
- ☞ public outreach and education activities partners agree to implement;
- ☞ the period for which it will bind the partner, as well as any renewal, modification and amendment opportunities under it;
- ☞ data sharing of Natural Heritage Inventory data for Karner blue butterfly element occurrences.

The commitments of the partners are detailed in their individual conservation agreements. Most partners have agreed to follow the guidelines and protocols included in the HCP User's Guide in Appendix E. Others will do a mix of what is in the HCP and some specific conservation measures outlined in their individual conservation agreements. All commitments, however, are stated in the partners' conservation agreements, especially in cases where they have chosen to operate differently than what is outlined in the HCP.

Any incidental take of a state or federally-listed species other than the Karner blue butterfly requires a permit or approval, other than the ITP granted for this HCP, from the

DNR and/or the USFWS. Such a permit was issued by the DNR to the HCP Partners in 1999 that allows for the incidental take of a specific suite of state-only listed species that will likely benefit from the Kbb conservation measures in the HCP and are able to withstand the minimal amount of impact from land management activities.

Access to the lands and relevant records of each partner, for the purpose of implementing the conservation program and assuring compliance with the agreement, is described in the conservation agreement. It is necessary for the DNR, and others including the USFWS, to access partner lands for the purposes of auditing and implementing the ITP.

The conservation agreements also include provisions to address the assignment of privileges and the transfer of lands, including the process to address proposed transfers. The transfer of lands or modification of obligations will be addressed by notice to the DNR.

Remedies. Finally, the conservation agreements detail the remedies available in the event that a partner violates provisions of the agreement. A partner violating provisions of the conservation agreement may not only lose coverage under the ITP and be subject to prosecution by the USFWS if take is involved, but will also be subject to various civil remedies and damages the DNR may seek for contract breach. Decisions on when to seek such contract remedies by the DNR will involve the IOC. The final decision on conservation agreement enforcement will rest with the parties; therefore, a partner's violation of the conservation agreement will be the DNR's responsibility to enforce. The decision to seek enforcement for an unauthorized take under the ESA will be solely the decision of the USFWS.

The goal of this contractual relationship between the partners and the DNR is that of most service contracts. The parties want to continue their relationship in an amicable and reasonable manner to achieve the goal of the contractual agreement. In this case, both parties want to assure the conservation of the Karner blue butterfly, but be allowed to reasonably continue land management and use activities. With this species, both can be reached. Few contractual relationships flow without bumps in the road. Minor infractions could take place, but should not jeopardize the completion of the contract or achievement of the goals it was entered into to achieve. Therefore, levels of contract enforcement or administration are common. These may include:

- ☞ notification to fully comply, pointing out an infraction not needing correction, with no further pecuniary remedies or loss of ITP coverage;
- ☞ notification to comply, and correction of an infraction within a certain period of time, with no further pecuniary remedies or loss of ITP coverage;
- ☞ notification of an infraction and the seeking of pecuniary damages, but *no* loss of ITP coverage; or
- ☞ notification of an infraction and the seeking of pecuniary damages *with* loss of ITP coverage.

These stages of contract administration cannot be well-defined. Sound judgment and understanding must be included in contract administration and is an obligation of both the DNR and the partners. Strict and unreasonable administration and enforcement on the part of either party might assure that the goals of the agreement cannot be reached. (*For specifics regarding remedies, see the conservation agreement (SHCA) templates in Appendix D.*)

This HCP partnership relies and must be based on an open and honest relationship that encourages on-going communication. Immediate notification to the DNR of any violations of the conservation agreements, especially if they involve an unauthorized take of the Karner blue butterfly, is expected. Likewise, the reaction of the DNR to the information and notice should recognize this working partnership and the efforts to jointly conserve and protect the species. Responses should be molded to encourage the process to mitigate or address take in a reasonable and responsible manner through reasonable and realistic contract administration and remedy selection.

At any time that a partner engages in unauthorized take of Karner blue butterflies (i.e. take not covered by the ITP), the issue of ESA enforcement by the USFWS arises. This may result in civil or criminal penalties being assessed against the partners involved. The enforcement will be at the discretion of the USFWS.

Any contractual administration, as will be the case with the conservation agreements, must be flexible and have the latitude to address infractions or violations of agreements in a manner which includes the exercise of sound judgment, consideration of the resource, and furtherance of the conservation goals of the agreement. This conservation plan relies on continuing activity by the partners. Similarly, the continuation of activity by the partners may rely on their authorization under the ITP. Partners often depend on employees and agents, that they cannot constantly supervise, to conduct land management and use activities. Conservation measures in contracts and directions for conducting activities will, in large part, assure they conform to the ITP. Through the IOC and other partners and participants, a wide variety of views and experiences will be available to assure sound, reasonable and equitable administration and enforcement of the agreements, including any remedies that may be sought consistent with them.

C. Implementation Oversight Committee (IOC)

The Implementation Oversight Committee (IOC) is a subset of partners and non-partner cooperators, which primarily exists to represent the partners' interests during the permit period. Non-partner participation is encouraged to provide a broader perspective of shared goals for successful conservation of the Karner blue butterfly and its habitat.

There are four levels of participation in which the IOC will act:

- 1) advising the DNR,
- 2) making decisions on behalf of the partners,
- 3) actively planning and providing services, and
- 4) making recommendations to the partnership and the DNR.

Each of these roles is briefly discussed below.

The IOC will act in an advisory capacity, to provide guidance to the "permit administrator" (DNR) in any and all matters pertaining to the HCP. The implementation activities which the IOC, in its advisory role, will review and offer recommendations to the DNR include the following:

- ☞ the approval of new partner applications (Note: ITP coverage for new partners requires issuance of a Certificate of Inclusion by the DNR);
- ☞ the withdrawal of partners from the HCP and termination of conservation agreements;
- ☞ the transference of incidental take authority by way of the transfer of land rights (as defined in the agreements);
- ☞ HCP review process and permit renewal;
- ☞ the approval of amendments and changes to the HCP;
- ☞ disposition of funds common to the partnership [Note: This does not include funds and in-kind services belonging to an individual partner or the state.];
- ☞ review of partner audit reports with non-compliances and consideration of remedies for non-compliant performance (agreement violations);
- ☞ remedies for conservation agreement violations;
- ☞ public relations and communications; and
- ☞ adaptive management and research guidance.

The IOC will act as a decision maker on behalf of the partnership in some matters, including:

- ☞ IOC administrative issues, such as membership, IOC operating rules and processes;
- ☞ Establishment of IOC operating ground rules/rules of conduct;
- ☞ Composition and assignment of IOC subcommittee responsibilities and operations; and
- ☞ Creation of programs for annual HCP partnership meetings.

The IOC will play an active role in planning and providing services and products in some areas, by both working as a committee and through IOC working subcommittees. Some of these areas are:

- ☞ developing funding strategies and coordinating and seeking funding;
- ☞ providing guidance on outreach and education activities;
- ☞ providing materials and guidance on public relations and communications issues and activities; and
- ☞ in conjunction with the HCP Coordinator, developing, planning and co-hosting periodic HCP partner meetings.

In matters of direct concern for all partners, the IOC will assess available information and make recommendations or offer alternatives to the partners regarding matters requiring a full partnership decision. In these cases, the Articles of Partnership will be followed for partner decision making and voting. Issues for entire partnership include:

- ☞ issues governing changes to IOC decision making process and authority, and
- ☞ amendments to the HCP including ESA listing status changes.

IOC Leadership and Partner Participation. The DNR performs two roles for the HCP: permit administrator and partner. As a partner, the DNR will be a permanent member of the IOC. The DNR HCP Coordinator will act as the DNR representative and facilitate IOC meetings.

Any qualifying Full partner may sit on the IOC. This includes new partners added during the permit period. Limited partners are not expected to participate in HCP or IOC meetings, but are welcome to attend and fully participate, except in cases of voting. The IOC will be composed of one member from each type of partner. The current entity groups which will be represented are:

- ☞ utility managers,
- ☞ road rights-of-way managers,
- ☞ forest industry,
- ☞ county forests,
- ☞ the DNR, and
- ☞ the DATCP.

Members may be added in the future as new entity groups join the HCP. Membership will rotate on a staggered basis among partners. Each partner should consider it a serious responsibility of membership in the HCP to contribute their time to serve at least one term on the IOC. Representation of their interests will depend on their participation.

A partner other than the DNR will chair the IOC. Elections will be held consistent with the IOC administrative procedures ([Refer to the IOC Administrative Procedure in Appendix E](#)) to determine the chair person. Several members of the IOC may be "sub-committee chairs" of specific areas or ad hoc teams. They will not be involved in the day-to-day operations of the HCP, but will serve an advisory function for major issues brought to them by the HCP Coordinator, the IOC, the Partners, the Wisconsin KBB Recovery Working Group or the USFWS. The sub-committees' role will mostly be to research issues (often outside the partnership), develop information on issues, communicate information to those concerned and lead discussions at IOC meetings.

IOC Representation by Non-Partners. Five non-partner participants will be encouraged to be formal members on the IOC in the same manner as they were during the HCP development process. These participants are the Wisconsin Audubon Council, the Sierra Club, the Wisconsin Paper Council, the Wisconsin Woodland Owners Association and The Nature Conservancy.

Consistent with the Articles of Partnership, if they choose to, these non-partner IOC members have the opportunity to participate in an advisory capacity; with their opinions being considered in consensual discussions and decision making. Non-partner members will not vote with partners on partner-only decisions. Non-partners will not be eligible to

chair the IOC, as described elsewhere in this subsection.

Other non-partners are welcome to attend public-noticed IOC meetings as observers, but will only be allowed to passively participate, as IOC meetings are not public forums for general discussion, but working committee meetings. Where it would further the goals of the HCP and the IOC, other non-partners may be considered for formal membership, as approved by the IOC.

The special advisory role of the USFWS in the HCP development process is encouraged to continue as an advisory member to the IOC. Direct participation by the USFWS in IOC meetings is welcome, but not mandatory.

IOC Sub-committees. IOC sub-committees will provide focal points for and distribution of responsibility associated with preparation and leadership on key IOC issues. Sub-committees will primarily investigate action items between IOC meetings and develop recommended courses of action. All members of the IOC can serve as sub-committee chairs. IOC sub-committee chairs will interface with individuals and organizations outside the IOC to gather information essential to IOC matters and discussion (e.g., seeking opinions of other entity members or others regarding the appropriateness of a corrective action or remedy involving an agreement violation; investigating science-related issues with outside experts; or seeking financial accounting data or funding information from the funding sources, such as a foundation or the DNR). IOC sub-committee chairs will coordinate and/or present informational field trips or presentations, which enhance the knowledge of IOC members and participating guests.

Recommendations for IOC sub-committee areas include:

- ☞ approval of new partners,
- ☞ approval of modifications to the HCP,
- ☞ disposition of funds,
- ☞ auditing and non-compliance,
- ☞ partner support of Kbb recovery,
- ☞ public relations and communications, and
- ☞ adaptive management and research guidance.

IOC Operating Procedures. All IOC meetings will be noticed as a public meeting. The IOC will operate in an environment respecting anti-trust policies (see HCP Partnership anti-trust statement in Appendix C), and the IOC and the HCP partners will continue to follow the Articles of Partnership. (*Refer to Appendix E, the administrative procedures in the HCP User's Guide for detailed IOC operating procedures and processes.*)

D. Future Applications for Partner Status or Participation

Application Processing. The participation plan discussed in Chapter 5 of the HCP provides that those landowners or users requiring permit coverage will be offered the opportunity to join this conservation effort either as a Full partner, a Limited (Local) partner or a one-time sub-permittee. A person or entity desiring to join as a Full partner

must be willing to assume all obligations and duties of a partner, and will in turn, obtain the benefit of continued coverage and a voice in the continuing administration and implementation of the ITP. Limited partners (further described in Chapter 3 of the HCP) are county highway departments and townships that follow best management practices to perform a limited suite of road ROW maintenance activities. Limited partners have fewer obligations and responsibilities than full partners. The abbreviated nature of their participation is reflected in a simpler conservation agreement. One-time permittees requesting permit coverage for permanent take are required to agree to a compensatory mitigation plan. Under any category, the person or entity wishing to join the conservation program will seek to enter through an application and review process. *(The Application process for coverage under the ITP for those in the Non-Voluntary category is described in the "Inclusion Procedure" in Appendix E and in the HCP User's Guide ; Refer to DNR's Karner Blue HCP webpage for most current version .).*

E. Incidental Take Permit Period

Based upon partner responses gathered at the 2008 annual Partner's HCP Team meeting, the DNR is applying to renew the ITP for a 10-year extension with the opportunity to extend the period of coverage again if needed.

F. Incidental Take Permit and HCP Amendments

Amendments are anticipated to fall into two categories: major and minor. Major amendments will likely require amendment of the ITP and related documents as appropriate. Minor amendments to the HCP or ITP will be handled administratively and coordinated internally between the DNR and USFWS. With the adaptive management strategy being used, it is anticipated that ITP and major HCP amendments will be infrequent, if at all. HCP minor amendments will occur more often as new information informs changes to the HCP's conservation program.

Major Amendments to the ITP and HCP. Major amendments to the ITP and HCP proposed by the DNR will be processed by the USFWS in accordance with the ESA and permit regulations of 50 CFR Parts 13 and 17. Amendments to the ITP are needed when the DNR wishes to significantly modify the conservation program as described in the HCP (i.e., if the net effect on the species involved and level of take are significantly different than that analyzed under the original HCP and USFWS decision documents). Examples of modifications that would require amending the ITP include, but are not limited to:

- ☞ the addition of federally-listed species to the permit that were not previously addressed in the HCP;
- ☞ substantive reduction in the total acres that have been committed to the conservation program, if the reduction will significantly reduce the conservation effort to the extent its goals cannot be attained; and
- ☞ adjusting any mitigation to address "unforeseen circumstances" (unless adjustment is minor; see discussion of "No Surprises rule" on pages 68-69).

Minor Amendments to the ITP and HCP. Minor changes or amendments to the ITP or HCP can be completed administratively without amending the permit. Minor amendments are those that do not substantially modify the conservation program in the HCP. To qualify as a minor change, the net effect of the proposed change on the species involved cannot be significantly different than that analyzed under the original HCP and USFWS decision documents. Examples of minor changes include, but are not limited to:

- ☞ new activities not covered in the original HCP
- ☞ new conservation and implementation strategies not considered in the original HCP program
- ☞ new guidelines, protocols or administrative procedures

Routine revisions and clarifications to operating and administrative procedures do not warrant a formal minor amendment, (*Refer to IA provision 11.6 (14)(a) and the Amendment Administrative Procedure in App/E*) examples include:

- ☞ revisions and clarifications to survey and monitoring protocol,
- ☞ changes in land ownership that do not otherwise alter the effectiveness of the HCP.
- ☞ changes in the total acres that have been committed to in the conservation program that do not otherwise alter the effectiveness of the HCP, and

Detailed ITP/HCP amendment procedures can be found in the HCP administrative procedures. (*Refer to Amendment Procedures in appendix E and the HCP User's Guide.*)

The USFWS will retain its right to amend the permit for just cause at any time during the permit term, upon written finding of necessity.

G. Incidental Take Permit Renewal

At the end of the permit period, the DNR may choose to request a renewal or extension. The DNR will work with the USFWS and the HCP Partners to identify any information needed to extend the ITP. Any request for renewal or extension will be in writing and will comply with any applicable USFWS permit application guidelines.

H. USFWS Habitat Conservation Plan Assurances ("No Surprises" Rule)

The USFWS's final rule, entitled Habitat Conservation Plan Assurances ("No Surprises" Rule) dated February 23, 1998, (CFR 63(35):8859-8873) is intended to provide economic and regulatory certainty for non-federal property owners with approved and properly implemented HCPs in the event of "unforeseen circumstances." HCPs must provide provisions for addressing both "unforeseen" and "changed circumstances" not already addressed in the conservation plan. The provisions of the rule and their application to this HCP are discussed below.

Unforeseen Circumstances

Pursuant to the rule, *unforeseen circumstances* are changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by the plan developers at the time of the HCP's negotiation and development, and that result in a substantial and adverse change in the status of the covered species. Unforeseen circumstances, therefore, would include natural disasters of a scale or magnitude that would not be anticipated under normal circumstances. Events such as tornadoes or wildfires that might reasonably be anticipated to occur in Wisconsin would not meet this definition; however, events such as a wildfire of unanticipated size, an earthquake or other catastrophic event that would not normally occur in Wisconsin would meet the definition of unforeseen circumstances.

Changed Circumstances and Conservation Measures to Address Them

Unforeseen circumstances should not be confused with *changed circumstances*. Changed circumstances are changes in circumstances affecting the Karner blue butterfly within the High Potential Range, the lands included in the HCP that are subject to Partners' conservation agreements and that can reasonably be anticipated. Changed circumstances not already covered in other sections of the HCP that may occur during the permit period will be addressed by the DNR, USFWS and affected partners in the manner presented in Table 8.10 (pages 70-71).

Changed Circumstances Not Provided for in the HCP. In the event of *changed circumstances* with no conservation measures provided for in the plan, the USFWS will not require any conservation or mitigation measures above and beyond what is provided for in the HCP (and associated agreements), without the consent of the permittee and affected partner(s), provided the HCP is being properly implemented. The USFWS will coordinate and work cooperatively with the DNR and affected partners to explore ways that the operating conservation program can address the impact.

Unforeseen Circumstances and Measures to Address Them

Pursuant to the Rule, should *unforeseen circumstances* occur the following steps will be taken:

1. The USFWS will demonstrate that unforeseen circumstances exist and determine whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the Karner blue butterfly.
2. If the USFWS determines that additional conservation and mitigation measures are necessary to respond to unforeseen circumstances, the USFWS will work cooperatively with the DNR and appropriate Partners on additional conservation measures or mitigation measures that may be taken to address the impacts however:

- A. Requested modifications will be limited to the HCP's operating conservation program and maintain the original terms of the conservation plan to the maximum extent possible.
- B. The USFWS will not ask for more lands, financial compensation, or additional restrictions on land use, or other natural resources otherwise available for development or use without the consent of the DNR, who in turn, will obtain consent from the HCP partners as appropriate.

Table 8.10 Changed Circumstances and Assessment and Management Adjustments to Address Them

Changed Circumstance	Assessment and Management Adjustments
Forest fires and other wildfires of anticipated degrees and fire suppression activities related to them	Prior to a management action on lands impacted by the changed circumstance, the land manager will assess any necessary changes in management that may be needed to further the conservation of the Kbb and incorporate those measures into the management plan (e.g., burn management on lands impacted by a forest fires or other wildfire may have to be adjusted (e.g., postponed). There are no specific reporting requirements above and beyond normal annual reporting.
Natural weather events such as tornadoes and flooding	Same procedures as for forest and other wildfires

Partner Assurances. The DNR and HCP partners acknowledge that the assurances provided by the Rule are extended to this HCP provided the permittee and partners are properly implementing the HCP, Implementing Agreement, associated conservation agreements and the ITP.

Processing Conservation Plan Changes as a Result of Unforeseen or Changed Circumstances. Changes to the conservation program will be processed as amendments to the ITP and/or HCP, as appropriate, with commensurate changes to partners' conservation agreements, as needed.

Relationship of Changed Circumstances to the HCP's Adaptive Management Strategy. In the event of changed circumstances that may be adequately addressed

through the adaptive management strategy, the HCP Partnership will respond to those changed circumstances, as specified in and consistent with the HCP, Implementing Agreement and associated conservation agreements, during the life of the ITP.

The changed circumstances noted in Table 8.10 (page 70) will be addressed in the context of the adaptive management strategy outlined in this HCP.

Among other things, adaptive management is intended to detect changes in Karner blue butterfly populations and habitat over time. The process is designed for normal circumstances, to observe and analyze the results of management activities and treatments. This is a relatively long-term view looking at cumulative effects. In contrast, changed circumstances are the result of a short-term or real-time event, the adverse effects of which may be realized simultaneous to the event. If the event negatively affected occupied habitat in a manner not reasonably expected under management and use of the land without the event, a process for appropriate and available corrective action will result as a normal application of the adaptive management process.

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Chapter 9. Amendments for Future Species Listings

If a currently unlisted species is federally listed as endangered or threatened pursuant to the ESA after the ITP has been issued, and the partners desire incidental take coverage for that species, the DNR shall coordinate with the USFWS on a permit amendment to include the newly listed species.

This process shall entail the review of the HCP and conservation agreements to determine if the conservation measures identified in those documents are adequate for conservation of the newly listed species. If determined adequate by both parties, the DNR shall request an amendment to the ITP to include the newly listed species.

If conservation of the species is not adequately covered by the HCP and conservation agreements, the DNR shall submit a revised or supplementary HCP and supporting documentation including amended conservation agreements (as appropriate) with the request to amend the ITP. While DNR may negotiate an amendment to include other species, participation regarding additional species through this amendment provision is on a partner-by-partner basis, and would only bind a partner should they choose to amend their own conservation agreement. Any permit amendment for take of newly listed species would only cover those partners with conservation agreements that conserve the species. The USFWS is responsible for completing environmental compliance documents under NEPA (although the DNR may assist with this process) and for all internal compliance under section 7 of the ESA.

Wisconsin Karner Blue Butterfly Habitat Conservation Plan

Chapter 10: List of Preparers

A. Major Contributors

Individuals who contributed significantly to the drafting and editing of the HCP and EIS documents and their qualifications are listed briefly in this section.

David R. Lentz received his B.S. in Natural Resource Management from the University of Wisconsin-Stevens Point in 1975. He has worked at the Wisconsin DNR since 1993, first as a Fisheries Biologist and since 1995 as the coordinator of the Karner Blue Butterfly HCP program. Dave has consulted and lectured nationally on HCP and team processes. Prior to 1993, Dave was in the private sector in industrial management for 12 years. He spent half of this time in the management and reclamation of open pit mining, and the other half in Total Quality Management in manufacturing, focusing on group facilitation and team dynamics.

Jim Christenson received his B.S. in Business Administration from the University of Wisconsin-Eau Claire in 1968, and his J.D. from the University of Wisconsin-Madison. Jim has almost 35 years of experience in public sector law, and, excepting one year as the Assistant District Attorney of Dane County, all of his service has been for the DNR. Jim has provided legal counsel and representation in all facets of natural resource and house counsel law, with an emphasis in areas of fish and wildlife, forestry, endangered resources, and land management.

Darrell Zastrow received his B.S. in Forest Management from the University of Wisconsin-Stevens Point in 1982. He completed the Program of Advanced Studies in Silviculture and was certified as a Silviculturist in 1993. Darrell has 25 years of experience with the DNR, with 10 of those as a field forester and 15 as a Forest Ecologist/Silviculturist, and is currently the Deputy Chief State Forester and Division of Forestry Deputy Administrator. In the field, he has assisted a wide variety of public, private, and tribal forest landowners in meeting their management goals and objectives. Most recently, his responsibilities focus on the development of statewide guidelines for integrating ecological considerations into the management of forest resources.

Cathy Bleser received her B.S. in Biology in 1984, and B.A in Journalism in 1981, both from the University of Wisconsin-Madison. Cathy worked with the DNR's Bureau of Endangered Resources for over 10 years as the coordinator for rare butterfly and moth conservation. From 1990-1999 she coordinated the state's Karner blue butterfly survey, management, and protection programs. In addition to her state efforts, Cathy also served

on the Karner Blue Butterfly Federal Recovery Team. Currently, Cathy serves as the Regional Ecologist for the DNR's South Central Region.

Gary Birch received his B.S. in Forestry from the University of Wisconsin-Madison in 1974. He has 24 years of experience as a biologist, five with the U.S. Forest Service and 15 with the DNR. He has extensive experience developing environmental impact statements and other environmental review documents. Gary is currently a biologist with the Wisconsin DOT.

Catherine Carnes received her B.S. in Biology from the University of Wisconsin-Stevens Point in 1972, and her M.S. in Biology from Buffalo State College in 1981. Cathy is currently the USFWS Karner Blue Butterfly Recovery Coordinator, and has worked extensively on issues related to conservation and recovery of the species. She has been with the USFWS since 1987, and served as the USFWS Endangered Species Coordinator for Wisconsin for the past fourteen years. Prior to this, Cathy worked in the wetland regulatory program at the Army Corps of Engineers for four years. From 1975 to 1983, Cathy worked in limnological field and laboratory work at both UW-Madison and the Great Lakes Laboratory at Buffalo State College.

Lisa Mandell received her B.S. in Biology and Spanish from the College of William and Mary in 1979. She worked for the USFWS from 1980 to 2001, left Government service for a time, and returned to the agency in 2008. Lisa currently serves on the Region 3 Endangered Species staff and works on HCPs, Recovery Permits, and State Grants for the States of Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, Ohio and Wisconsin.

Bernadette Williams received her B.A. in art history from the University of Pittsburgh in 1996, and her MFA in Art History from the University of Pittsburgh in 1999. Bernadette has over 7 years in outreach and education surrounding environmental issues, including leading the National Science Program at the Milwaukee Public Museum for 4 years, leading courses in entomology, biology and ecology for inner city schools in Milwaukee, 2 years assisting the development of Wisconsin's Invasive Species Best Management practices, and is one of the Invasive Species Coordinators for the Wisconsin Department of Natural Resources in addition to her position with the Karner Blue Butterfly program as a Special Assistant to the Karner Blue Butterfly Coordinator.

Quinn Williams received his B.A. in political science from the University of Wisconsin in 2002, and his Juris Doctorate from Marquette University Law School in 2006. Quinn interned in law school with the Wisconsin Department of Justice, the Wisconsin Department of Natural Resources Bureau of Legal Services, and with the United States Department of Agriculture Forest Service Office of General Counsel. Quinn has been the Division of Forestry's attorney with the Department of Natural Resources Bureau of Legal Services for the past 3½ years.

Ursula Petersen received her B.S. in Conservation of Natural Resources from the University of Michigan at Ann Arbor and her M.S. in Botany/Zoology from the University of Wisconsin-Madison. Ursula has participated and been employed in

ecological education, species and habitat mapping and surveying, and behavioral ecology research. Since 1991, she has managed the DATCP's Endangered Species Program of protecting listed species and their habitats from pesticide injury.

Michael Luedeke received his B.S. in Mathematics from Xavier University in 1971, and his M.S. in Forest Management from the University of Wisconsin-Madison in 1977. As of 1990, he has served as the Burnett County Forest and Parks Administrator. Previously, Mike worked in Burnett County as a DNR field forester for 10 years. Other experience includes three years as a forest analyst for the Northwest Regional Planning Commission and two years as a statistical assistant at the USDA Forest Products Lab. Currently, Mike is the DNR's Regional Forestry Leader in the Northern Region.

Fred Souba, Jr. received his B.S. in Forest Management and Administration from the University of Minnesota in 1973. From 1990 to 1998, Fred worked for Johnson Timber Corp. As Vice President, Fred was responsible for all aspects of manufacturing, wood procurement, and forest management on 20,000 acres. Prior to this, he served as Operations Manager for Nekoosa Papers, with responsibilities for nursery operations, woodland services, and forest management activities on 450,000 acres in Wisconsin and Michigan. Areas of expertise include forest operations, forest inventory design, forest management and planning, and GIS applications for forestry and wood procurement. Fred is currently employed by New Page Corp., Inc.

Pam Rasmussen received her B.B.A. in Biology and Business Administration from the University of Wisconsin-Eau Claire in 1987. She currently serves as the Analyst and Planning Coordinator of environmental affairs and lands for Northern States Power Company. Pam has eight years of experience in the environmental aspects of utility management. She has been involved in transmission line permitting and environmental review, statewide electric planning coordination, and hydropower plant licensing. Prior to this, Pam worked briefly as a Crew Leader for the Wisconsin Conservation Corps.

B. Other Contributors

A number of other participants in the Wisconsin Karner Blue Butterfly HCP process contributed to the development of the HCP and EIS documents by providing information, reviewing and editing portions of the document, contributing ideas in HCP meetings and discussions, and in other ways too numerous to list. These individuals are listed in this section.

Other Contributors:

Dreux Watermolen, Wisconsin DNR
Christopher (Kit) Hart, Plum Creek Timber
Kathryn Kirk, Wisconsin DNR
Pat Kandziora, Wisconsin Department of Agriculture, Trade and Consumer Protection
Thomas C. Hunt, University of Wisconsin – Platteville (formerly Wis. Power & Light Co.)
Nancy Braker, Carleton College (formerly with TNC)
Doug Barncard, Thilmany International Paper (retired)
Bob Hess, Wisconsin DNR
Cynthia Lane, Ecological Strategies, LLC (formerly with the University of Minnesota)
Louis Locke, Wisconsin Audubon Council
Nancy Bozek, Wisconsin Woodland Owners Assoc.
Alan Madsen, Northwest Wisconsin Electric Company
Chuck Pils, DNR Bureau of Endangered Resources (Retired)
Ann B. Swengel, North American Butterfly Association

Wisconsin Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement Chapter 11: References Cited

This chapter lists references cited in the Wisconsin Karner Blue Butterfly HCP (2009). References are listed alphabetically by primary author.

- American Forest and Paper Association. 1995. *Facts and Figures: U.S. Forests, 1995*. Amer. Forest & Paper Assoc., Washington, DC. 32 pp.
- Andow, D.A., R.J. Baker and C.P. Lane. (eds) 1994. *Karner Blue Butterfly: A Symbol of a Vanishing Landscape*. Univ. Minnesota Agr. Experiment Sta., St. Paul. *Misc. Publ.* 84-1994. 220 pp.
- Baker, R.J. 1994. The Karner blue butterfly: 1993 and beyond. Pp. 163-169 *In* Andow, D.A., R.J. Baker and C.P. Lane. (eds) 1994. *Karner Blue Butterfly: A Symbol of a Vanishing Landscape*. Univ. Minnesota Agr. Experiment Sta., St. Paul. *Misc. Publ.* 84-1994. 220 pp.6
- Besl, J. 1994. Wisconsin household projections. *Wisconsin State Data Center News* 13(4):1.
- Bidwell, A. 1996. A Habitat Evaluation Plan for the Karner Blue Butterfly. Unpubl. Rept. to Wisconsin Dept. Natural Resources, Madison. 26 pp.
- Bleser, C.A. 1993. *Status Survey, Management and Monitoring Activities for the Karner Blue Butterfly (Lycaeides melissa samuelis) in Wisconsin, 1990-1992*. Final Rept. to U.S.F.W.S. per Coop. Agree. E-113, Study 320. Wisconsin Dept. Natural Resources, Madison. 88 pp. + appendices.
- Boorman, S.A. and P.R. Levitt. 1973. Group selection on the boundary of a stable population. *Theoretical Pop. Biol.* 4:85-128.
- Borth, B. 1996. Wisconsin butterflies. Unpubl. Rept. Wisconsin Gas Co., Milwaukee. 1 pp.
- Borth, R.J. 1997. Karner blue management implications for some associated Lepidoptera of Wisconsin barrens. Unpub. Rept. to HCP partners. Wisconsin Gas, Milwaukee.
- Celebrezze, T.M. 1996. Spatial patterning of lupine (*Lupinus perennis*): Implications for metapopulation viability analysis of the endangered Karner blue butterfly (*Lycaeides melissa samuelis*). M.S. Thesis. Univ. Wisconsin, Madison. 65 pp.
- Eckstein, R. and B. Moss. 1995. Oak and pine barrens communities. Pp. 98-114 *In* Wisconsin's Biodiversity as a Management Issue: A Report to Department of Natural Resources Managers. Wisconsin Dept. Natural Resources, Madison.
- Everett, R.L. and D.M. Baumgartner. 1997. Disturbance management and resource product availability. Pp. 14-23 *In* R.J. Barbour and K.E. Skog (eds.). *Role of Wood Production in Ecosystem Management: Proceedings of the Sustainable Forestry Working Group at the IUFRO All Division 5 Conference, Pullman, Washington, July 1997*. General Tech. Rept. FPL-GTR-100, For. Prods. Lab., U.S. For. Service, Madison. 98 pp.
- Ferge, L.A. 1990. Checklist of Wisconsin butterflies. *Wisconsin Entomol. Soc. Spec. Publ.* (1):1-4.
- Grigore, M. 1992. The short-term effect of fire on wild lupine (*Lupinus perennis* L.). M.S. Thesis. Univ. Toledo. Toledo, OH.
- Grundel, R., N.B. Pavlovic and C.L. Sulzman. 1998. Habitat use by the endangered Karner blue butterfly in oak woodlands: The influence of canopy cover. *Biol. Conserv.* 85:47-53.
- Haack, R.A. 1993. The endangered Karner blue butterfly (Lepidoptera: Lycaenidae): Biology, management considerations, and data gaps. Pp 83-110 *In* Gillespie, A.R., G.R. Parker, P.E. Pope and G. Rink (eds). *Proc. 9th Central Harwood Forest Conf.* General Tech. Rept. NC-161. USDA-Forest Service, North Cent. For. Exper. Sta., St. Paul.
- Henderson, R. 1995b. Plant species composition of Wisconsin prairies: An aid to selecting

- species for plantings and restorations based upon University of Wisconsin-Madison Plant Ecology Laboratory data. Wisconsin Dept. Natural Resources *Technical Bull.* (188):1-58.
- Howe, H.F. 1994. Managing species diversity in tallgrass prairie: Assumptions and implications. *Conservation Biol.* 8:691-704.
- Howe, W.M. (ed) 1975. *The Butterflies of North America*. Doubleday & Co., Inc. Garden City, NY. 633 pp.
- Johnson, K. and J.M. Malick. 1972. An annotated list of central Wisconsin butterflies. *Repts. on the Fauna and Flora of Wisconsin* (7):1-6. Mus. Nat. Hist., Univ. Wisconsin-Stevens Point.
- Karner Blue Technical Team. 1998. *Wildlife Management Guidelines for the Karner Blue Butterfly*. Unpubl. Rept. Wisconsin Dept. Natural Resources, Madison. 42 p.
- King, R. 1996. *Spatial Ecology, Dispersal Patterns and Monitoring Methods for the Karner Blue Butterfly*, *Lycaeides melissa samuelis*, on *Necedah National Wildlife Refuge*. Unpubl. Rept. to Natl. Fish Wildl. Foundation, USFWS and Forest Industry.
- Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Final Rept. to USFWS (Amendment #38 to Cooperative Agreement #14-16-0003-89-933). Wisconsin Dept. Natural Resources, Madison.
- Klots, A.B. 1951. *A Field Guide to the Butterflies of North America, East of the Great Plains*. Houghton Mifflin Co., Boston. 349 pp.
- Lane, C.P. 1994. Habitat preferences of the Karner blue butterfly in Minnesota. Pp. 63- 72 In Andow, D.A., R.J. Baker and C.P. Lane. (eds) 1994. *Karner Blue Butterfly: A Symbol of a Vanishing Landscape*. Univ. Minnesota Agr. Experiment Sta., St. Paul. *Misc. Publ.* 84-1994. 220 pp.
- Lane, C.P. 1997. Forestry Management Guidelines. Unpubl. Rept. for Wisconsin DNR, Madison and U.S. Fish & Wildl. Service, St. Paul.
- Opler, P.A. 1981. Management of prairie habitats for insect conservation. *J. Nat. Areas Assoc.* 1(4):3-6
- Opler, P.A. 1995. Scientific evaluation of literature cited in "A review of the information on federally endangered Karner blue butterfly *Lycaeides melissa samuelis* Nabokov (Lepidoptera: Lycaenidae)" by Premo et al. (1994). 24 pp. In National Fish and Wildlife Foundation. *Review and Assessment of Information on the Federally Endangered Karner Blue Butterfly* (*Lycaeides melissa samuelis*). Washington, DC.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. John Hopkins Univ. Press, Baltimore. 294 pp + plates.
- Pyle, R.M., M. Bentzien and P. Opler. 1981. Insect conservation. *Ann. Rev. Entomol.* 26:233-258.
- Rock, H.W. 1977. *Prairie Propagation Handbook: A List of Prairie Plants of Wisconsin and Suggested Techniques for Growing Them as Part of a Prairie or of a Wild Garden to Preserve Them for Our Joy and for Future Generations*. 5th ed. Wehr Nature Center, Hales Corners, WI. 75 pp.
- Rogers, P. 1996. *Disturbance Ecology and Forest Management: A Review of the Literature*. General Tech. Rept. INT-GTR-336, Intermountain Res. Sta., U.S. For. Service, Ogden, UT. 16 pp.
- Savignano, D.A. 1990. Field Investigations of a Facultative Mutualism Between *Lycaeides melissa samuelis* Nabokov (Lycaenidae), the Karner Blue Butterfly, and Attendant Ants. Ph.D. Thesis. Univ. Texas.
- Savignano, D.A. 1994a. The distribution of the Karner blue butterfly in Saratoga County, New York. Pp. 73-80 In Andow, D.A., R.J. Baker and C.P. Lane. (eds) 1994. *Karner Blue Butterfly: A Symbol of a Vanishing Landscape*. Univ. Minnesota Agr. Experiment Sta., St. Paul. *Misc. Publ.* 84-1994. 220 pp.
- Savignano, D.A. 1994b. Benefits to Karner blue butterfly larvae from association with ants. Pp. 37-46 In Andow, D.A., R.J. Baker and C.P. Lane. (eds) 1994. *Karner Blue Butterfly: A Symbol of a Vanishing Landscape*. Univ. Minnesota Agr. Experiment Sta., St. Paul. *Misc.*

- Publ.* 84-1994. 220 pp.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford. 583 pp.
- Shively, M.M.R. and S.A. Temple. 1994. An Ecosystem Recovery Plan for Wisconsin Pine-Shrub-Grassland Ecosystems (Pine Barrens). Unpubl. Rept. Dept. Wildlife Ecol., Univ. Wisconsin, Madison. 82 pp.
- U.S. Fish and Wildlife Service. 2000. Notice of availability of a final addendum to the handbook for habitat conservation planning and incidental take permitting process. Federal Register 65(106):35242-35257).
- U.S. Fish and Wildlife Service. 2003. Final Recovery Plan for the Karner Blue Butterfly (*Lycaeides melissa samuelis*). U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 273 pp.
- U.S. Fish and Wildlife Service. 1992a. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Karner Blue Butterfly (50 CFR Part 17) *Federal Register* 57(240):59236-59244.
- U.S. Fish and Wildlife Service. 1992b. Endangered and Threatened Wildlife and Plants; Proposed Endangered Status for the Karner Blue Butterfly (50 CFR Part 17) *Federal Register* 57(13):2241-2246.
- U.S. Fish and Wildlife Service. 1996. *Endangered Species Habitat Conservation Planning Handbook*. U.S. Fish Wildl. Serv. and Natl. Marine Fish. Serv., Washington, DC.
- U.S. Fish and Wildlife Service. July 2009. Fact Sheet: Habitat Conservation Plans Under the Endangered Species Act
- Vogl, R.J. 1970. Fire and the northern Wisconsin pine barrens. Pp 175-209 *In Proc. Annu. Tall Timbers Fire Ecology Conf. No. 10*.
- Welch, R. 1993. Dispersal and conservation behavior in the Karner blue butterfly (*Lycaeides melissa samuelis*) in central Wisconsin. Unpubl. Rept. to USFWS, Green Bay.
- White, P.S. 1987. Natural disturbance, patch dynamics and landscape pattern in natural areas. *Nat. Areas J.* 7:14-22.
- Wisconsin Department of Transportation. (no date). *Wisconsin's State Highway Mowing Policy*. Wisconsin Dept. Transportation, Madison. 4 pp.
- Wisconsin DNR 1999. Wisconsin Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement
- Wisconsin DNR. 1995. *Wisconsin's Forestry Best Management Practices for Water Quality*. Bureau Forestry. Wisconsin Dept. Natural Resources, Madison. 76 pp.

Wisconsin Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement

Appendix A. Karner Blue Butterfly Biology

The following summary of Karner blue butterfly biology and ecology is excerpted from the USFWS's working draft Karner Blue Butterfly Recovery Plan (USFWS 1997). *Text is reproduced here without editing; only formatting was changed.* For a complete copy of the federal Recovery Plan, please contact the Green Bay Field Office of the USFWS.

Since this appendix consists of material excerpted from another document, some clarification is merited. The federal Recovery Plan was used as the source for this appendix because it includes the most succinct and current summary of Karner blue butterfly biology. References to "this recovery plan" found in this excerpt refer to the working draft Karner Blue Butterfly Recovery Plan (USFWS 1997), *not* the Wisconsin Karner Blue Butterfly HCP and EIS documents (the HCP is not a federal recovery plan). Similarly, mention of appendices made in this excerpt refers to appendices of the working draft Karner Blue Butterfly Recovery Plan, not material appended to the HCP and EIS. To reduce redundancy and costs, references cited in the excerpt are not included in Chapter VIII of the EIS. Readers should refer to the recovery plan for proper citations. However, table and figure references included here do refer to tables and figures in the excerpt.

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Part I. Introduction

Karner blue butterfly (*Lycaeides melissa samuelis* Nabokov) differs from many other federally listed species, particularly other arthropods, in that it is geographically widespread. In some areas it has been or continues to be locally abundant. Much of its original savanna/barrens habitat has been destroyed by development or degraded by succession, and has not been replaced by other suitable habitat, especially in the eastern part of its range and its geographic range margins. Fragmentation of the landscape from larger suitable habitats, to smaller sometimes isolated habitats, is also suspected of contributing to the problem. The loss of suitable habitat resulted in a rapid decline in population numbers and extirpation of large populations across its range, and prompted its listing as a federally endangered species.

Karner blue butterfly ecology is closely interwoven with its habitat. These habitats provide food resources and key microhabitats for the butterfly. The larval stage is known to feed only on one species of plant, wild lupine (*Lupinus perennis*). Adults require nectar sources to survive and lay sufficient eggs. Several life stages of the butterfly benefit from the variety of microhabitats often provided in some types of barrens, savanna, silvicultural, and rights-of-way ecosystems. These favorable microhabitats will disappear in a few to many years from normal successional processes, so Karner blue persistence is dependent on disturbance to renew existing habitat or to create new habitats. The distribution and dynamics of these ephemeral habitats form the ecological basis for recovery planning.

Taxonomy and Description

Karner blue butterfly was proposed for federal listing on January 21, 1992 (57 FR 2241), and on December 14, 1992 it was listed as federally endangered rangewide (57 FR 59236). The taxonomy follows Lane and Weller (1994) who have conducted the most recent review of the taxonomy of Karner blue butterfly. Karner blue is a member of the genus *Lycaeides* (Lepidoptera: Lycaenidae: Polyommatainae) (Elliot 1973, Nabokov 1943, 1949). In North America there are two species of *Lycaeides*, *L. idas* (formerly *L. argyrognomon*) and *L. melissa* (Higgins 1985, Lane and Weller 1994). *Lycaeides melissa* is comprised of six subspecies, *L. m. melissa*, *L. m. annetta*, *L. m. inyoensis*, *L. m. mexicana*, *L. m. pseudosamuelis*, and *L. m. samuelis* (Lane and Weller 1994). The taxonomy for this group was conducted by Vladimir Nabokov in the 1940's. Sometime after this work was published, Nabokov commented in private letters that Karner blue should be classified as a distinct species (Nabokov 1952, 1975, 1989). Nabokov noted that the male genitalia of *L. m. melissa* were very variable geographically, but the male genitalia of *L. m. samuelis* were remarkably constant over the entire range of the subspecies. Moreover, *L. m. samuelis* uses only one host plant throughout its geographic range, while *L. m. melissa* uses many species of host plant.

The taxonomic work to elevate *L. m. samuelis* to the species level was never completed, and the currently accepted status of Karner blue butterfly is subspecific (Miller and Brown 1983, Nabokov 1943, 1949, Opler 1992, Opler and Krizek 1984).

Packer (1994) surveyed electrophoretic variation at 34 loci among Wisconsin (n=17) and New York (n=13) Karner blue butterflies and a Minnesota (n=15) population of melissa blue. An

average of 16.2-20.1 haploid genomes were sampled for each locus, and only 16 of the loci exhibited any electrophoretic variation among samples. Nei's genetic identity values were high (>0.967), and Packer concluded that the electrophoretic evidence does not provide evidence that Karner blue is a separate species from melissa blue. Electrophoretic data, however, are not usually reliable for separating closely related species, and this electrophoretic analysis cannot be used to determine the taxonomic status of Karner blue, because no relevant outgroup is identified for comparison.

The forewing length of adult Karner blue butterflies is 1.2-1.4 cm for males and 1.4-1.6 cm for females (Opler and Krizek 1984). The wing shape is rounded and less pointed than *L. m. melissa*, especially in the female hind wing (Nabokov 1949). The upper (dorsal) side of the male wing is a violet blue with a black margin and white fringed edge. The female upper side ranges from dull violet to bright purplish blue near the body and central portions of the wings, and the remainder of the wing is a light or dark gray-brown, with marginal orange crescents typically restricted to the hind wing. Both sexes are a grayish fawn color on the ventral side. Near the margins of the underside of both wings are orange crescents and metallic spots. The black terminal line along the margin of the hind wing is usually continuous (Klots 1979, Nabokov 1944). Male genitalia is the most reliable character for distinguishing adult *L. m. samuelis* from other subspecies (and species) (Nabokov 1944, 1949).

The eggs of Karner blue are tiny and radially symmetric with an approximately 0.7 mm diameter, somewhat flattened, and pale greenish-white in color (Dirig 1994 provides a photograph). The surface is deeply reticulated with a fine geometric pattern (Spoor 1994 provides some scanning electron micrographs of the reticulation). Larvae are a pea-green color, pubescent and dorsally flattened, with a brown-black to black head capsule. The head is often not visible as it is tucked under the body. Older larvae have pale green (to white) lateral stripes, and a dark green longitudinal stripe dorsally. In pre-pupal larvae the lateral stripes become less distinct and the color becomes a duller green. Larvae have four instars (Savignano 1990), and have three glandular structures that are known to mediate interactions with ants in other species of Lycaenidae (Savignano 1994 and references therein). Some of these glandular structures mediate interactions with ants in Karner blue, but it is not known what is secreted by any of the structures, and it is not known if any of the structures are active throughout larval life. Pupae are bright green and smooth, changing to a light tan with hints of purple shortly before emergence when the pharate adult cuticle separates from the cuticle of the pupal case.

Distinguishing Karner Blue from Similar Species. In eastern U.S., Karner blue butterfly can be confused readily with eastern-tailed blue (*Everes comyntas*) and less readily with spring azure (*Celastrina argiolus* complex) (Opler 1992, Scott 1986). Eastern-tailed blues are on average smaller than Karner blue and they have black projections or "tails" on the outer angle of the hind wings (Opler 1992, Scott 1986). These tails may be broken off, but usually leave some remnant indicating their former presence. On the underside of the wings, orange crescents are absent on the forewing, and four spots, two large and two small, are present on the hind wing (Opler 1992, Scott 1986). It may be difficult to distinguish a large male eastern-tailed blue from a small male Karner blue when they are in flight. Spring azures lack the orange crescents on the under sides of their wings (Opler 1992).

In the midwest, Karner blue butterflies can be confused with Nabokov's blue (*L. idas nabokovi*), melissa blue (*L. melissa melissa*), eastern- and western-tailed blue (*Everes comyntas* and *E. amyntula*), Reakirt's blue (*Hemiargus isola*), greenish blue (*Plebius saepiolus*), marine blue (*Leptotes marina*), acmon blue (*Icaricia acmon*), spring azure (*Celastrina argiolus* complex), and silvery blue (*Glaucopsyche lygdamus*) (Opler 1992, Scott 1986). Species occurrence varies throughout the midwest and to determine the species present locally, consult local guides and checklists. Eastern-tailed blue is the only species that is confused readily with Karner blue. Spring azure, silvery blue, Reakirt's blue, and marine blue, lack the orange crescents on the under sides of their wings (Opler 1992, Opler and Krizek 1984, Scott 1986). Eastern- and western-tailed blues have tails (as described above), orange crescents are absent on the underside of the forewing, and there are, respectively, four or one orange spot(s) on the hind wing (fewer than Karner blue). Greenish blue has one or more orange marginal crescents, which are, however, much smaller in size than the spots on Karner blue. The marginal crescents on the dorsal side of the male acmon blue hind wing, tend to be more pink than orange (Opler 1992). Melissa blue can be distinguished from Karner blue by having orange banding on the upper (dorsal) side of the forewing, genitalic differences and differential habitat use (Nabokov 1943, 1949, Scott 1986). Melissa blue larvae can feed on *Astragalus* sp., *Glycyrriza lepidota*, *Lupinus* sp., and several other species (Scott 1986). The occurrence of melissa blue comes closest (30 miles) to Karner blue sites in southeastern Minnesota. The range of Nabokov's blue, *L. idas nabokovi*, overlaps with Karner blue in certain areas, but Karner blue is typically found in oak and pine savanna/barrens, whereas Nabokov's blue is found primarily in forest clearings (Masters 1972). Also, the two species have different host plants. Karner blue feeds exclusively on wild lupine (*Lupinus perennis*), and Nabokov's blue feeds on dwarf bilberry (*Vaccinium cespitosum*) (Nielsen and Ferge 1982). Although there are superficial differences in coloration between these two subspecies (Masters 1972), unequivocal identification would require dissection and examination of the male genitalia (Nabokov 1944). Interested readers should consult the cited references for more details.

Distribution

Historically the Karner blue butterfly occurred in a geographic band between 41° and 46° N latitude extending from Minnesota to Maine (Dirig 1994). The butterfly is commonly found on sandy soil types that have populations of *Lupinus perennis* (the only known larval food source), and often inhabits communities similar to oak and pine savanna/barrens communities. In this recovery plan, the term "lupine" will refer to *L. perennis* to the exclusion of all other species of *Lupinus*.

Dirig (1994) reviewed all of the locality records of Karner blue he could find, whether or not they were confirmed with vouchered specimens. His work is an exhaustive summary of the reports of Karner blue occurrence. To establish a definitive historic geographic range, the Recovery Team included only locality records with confirmed specimens. The Recovery Team contacted Dr. Robert Dirig for further information on some of his records, which he promptly provided. Information from him was especially critical for evaluating records from Pennsylvania, New Jersey, Maine, and Wisconsin. A summary of some of these findings are shown in Figures 8-11 below.

The historic northern limit of the butterfly corresponds roughly with the northern limit of lupine (Dirig 1994), but the current distribution indicates that the butterfly has contracted away from this limit. Many of the most northern populations of Karner blue have been extirpated, such as at Norway, ME, Webster, NH, Watertown, NY, throughout Ontario, Canada, Wausaukee, WI (this record is being checked), and Anoka, MN. Lupine has been reported from as far north as northern Vermont, and Elk Rapids, MI, but there are no records of Karner blue from these sites. The only populations of Karner blue now near the northern limit of lupine occur within the Superior Outwash Recovery Unit in Wisconsin.

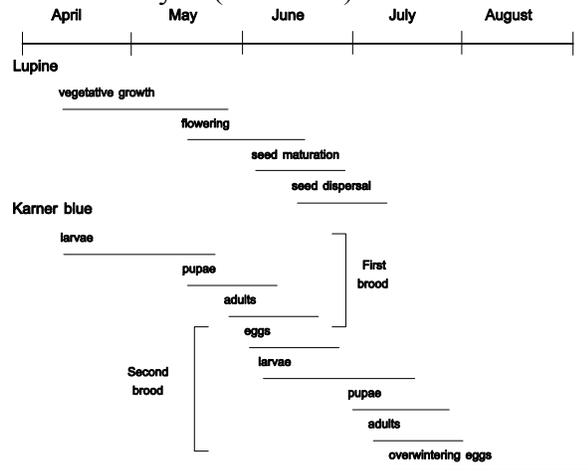
The historic western limit of the butterfly roughly corresponds with the western limit of lupine (Dirig 1994), and butterfly distribution appears to have contracted away from this limit as well. Although lupine occurs as far west as central Minnesota, the western-most record of Karner blue is at Anoka, MN, approximately 50 miles to the east. The Anoka population was extirpated sometime after 1984. The Iowa populations on the southwest fringe are also extirpated. Currently, the western-most populations of Karner blue occur in the Superior Outwash Recovery Unit and a small population occurs at the Whitewater Wildlife Management Area in southeast Minnesota in the Paleozoic Plateau Recovery Unit. The historic eastern limit of the butterfly roughly corresponds with the eastern limit of lupine. No historic or current records of Karner blue exist in Connecticut, Rhode Island, eastern Massachusetts, or eastern Long Island, but these native habitats were converted to incompatible human uses long ago, so the previous presence of the butterfly cannot be verified. Nonetheless, based on the biology of the butterfly and information on the native habitats, the butterfly probably inhabited these areas in the past. The eastern-most historic records of Karner blue exist from southwest Maine and throughout the Merrimack River valley system in New Hampshire and Massachusetts, but currently, this eastern-most population has contracted to a very small population near Concord, NH.

Unlike the other geographic limits, the historic southern limit of the butterfly does not correspond to the southern distribution of lupine. The distribution of lupine extends farther south than Karner blue in eastern U.S. along the eastern Appalachian Mountains and the Atlantic Coastal Plain, and in central U.S. in Illinois (Dirig 1994). Some of the historic records of Karner

blue along this southern limit are uncertain. The southern-most record near Coyington, IN, is probably erroneous. The recovery team could not find a specimen associated with this record, and lupine has not been recorded from near this locality. The records from several Pennsylvania localities could not be confirmed. These localities are recorded by Dirig (1994) and were reported to him by Dr. A. Shapiro. The recovery team corresponded with Dr. Shapiro, who stated that he could not locate a specimen corresponding with any of his reported Pennsylvania localities. The only confirmed record in Pennsylvania is from Wayne County. Several of the NY records along the Delaware River and the eastern branch of the Susquehanna River were confirmed with specimens. The New Jersey record may be erroneous, although specimens exist. Schweitzer (personal communication) suggested that the specimens were unlikely to have been collected from New Jersey and may have been mis-labelled NY specimens. The record from Brooklyn, NY, has been confirmed. The lack of correspondence of the southern limits of Karner blue and lupine has not been adequately addressed. Dirig (1994) suggested that the southern limit of Karner blue may follow the band of 80-100 days continuous winter snow cover, which he hypothesized was necessary for high overwintering egg survival. Many other hypotheses could explain the southern distribution limit of Karner blue.

Despite this uncertainty, similar to the other geographic limits, the distribution of Karner blue has contracted away from its historic southern limit. Populations have been extirpated from southern New York, Pennsylvania, Ohio, Illinois, and Iowa. In Indiana, the distribution has contracted. Once present throughout northern Indiana, it now occurs only in a few localities in northwestern Indiana, associated with the dunefields and dune and swale complexes near the southern end of Lake Michigan.

Figure 1. Phenology of Karner blue and lupine. In colder (warmer) areas and years phenologies will be delayed (advanced).

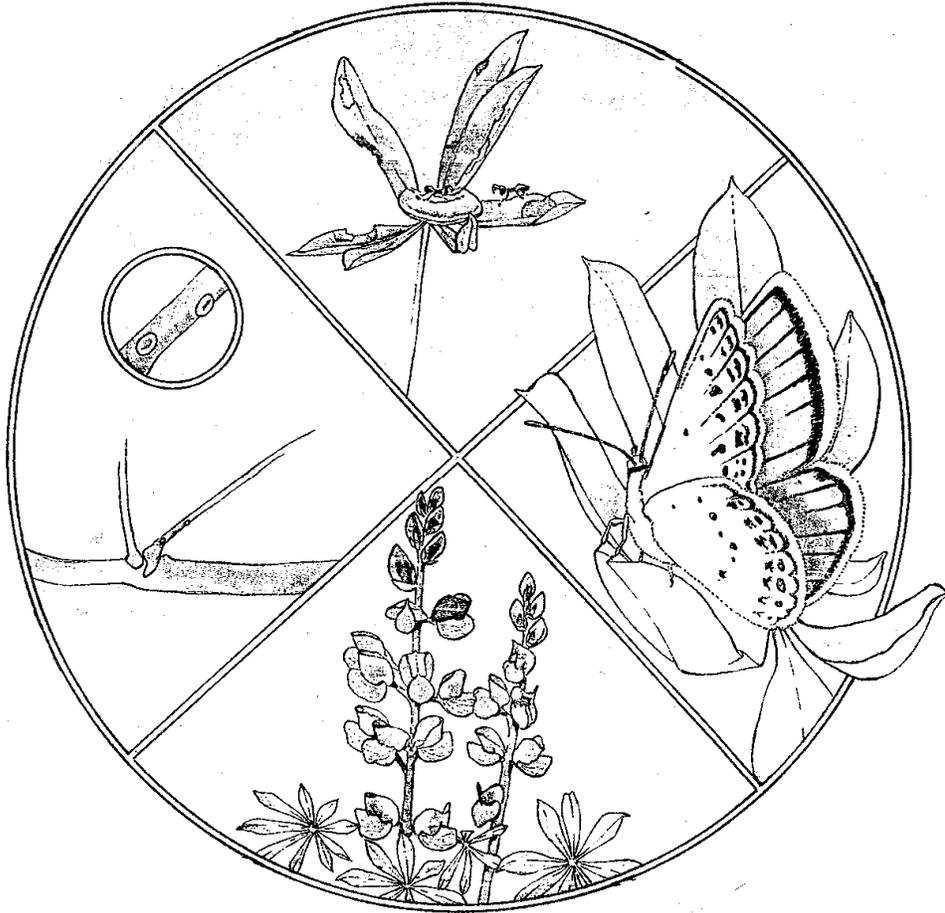


As of fall, 1996, populations of Karner blue existed in Indiana, Michigan, Minnesota, New Hampshire, New York and Wisconsin. Almost all known extant populations occur on sandy soils associated with glacial outwash plains and terraces, glacial moraines, the shores and bottoms of glacial lakes, the glacial shores of existing lakes, and dissected sandstone outwashes (Andow et al. 1994 and references therein, Appendix B). Wisconsin and Michigan have the largest number of local populations with the greatest numbers of individuals, and New York also has one large population (Baker 1994). Many local populations of the butterfly appear extirpated, and the states of Iowa, Illinois, Ohio, Pennsylvania, Massachusetts, Maine, and the Canadian province of Ontario no longer support populations of the butterfly (Baker 1994). More detailed descriptions of the historic and current distribution of Karner blue are provided in Appendix B.

Life History and Ecology

Karner Blue Butterfly. The life history of Karner blue butterfly has been studied by Scudder (1869), Dirig (1976, 1994), Cryan and Dirig (1978), Savignano (1990) and Lane and Welch (1994). Karner blue butterfly is bivoltine, which means that it completes two generations per year (Figure 1). In typical years, first brood larvae hatch from overwintered eggs in mid- to late April and begin feeding on wild lupine (*Lupinus perennis*), the only known larval food source (Figure 2). Larvae pass through four instars, between which the relatively soft larval exoskeleton is shed. Feeding by first and second instar larvae results in tiny, circular holes in the lupine leaves while older larvae eat all but the upper or lower epidermis, creating a characteristic window-pane appearance (see Swengel 1993b for detailed description). Larvae feed for approximately 3-4 weeks and pupate in late May to early June. Larvae are commonly tended by ants. Mature larvae enter a wandering phase, after which the pre-pupal larvae attach themselves to various substrates with a silk thread. Known pupation sites include in the leaf litter, on stems and twigs, and occasionally on lupine leaves (Dirig 1976, Dirig and Cryan 1978, Savignano, personal communication). Dirig (1976) reported that pupation generally lasted seven to eleven days in the field. Laboratory-reared pupae took eight or nine to eleven days before eclosing (Savignano 1990, Lane, personal communication). Adults begin emerging in late May through mid-June. Peak flight for males usually precedes peak flight for females by a couple of days.

Figure 2. Illustration of life history stages of karner blue butterfly, showing (top) larva on a lupine leaflet tended by ants, (left) eggs laid on a lupine leaf petiole, (right) adult on a lupine leaf, and (bottom) flowing lupine inflorescence.



Adults are believed to live an average of 4-5 days but can live as long as 2-3 weeks. First flight adult females lay their eggs primarily on lupine plants, often singly on leaves, petioles, or stems, or occasionally on other plants or duff close to lupine plants.

Second brood eggs hatch in 5-10 days, depending on the ambient temperature. Second generation larvae can be found feeding on wild lupine leaves and flowers from early June through late July. Typically, one larvae can survive on one large lupine stem, however, it moves from leaf to leaf on the lupine stem, often returning to leaves fed on during earlier instars, and it may even move to other lupine stems (Lane, personal communication). Larvae are found often on the lower parts of the stems and petioles. Second brood larvae are also typically tended by ants, but during midday on hot days tending may be reduced. Pupae are also frequently tended by ants (Lane, personal observation).

Second brood adults begin to appear in early to mid-July and fly until mid-August. Flight phenology may be delayed because of cool wet summers and result in an adult flight period lasting through late August (Bleser 1992, Lane 1996). The peak flight period usually lasts one to two weeks. Generally, there are about 3-4 times as many adults in the second brood compared with the first brood (Schweitzer 1994a), but exceptionally poor years can occur where the second brood is no larger than the first brood. First brood may typically be smaller because of high overwintering mortality of eggs, the inability of larvae to find lupine in the spring, or greater oviposition success of first flight females. Maxwell and Givnish (1993) surveyed Karner blue populations at 46 locations at Ft. McCoy, Wisconsin during 1993, and found that locations with high first flight butterfly counts also had high second flight counts ($r^2 = 0.674$), and that populations were 3-4 times as abundant during the second flight. Second flight females usually land on green (non-senesced) lupine, crawl down the stem, and lay eggs primarily on grasses and sedges, other plant species, leaf litter near lupine stems, and occasionally on lupine (Lane 1995). In general, insects that overwinter in the egg stage often lay their eggs on various materials close to the ground because these sites afford better winter protection (Bernays and Chapman 1994). The eggs laid by second flight females are the overwintering stage (evidence summarized by Haack 1993) and studies by Spoor (1994) and Van Luven (1993, 1994a) provide strong experimental evidence of this. Spoor (1994) observed second brood eggs through November and determined hatching rates of these eggs the following spring. Researchers in New Hampshire and Wisconsin have successfully overwintered eggs for rearing experiments (VanLuven 1993, 1994a; Meehl, personal communication).

Karner blue adults are diurnal and initiate flight between 8:00-9:00 a.m. and continue until about 7:00 p.m., a longer flight period than most butterflies. Adult activity decreases in very hot weather, at temperatures lower than 75° F, during heavy to moderate rains, or during extremely windy conditions.

Lupine Food Resource. *Lupinus perennis* is a member of the pea family (Fabaceae) and has the common names wild lupine and blue lupine. Lupine is the sole larval food source of the Karner blue butterfly.

Karner blue and is an essential component of its habitat. Two varieties have been identified: *Lupinus perennis* var. *occidentalis* S. Wats. and *L. perennis* var. *perennis* L. (Ownbey and Morley 1991). The varieties are morphologically similar except the former has spreading pilose hairs and the latter thinly pubescent hairs (Boyonoski 1992). Although Karner blue may use both varieties, the relation between Karner blue and these lupine varieties is not known. The

inflorescence is a raceme of numerous small flowers which are two lipped, with the upper lip two-toothed and the lower lip unlobed. Flower color ranges from blue to violet and occasionally white or pink (Gleason and Cronquist 1993). Peak bloom typically occurs from mid-May to late June within the geographic range of Karner blue, but varies depending upon weather, degree of shading, and geographic location in its range. Stem density and flowering is greatest in open- to partial-canopied areas, although areas receiving high solar radiation can have low lupine densities and may be less than ideal habitat (Boyonoski 1992). Plants in dense shade rarely flower.

Lupine distribution extends from Minnesota east to New England, extending southward along the eastern Appalachian Mountains to southern Virginia and along the eastern coastal plain to Georgia wrapping around the Gulf coastal plain to Louisiana (Dirig 1994). Surveys of lupine throughout its northern range all report populations to be declining and many sites have been extirpated (Boyonoski 1992, Cuthrell 1990, Grigore 1992). The primary cause of this decline appears to be loss of habitat from conversion to housing, retail, light industrial, and agricultural development, and degradation of habitat because of the deep shade that develops when natural disturbance is interrupted.

Lupine abundance and Karner blue. Management for sufficient lupine is critically important for Karner blue, because it is the only food plant for the larvae. Significant increases in the abundance of lupine will usually not be detrimental to Karner blue, and may in many cases be beneficial. Lupine, however, is not the only factor limiting Karner blue butterfly subpopulations, so it is important to manage for additional factors that are important for Karner blue in addition to lupine.

A positive association between lupine abundance and Karner blue abundance or persistence would indicate that lupine could be a factor limiting Karner blue populations. Several researchers have found such a positive correlation between lupine abundance and number of Karner blue butterfly adults in NY, MI, and WI (Herms 1996, Maxwell and Givnish 1993, Papp 1993, Savignano 1994b). Savignano (1994b) found a significant correlation between Karner blue numbers and the number of lupine rosettes in New York studies. One site had abundant lupine but few butterflies, and Savignano (1994b) suggested that a dearth of nectar plants limited the butterfly.

Lupine was not a good predictor of Karner blue abundance in Michigan and Minnesota studies. Lawrence (1994) noted that the vast majority of lupine plants did not support Karner blue larvae at the Allegan State Game Area in Michigan. Herms (1996 [same data as Papp 1993]), however, surveyed seven sites and found a significant positive relationship between lupine and Karner blue abundance at the Allegan State Game Area. Lawrence's study included more sites than Herms', and Herms' result appears to be strongly affected by a few sites, so Lawrence's remains the more scientifically credible result. The site with the densest lupine populations did not support Karner blue butterflies in Minnesota, however this site is over 2.5 km from occupied habitat (Lane 1994a). Lawrence (1994) and Lane (1994a) suggested that other factors, such as microhabitat may influence Karner blue butterfly population dynamics.

Lupine abundance at a site may vary temporally within a year or between years. Late emergence or early senescence of lupine might result in larval starvation. The timing of lupine senescence varies with canopy cover and annual weather. Maxwell and Givnish (1996) found that with

increased shrub cover, the onset of lupine senescence was later and less abrupt. Lane (1994b) observed that second brood larvae disappeared from lupine that senesced early. These individuals probably died because lupine density was low and successful dispersal to another plant was improbable.

It is unlikely that a single factor, such as the density of lupine, would account for variation in abundance of Karner blue throughout its range. In places where it does, however, such as in the Glacial Lake Albany Recovery Unit in New York and Ft. McCoy, WI, it suggests that Karner blue populations might be enhanced by increasing the amount of lupine available. In those localities where there is a poor correlation between lupine abundance and adult Karner blues, such as in the Allegan State Game Area and the Paleozoic Plateau Recovery Unit, other factors may be important.

Lupine quality and Karner blue. Lupine quality may influence Karner blue butterfly ecology. Within species variation in plant quality has been shown to be related to variation in plant chemistry, morphology, health, etc. (Bernays and Chapman 1994). Chemical factors most likely to influence food quality are nutrient composition and secondary plant compounds. The concentrations of proteins and sugars have been shown to vary with leaf position on the plant, leaf age, and sun received for several species (Bernays and Chapman 1994). *Lupinus* species have secondary plant compounds, typically alkaloids, that have been shown to influence their suitability for insect food. Levels of alkaloids in lupine vary with plant part and are highest in reproductive parts and the epidermis (Bernays and Chapman 1994). The fact that Karner blue larvae feed solely on lupine is strong evidence that they are adapted to the alkaloids in lupine, but the role of these factors in the ecology of Karner blue is unknown.

Laboratory feeding studies by Grundel (1994) showed that larvae fed pre-flowering, shade-grown lupine had higher growth rates than larvae fed post-flowering sun-grown lupine. Shading of sun-grown plants, however, did not affect development rates. In addition, this study indicated that larvae fed leaves from plants grown on sandy soils developed faster than those fed leaves from plants grown on soils with an A horizon, and they grew faster when fed seeds

Table 1. Nectar plant species used commonly by first and second brood Karner blue butterfly. Percent of all nectaring observations at a locality for all plant species used by more than 10% of the observed butterflies.

Plant species Percent of butterflies nectaring at plant species

	Locality			
	First Brood MI ¹	WI ²	WI ³	WI ⁴ WI ⁵
<i>Arabis lyrata</i>		50		11
<i>Hedyotis longifolia</i>			14	
<i>Hieracium aurantiacum</i>				56
<i>Lupinus perennis</i>				29 13
<i>Melilotis officinalis</i>		16		
<i>Potentilla simplex</i>				35
<i>Rubus flagellaris</i>	89	19		
<i>Rubus</i> sp.				20

Second Brood	MN ⁶	MI ¹	MI ⁷	MI ⁸	MI ⁹	WI ²	WI ³	WI ⁴	WI ⁵
<i>Amorpha canescens</i>						15	39	16	
<i>Asclepias tuberosa</i>		66	40	22					
<i>Asclepias verticillata</i>							11		
<i>Berteroa incana</i>								23	
<i>Centaurea biebersteinii</i>					33	40			
<i>Euphorbia corollata</i>				33					11
<i>Euphorbia podperae</i>						12			
<i>Helianthus occidentalis</i>									13
<i>Liatris cylindracea</i>				11					
<i>Melilotus alba</i>					38				
<i>Monarda punctata</i>	91	20	20		60	13	25	13	
<i>Rudbeckia hirta</i>								28	
<i>Solidago speciosa</i>									17

References: 1 = Lawrence 1994, 2 = Leach 1993, 3 = Maxwell and Givnish 1993, 4 = Lane personal communication, 5 = Swengel 1993a, 6 = Lane 1994a, 7 = Papp 1993, 8 = Sferra et al. 1993, Site 1, 9 = Sferra et al. 1993, Site 2.

Lane (in preparation) found no difference in larval growth rates in laboratory feeding studies with sun- and shade-leaves from pre-flowering plants. Maxwell and Givnish (1993) reported that Karner blue abundance was positively correlated with the abundance of non-flowering lupine and negatively correlated with the abundance of flowering lupine. In 1995 studies, 75% of the larvae were found on non-flowering lupine (Maxwell and Givnish 1995). Feeding studies comparing flowering and non-flowering stems have not been done. Qualitative variation in lupine can affect Karner blue larvae, but the laboratory results need to be replicated and their significance extended to the field.

Swengel (1993b) compared larval abundance and body length to various lupine measurements to examine the relationship between lupine and larval phenology. The number of larvae was positively correlated with lupine rosette diameter, and larval length was positively correlated with lupine height (Swengel 1993b). These results imply that bigger lupine plants have more larvae, and the earlier lupine starts growth in the season, the longer the time the larvae have to grow and the bigger the larvae.

Lupine growth, reproduction, dispersal, and propagation. Lupine reproduces vegetatively and by seed. Seed pods have stiff hairs with an average of 4-9 seeds per pod (Boyonoski 1992). When seed pods are dry, they will suddenly twist and pop open (dehiscence), throwing seeds several feet. This is the only known dispersal mechanism and Celebrezze (1996) suggests that colonization would be very slow, about 0.5 to 2 meters per year (20 to 79 inches per year). Seeds are known to remain viable for at least three years (Zaremba 1991), and do not have a physiological dormancy, and will readily germinate if moisture and temperature conditions permit. The hard seed coat produces an effective dormancy and germination is usually enhanced

by scarification, stratification and/ or soaking in water (Boyonoski 1992, Zaremba and Pickering 1994, Welch, personal communication).

Lupine also reproduces vegetatively by sending up new stems from rhizomatous buds. Usually plants a few years old will form a clump of several stems and in areas with dense lupine it is difficult to distinguish individual lupine plants. Established lupine plants do not grow every year. It is not known how long an established plant can remain dormant.

Lupine can be propagated by planting seed or transplanting seedlings. Direct germination from seed appears to result in higher first year survival than seedling transplants (VanLuven 1994b, Zaremba and Pickering 1994). Seedling establishment from seed in New Hampshire was between 3-43 percent in the first year and survival of seedlings was about 50-60 percent per year (VanLuven 1994b). Large quantities of seed will be necessary to establish dense stands of lupine in this area. Welch (1994) established lupine patches with over 5,000, 8,500, and 17,500 2-4 month old seedlings and uncounted numbers of seeds near Waupaca, Wisconsin. The patches were established successfully, but no data are available on survival. Maxwell and Givnish (1994) established lupine by direct seeding in experimental plots in 1993.

Although soil preparation was homogeneous, lupine establishment was better in the compacted, subsided soils associated with an old trail. This area had less vegetative cover, and the lupine was growing in association with *Cycloloma atriplicifolium*, which may have protected it from deer browsing. During the dry 1995 season, *C. atriplicifolium* was absent and lupine on this trail developed faster and senesced earlier than the surrounding lupine, and lupine cover was greater where the seeded perennial grasses had established the best (Maxwell and Givnish 1996). These observations suggest that nurse plants may be useful for establishing lupine.

Renewal of lupine habitat. Lupine is an early successional species adapted to survive on dry, relatively infertile soils. Even very young seedlings have long tap roots that presumably allow the plant to reach soil moisture. It can grow on soils low in nitrogen because of its association with the nitrogen fixing bacterium *Rhizobium lupina*, and does not do well when grown without *R. lupina* (Zaremba and Pickering 1994). Similar to other legumes, it probably does best when growing on nitrogen-poor soils that have sufficient phosphorus. Lupine does not reproduce in dense shade. All available evidence suggests that lupine thrives on nitrogen-poor soils in partial- to open-canopied areas, and is suppressed by shade; it is possibly out-competed by other plants on nitrogen-rich soils, and phosphorus-poor soils.

Several species of pines, oaks, and shrubby vegetation are adapted to the same soils and habitat as lupine (Haney and Apfelbaum 1990, Nuzzo 1986), and without disturbances, they will close the canopy, shading and suppressing lupine (Apfelbaum and Haney 1991, Haney and Apfelbaum 1990). The rate of closure will vary from locality to locality, based on edaphic and prevailing climatic conditions, and current and historic management practices. If the habitat supports high grass and sedge productivity, then litter can build up that could also suppress lupine. Consequently, disturbances that reduce tree and shrub canopy cover are necessary for lupine to persist, and under some conditions, occasional disturbances that remove the litter layer are needed for lupine regeneration. Several disturbances have been suggested as beneficial for renewing lupine habitat, including prescribed fire, tree removal, and a variety of methods to kill trees and shrubs.

Other factors affecting lupine. Mechanical disturbance of the soil can affect lupine. Maxwell and Givnish (1996) evaluated the effect of tank traffic on plots of established lupine at Ft. McCoy, Wisconsin. This kind of traffic causes greater soil disturbance than ATV (all-terrain vehicle) traffic, but could be comparable to some of the traffic during site preparation and harvest of commercial forest stands. Tank traffic crushed the existing emergent lupine, and within several weeks, seedling germination was observed on the disturbed soil and the crushed plants regrew with a three-week delay in developmental phenology. In the following year, plants on the disturbed areas developed about two weeks faster than the surrounding plants. Thus, mechanical disturbance can create greater heterogeneity in lupine development. As discussed below under microhabitat diversity, this heterogeneity can be beneficial to Karner blue.

Herbivory and disease may reduce the rate of canopy closure or open up gaps in the canopy. In this section, we review the direct effects of these factors on lupine; the indirect effects via canopy reduction are reviewed in the section on habitat below. Lupine is browsed by deer, woodchucks, and insects. The relationship between grazer density, grazing intensity, and Karner blue populations is largely unknown. If deer populations are too abundant in the spring and browse is scarce, excessive browsing could occur on lupine, with potential detrimental effects on Karner blue. Heavy spring flower browse by deer reduces the number of seed pods for that season's lupine (Straub 1994). Transplanted lupine may be less able to recover from being browsed than field sown plants (Zaremba and Pickering 1994). Herbivory by the painted lady butterfly (*Vanessa cardui*) has caused severe defoliation of lupine foliage (Lane, personal communication), but the potential detrimental effects on Karner blue are not documented. Lupine species typically contain alkaloid compounds which are hypothesized to serve as chemical defense mechanisms against herbivory (Dolinger et al. 1973), but the significance of these compounds in the ecology of Karner blue is not known. Several diseases of lupine are known, but their effects are unknown.

Nectar Food Resources. Adult Karner blue butterflies feed at flowers, sipping nectar and presumably obtaining nourishment; adult feeding increases longevity and fecundity in many Lepidopteran species, especially butterflies (Chew and Robbins 1989). Although increased longevity and fecundity have not been specifically demonstrated for Karner blue butterfly, it is generally agreed that nectar is an essential adult resource. Adult Karner blue butterflies spend considerable time nectaring on a wide variety of plant species (Appendix C). Adults have been observed during the first brood to feed on flowers of 39 species of herbaceous plants and 9 species of woody plants, and during the second brood on flowers of 70 species of herbaceous plants and 2 species of woody plants. Indeed, nectar plant availability may be a key factor in determining habitat suitability (Fried 1987). Lawrence and Cook (1989) suggested that the lack of nectar sources may limit populations at the Allegan State Game Area in Michigan, and Packer (1994) implicated the dearth of nectar sources as one of the causes of the extirpation of populations in Ontario. Bidwell (1994) found a positive correlation between nectar plant abundance, specifically abundance of *Monarda punctata*, and the number of Karner blue butterfly adults. Papp (1993) found a weak correlation between first brood adult numbers and nectar plant abundance, but no such correlation during the second brood. King (personal communication) did not find a correlation between adult Karner blue butterfly numbers and nectar plant abundance. Absence of correlation does not mean that nectar plants are unimportant,

but suggests that other factors, such as larval density, are contributing more directly to adult population numbers.

Some plant species appear to be utilized more frequently than others (Bidwell 1994, Bleser 1993, Fried 1987, Lane 1994a, Lawrence 1994, Leach 1993), however experiments to assess adult feeding preference have not been conducted. The nectar plant used most frequently in the field may be the one that is spatially or temporally available or most abundant, and not the species that is preferred. Observations of nectaring frequency, however, can indicate the relative utility of the species as a nectar resource (Table 1).

In addition to nectaring, males and females sip at moist earth (mud-puddling) and human perspiration, and males sip at animal droppings (Swengel 1993a). Adults may be obtaining sodium or other substances from this behavior.

Microhabitats. Karner blue adults and immatures use a variety of microhabitats created by tree canopy cover, topography, and soil moisture, and the population dynamics of the butterfly is probably influenced by these factors. Adult butterflies use open-canopied areas for nectaring, roosting, mate location, and oviposition (Lane 1994a, 1994b, Lawrence 1989, 1994, Maxwell and Givnish 1993, Packer 1987). The majority of Karner blue nectar plants require medium to high levels of sun to produce flowers and the adults nectar most frequently in open-canopied areas. The phenology of flower production is also likely to vary with microhabitat and microhabitat diversity may provide a more guaranteed source of nectar by enabling many potential nectar plant species to coexist in the habitat. For example wetlands adjacent to suitable Karner blue habitat at Indiana Dunes National Lakeshore or Necedah Wildlife Refuge may provide almost unlimited nectar resources. Extremely xeric sites, on the other hand, such as Allegan State Game Area, may have limited adult nectar resources which could limit butterfly populations (Lawrence and Cook 1989).

Adults are commonly found in open-canopied areas. In Minnesota, Lane (1992a) classified habitats with lupine or adult butterflies, and showed that adults were found in areas with less than 5 percent canopy cover. In western Wisconsin, Maxwell and Givnish (1994) collected data on the physical structure of habitat and cover estimates of selected vegetation, and found a positive correlation between adult Karner blue butterfly abundance and grass cover. Because the grass was used as adult roosting sites, they suggested that this indicated the importance of roosting sites for healthy populations of Karner blue. Grass cover may also indicate open canopy on less xeric, slightly more fertile areas of savanna, which could be beneficial in other ways to Karner blue.

Specific adult behaviors are commonly seen in open-canopied areas. Adults have been observed roosting in open- to closed-canopied areas during the day on several woody and herbaceous plant species, but at night adults have been seen roosting in the open on grasses such as big bluestem (*Andropogon gerardii*) (Schweitzer 1989). Male Karner blue butterflies appear to search for mates predominantly in open-canopied areas. Males are commonly observed in open areas, and in studies on butterfly movement, Bidwell (1994) commonly observed males flying back and forth through open areas.

Females have been observed ovipositing in open- to closed-canopy and in a variety of slopes and aspects (Lane 1993, 1994c, Maxwell and Givnish 1993). Females may be ovipositing in open- and partial-canopied areas in response to the greater lupine abundance in these microhabitats. In addition, in cool weather open and sunlit areas may permit butterflies to achieve threshold temperatures needed for flight activity (Lane 1994c). Shaded or closed-canopied areas may provide for cooling on extremely hot days (Lane 1994c, Packer 1994). Egg deposition in a

variety of microhabitats may also serve to mitigate physical or biological risks to immature stages (Bidwell 1994, Lane 1994c). For example, several researchers have suggested that lupine senescence is earlier in xeric open canopied areas and may result in larval starvation, particularly in drought years.

Optimal microhabitat for immature stages may contrast with that used by adults (Savignano 1990, Spoor 1994, Lane 1994b). Studies of larvae in Minnesota and Wisconsin, showed significant differences in larval survival and ant-tending between microhabitats (Lane 1994b). For second brood larvae, survival was highest in closed-canopied areas, intermediate in partial-canopied areas, and lowest in open-canopied and very xeric areas (Lane 1994b). Although the cause of mortality is uncertain, the lupine plants were heavily infested with powdery mildew (possibly reducing quality) and the introduced predator, the seven spotted lady beetle (*Coccinella septempunctata*) was observed on lupine (Schellhorn et al. unpublished). Lawrence and Cook (1989) suggested that the highest quality lupine plants for larvae occur in areas with partial sun, which is consistent with Grundel's (1994) finding that larvae fed post-flowering, shade-grown lupine had higher growth rates than larvae fed post-flowering sun-grown lupine.

In closed-canopied areas larvae may be more protected from temperature extremes, wind and rain, or natural enemies. Natural enemies may either not inhabit these areas or be less efficient at searching. Although the proportion of older larvae tended by ants was similar in open- and closed-canopy areas, early instar larvae were tended more in partial-canopy areas (Lane 1994b). Moreover, the tending ant species were different in the different microhabitats (Lane, personal communication). At Ft. McCoy during 1995, the summer drought conditions resulted in early senescence of lupine (Maxwell and Givnish 1996). In open-canopied areas, late-maturing second brood larvae were often seen on completely senesced plants, while in shady areas senescence was delayed. Karner blue populations declined during this generation and were more abundant in the shade, and the authors suggest that early lupine senescence may have been the cause.

In summary, mating and adult feeding take place primarily in open-canopied areas. Oviposition occurs in many types of microhabitats, but larval growth and survival may be best in partial- to closed-canopy areas. Small-scale variation in topography and soil moisture could be beneficial to Karner blue. A highly variable microtopography creates a highly variable thermal environment and a highly variable plant community and canopy structure, and variation in soil moisture will also contribute to variation in plant community and canopy structure. In addition, such variation in plant community and canopy could be beneficial to Karner blue in the long-term because in hot, dry years Karner blue can be found using shady, moist microhabitats, while in cool years, they are more strongly associated with sunny and partially sunny microhabitats.

Associated Ants. Immature stages of the Karner blue butterfly have a mutualistic relationship with ants. Larvae tended by ants have a higher survival rate than those not tended (Savignano 1990, 1994a), presumably because the ants provide some protection from larval natural enemies. Larvae possess specialized glands which secrete a liquid that is avidly harvested by ants, probably containing carbohydrates and amino acids. Tending levels for late instar larvae are close to 100 percent. In most cases, however, very few early instars are tended (Lane 1994b, Savignano 1990). Several ant species have been observed to tend Karner blue larvae (Table 4). Some species of ants appear to provide greater protection than other species. For example, larvae last tended by *Formica lasiodes* had significantly higher survival than those last tended by other ant species (Savignano 1990, 1994a).

During pupal survival studies, Lane (unpublished) observed several ant species to be associated with Karner blue pupae. One species of ant built nests of dead vegetation around the pupae. Many of the pupae within these nests were observed to eclose but how the ants influence pupal development or survival is not clear.

At the Crossgates Mall site in NY, Spoor (1993) observed ants (*Myrmica* sp.) removing eggs of Karner blue from lupine stems. Removal rates were sometimes exceedingly high (39-74 percent missing in one series of observations). Whether these eggs were killed or reared by the ants is unknown.

Table 2. Ant species tending Karner blue butterfly larvae.

Ant Species	Locality	Reference
<i>Aphaenogaster rudis</i>	Ont	Packer (1990)
<i>Camponotus americanus</i>	Mayr NY	Savignano (1994)
<i>Camponotus ferrugineus</i>	WI	Bleser (1992)
<i>Camponotus novaeboracensis</i>	Fitch NY	Savignano (1994)
<i>Camponotus pennsylvanicus</i>	Ont	Packer (199)
<i>Crematogaster ashmeadi</i>	WI	Bleser (1992)
<i>Creatogaster cerasi</i>	Fitch NY	Savignano (1994)
<i>Dolichoderus (Hypoclinea) plagiatus</i>	Mayr NY	Savignano (1994)
<i>Formica difficilis</i>	Emery NY	Savignano (1994)
<i>Formica exsectoides</i>	Ont	Packer (1990)
<i>Formica fusca</i>	WI	Bleser (1992)
<i>Formica lasioides</i>	Emery NY	Savignano (1994)
<i>Formica montana</i>	WI	Bleser (1992)
<i>Formica (Neoformica) incerta</i>	Emery NY	Savignano (1994)
<i>Formica (Neoformica) nitidiventris</i>	Emery NY	Savignano (1994)
<i>Formica (Neoformica) schaufussi</i>	Mayr NY	Savignano (1994)
<i>Formica querquetulana</i>	Wheeler NY	Savignano (1994)
<i>Formica schaufussi</i>	WI	Bleser (1992)
<i>Formica subsericea</i>	Say NY	Savignano (1994)
<i>Lasius alienus</i>	Foerster NY	Savignano (1994)
<i>Lasius neoniger</i>	Emery NY	Savignano (1994)
<i>Monomorium emarginatum</i>	DuBouis NY	Savignano (1994)
<i>Myrmica americana</i>	Weber NY	Savignano (1994)
<i>Myrmica fracticornis</i>	Emery NY	Savignano (1994)
<i>Myrmica punctiventris</i>	Ont	Packer (1990)
<i>Myrmica sculptilis</i>	NY	Savignano (1990)
<i>Paratrechina parvula</i>	Mayr NY	Savignano (1994)
<i>Tapinoma sessile</i>	Say NY, WI	Bleser (1992), Savignano (1994)
<i>Tetramorium caespitum</i>	WI	Bleser (1992)

Although ants appear to be important in the life cycle of Karner blue, it is uncertain if it is necessary to manage habitat to ensure their presence. The interaction between Karner blue and ants appears to be facultative, and the ants appear to be opportunistic in tending, so that any

species that is present might tend the larvae and pupae. In contrast, the apparent variation in protection provided by different ant species could influence Karner blue abundance and population dynamics, and therefore methods to manage the habitat to encourage more beneficial ant interactions may merit consideration.

Dispersal. Nearly all researchers that have examined Karner blue dispersal have concluded that dispersal rates and distances for the butterfly are relatively low and short (Bidwell 1994, Fried 1987, King 1994, Lawrence 1994, Schweitzer in Givnish et al. 1988, Welch 1993). King (1996), however, measured a maximum dispersal distance of <3 kilometers (<1.8 miles) and 92.5% moving less than 1.5 kilometers (0.9 miles). Prior to this result, many believed that dispersal was extremely rare and short, with nearly all movement <200 meters (220 yards). Although King's (1996) results expand the spatial scale of dispersal by an order of magnitude, the inferred rates are still relatively low and short.

Unfortunately, there has been no critical re-examination of the methods and the data. Without clear information on the sampling intensity at different distances from the release points, it is difficult to interpret the results. Definitive studies on insect dispersal frequently uncover unanticipated high frequencies of movement and distances far greater than expected. It is unknown what intrinsic factors or environmental conditions stimulate dispersal between habitat sites, or whether all Karner blue movement is trivial (movement that is associated with seeking food, mates, etc.) rather than migratory (movements where individuals do not respond to food or mate stimuli). Currently, much of the habitat between occupied areas is unsuitable for Karner blue. In some cases this is because the intervening habitat has been destroyed by development (such as in some areas of New York and New Hampshire). In other cases the historic extent and connectivity of suitable habitat is not clear.

Dispersal has not been carefully defined in the Karner blue literature. It usually refers both to the movement of individuals within and between suitable habitat sites. Because these two types of movements have different ecological implications, they will be separated in this discussion. The movement of individuals away from their natal site of suitable habitat, leaving the site and potentially finding another site will be referred to as dispersal from sites and includes dispersal between habitat sites. Movement that remains in a habitat site (or within the local population) will be called within habitat movement. Because suitable habitat sites vary in size, the frequency of these types of movement will vary from site to site. Dispersal from sites may lead to recolonization events, while movement within sites may result in greater use of the site, but will not contribute to recolonization.

The primary methods that have been used to determine dispersal distances and rates for the Karner blue butterfly are mark-release-recapture (MRR) (Bidwell 1994, Fried 1987, King 1994, 1996, Lawrence 1994, Schweitzer in Givnish et al. 1988) and tracking of individual butterflies (Welch 1993). Given their small size and that only a small number of butterflies can be found dispersing, mark-release-recapture methods have been the most cost-effective method of obtaining information on dispersal. Because MRR methods rely on detecting the rare long-distance recapture and a sampling intensity that declines with distance, they tend to underestimate the number and distance traveled by dispersing individuals. In addition, dispersal distance and rate may be related to the age of the insect (younger, prereproductive adults may be more migratory than older, reproductive adults).

Some researchers have suggested that MRR methods injure the insects (Murphy 1988), but extensive MRR work on Karner blue butterfly by an experienced researcher indicated that debilitating injury occurred to less than 1 percent of all individuals processed (Schweitzer 1994a); the effect of marking on dispersal behavior is not known. Morton (1989) found that high recapture frequencies and good fits to Poisson distributions are unreliable indicators of the suitability of the MRR technique for measuring dispersal, and the suitability of MRR techniques

for estimating dispersal in Karner blue has not been rigorously examined. Given the dearth of information on dispersal of Karner blue and the limitations of alternative methods, MRR methods will likely provide the best insight into dispersal of Karner blue. None of the dispersal information has been summarized to provide an estimate of the functional relationship between distance and the probability of dispersal.

Dispersal from sites. Most studies on Karner blue butterfly have documented very few between habitat dispersal events (Bidwell 1994, Fried 1987, King 1994, Lawrence 1994, Schweitzer in Givnish et al. 1988). King (1996) documented the greatest amount of between site dispersal. This study was conducted at the Necedah National Wildlife Refuge in the Glacial Lake Wisconsin recovery unit. The three occupied sites are each about ~100 hectares (~200 acres), and are separated from each other by >1,000 meters of mostly open wetlands habitat. Using MRR methods, an estimated 11 percent of the individuals moved between sites during the second flight, with the greatest emigration from the lowest density site (King 1996). In New York during 1975, Schweitzer (personal communication) captured two individuals out of about 50 individuals marked at a much smaller site about 1.3 kilometers away. Schweitzer (personal communication) measured little dispersal in the Concord, New Hampshire population. Less than 1 percent of the marked individuals crossed a narrow, little-used road separating two large habitat patches. Fried (1987) captured only three individuals (total captured = 224) dispersing between three sites that were approximately 400 to 700 meters apart. The habitat matrix between Fried's study sites was primarily dense woods or low shrubs, although dirt paths connected them. In Wisconsin, Bidwell (1994) captured 21 individuals (total number marked = 724) dispersing between habitat sites. Two sites were only 50 m apart, but they were separated by a dense stand of birch. These two areas were approximately 1,200 to 1,600 meters from a third habitat site. Fourteen of the 21 dispersal events recorded were between the two close sites and five were between these and the farther site. The remaining two dispersers were recaptured between the habitat sites. Maximum distances recorded by Bidwell (1994) were 1,600 meters for a male and 1,195 meters for a female. In Michigan, Lawrence (1994) marked 538 individuals and recaptured 142. His five study sites were 0.5 to 2.5 kilometers apart. No individual was recaptured at a site other than at the original marking site. Lawrence suggested that between habitat dispersal was probably uncommon because they marked and recaptured frequently, which would have enabled them to observe such dispersal if it were common.

Another approach used to determine dispersal distance is to follow individual Karner blue butterflies (Welch 1993). Potentially dispersing butterflies were located by searching areas 200 meters from lupine sites. The number of potential dispersers and distance each moved was recorded for spring and summer flights, along with wing-wear (fresh and worn individuals), sex, and habitat types (open and closed canopy). A total of 78 butterflies were observed. The largest number of potential dispersers were fresh males in open habitat during the first flight. Numbers of potential dispersers were lower for both sexes, wing-wear classes, and habitats during the second flight. Observed dispersal distances were farthest for fresh males in open habitat, ranging from 65-1,350 meters and averaging 461 meters. Dispersal distances for females were farther for worn individuals. Distances range from 85- 565 m in open habitat with an average of 244 meters. These data have not been statistically analyzed.

The percent of marked individuals dispersing between suitable habitat sites varied from 0 (Lawrence 1994) to 2.4 and 2.9 percent (Bidwell 1994, Fried 1987) or less than 5% (Schweitzer 1994a) to 11 percent (King 1996). In studies on the Heath fritillary butterfly (*Mellicta athalia*) in

England, Warren (1987) found an average of 1.5 percent dispersal between habitat areas. He argued that if similar rates of dispersal were observed to other areas not sampled, that a fairly substantial proportion of adults may be emigrating from the populations studied and arriving at new habitat areas (Warren 1987). For Karner blue it is unclear if observed rates of between habitat dispersal will limit recolonization of suitable habitat in all habitats, but the dispersal rates observed at Necedah National Wildlife Refuge indicate that recolonization is probably extensive.

Many factors have been suggested to be dispersal barriers for Karner blue butterflies. Anecdotal evidence has indicated that many geographic, vegetational, and human-constructed structures might act as dispersal barriers, including four-lane highways with heavy traffic in urban or semiurban areas, steep embankments and cliffs, forested areas if no openings such as trails or roads are present, and residential and commercial areas (including paved parking lots and roads), but scientific evidence supporting any of these speculations is absent.

Movement within sites. Within habitat movements were also examined in the above MRR studies and by following individual butterflies. The distance between the majority of recaptures was less than 200 meters for both Lawrence (1994) and Bidwell (1994). In examining the distances moved by marked individuals in one day, King (1994) also reported movement distances of less than 200 meters with the majority moving 25-50 meters. In the larger Indiana Dunes Inland marsh site, Knutson (1995) reported a maximum observed movement distance of 312 meters, which was less than the 850 meters possible in that site.

Lane (1994a) measured within habitat flight distances by following individuals and marking all landing points. The average flight distance between points was 4.99 meters for males and 1.49 meters for females, i.e. most within habitat flights were short distances, but adults took many small flights in a day (Lane 1994a). This data is not readily extrapolated. The overall picture that emerges is that within sites Karner blue moves short distances and moves often.

Dispersal corridors. Little data exist regarding dispersal corridors for Karner blue. It is widely believed that open-canopied corridors through wooded areas provide Karner blue with a dispersal corridor, but except for anecdotal observations, this has remained unproven. Welch (1993) conducted the most extensive recorded observations of Karner blue butterflies in flight. He found that dispersing butterflies almost always followed canopy openings along fence rows, woodland trails, or small gaps in the canopy, stopping frequently to bask in the sun. During these between-site movements open-canopied areas may be needed for thermoregulation (Lane 1994c), orientation (Welch 1993), or both. Thus, dispersal corridors may be quite diaphanous in native habitat, formed by a network of partially connected canopy gaps and trails. Of the 78 butterflies observed by Welch (1993), only two did not exhibit this common pattern of dispersal. One of these flew up the oak canopy dispersing above the canopy, and the other flew through the shade of a full canopy. Schweitzer (1979) also observed some adults to move over a young forest canopy. The frequency of these unusual dispersers is not known.

Habitat/Ecosystem

Structure. The physical features that affect Karner blue habitat vary across its geographic distribution. The western part of the range is subject to greater continentality effects, which include greater annual variation in temperature, lower precipitation, and greater year-to-year variation in precipitation. Average annual precipitation is higher in the eastern part of the range at over 50 inches per year and drops off in the west to under 40 inches per year. Annual variation in precipitation is generally less than 10 percent of normal in the east, but more variable in the west at 15 percent of normal. In the east, the annual range in temperature is less than 28°C, but in the west the annual range is greater than 28°C. Thus, in the west Karner blue habitat will be subjected more frequently to drought and temperature extremes, such as cool springs or hot summers, than in the east.

Throughout its range, Karner blue butterfly was historically associated with native barrens and savanna ecosystems, but it is now associated with remnant barrens and savannas, highway and powerline right-of-ways, gaps within forest stands, airports, and military camps that occur on the landscapes previously occupied by native barrens and savannas. Almost all of these contemporary habitats can be described as having a broken or scattered tree canopy from 0 to between 50 and 80 percent canopy cover, with grasses and forbs common in the openings. The habitats have lupine, the sole larval food source, nectar plants for adult feeding, critical microhabitats, and attendant ants. The stature and spacing of trees in native savannas is somewhat variable, reflecting differences in soils, topography and climate (Nuzzo 1986), and the distribution of trees in contemporary habitat is similarly diverse. Soils are typically well drained sandy soils which influences both plant growth and disturbance frequency. These conditions are generally wet enough to grow trees but dry enough to sustain fires (Breining 1993). Topography is diverse and includes flat glacial lake beds, dune and swale lake shores, and steep, dissected hills.

Remnant native habitats. Barrens are often separated from savannas on the basis of soil type, plant species and form, fire frequency, etc., however, the classification is not consistent among systems. For example in the Midwest Oak Ecosystems Recovery Plan, barrens are considered to be a treeless type of savanna, and by this definition, most Karner blue habitat would be considered savanna, but not barrens. In other parts of the Plan, savannas are wet/mesic habitats with burr oak and other mesic oak species, while barrens are xeric with 20-80% canopy cover on sandy soils. On the other hand, Karner blue habitat in Minnesota is classified as dry oak savanna, barrens subtype (MN DNR 1993). Given the lack of a generally accepted classification system, any of the following terms will be used to describe the types of ecosystems providing habitat for the Karner blue.

Most of the eastern portions of Karner blue habitat are dominated by pitch pine (*Pinus ridiga*), scrub oak (*Quercus ilicifolia*), or both. This ecosystem has been referred to as the pitch pine barrens, Northeast pine barrens, or (Albany) pine bush (Dirig 1994, Schweitzer and Rawinski 1987). Karner blue habitat around Saratoga, NY, however, appears to resemble oak savanna (Schweitzer 1990).

In the midwest, black oak (*Quercus velutina*), white oak (*Q. alba*), pin oak (*Q. ellipsoidalis*), burr oak (*Q. macrocarpa*), jack pine (*Pinus banksiana*), or any combination of these four dominate suitable Karner blue habitat. Composition can vary from predominantly oak, especially black or pin, to mixtures of oak and jack pine, to predominantly jack pine. Black and pin oak dominated

communities have been classified by Curtis (1959) as oak barrens. Those dominated by black oak, with or without white oak and jack pine, will be referred to as oak barrens. Sites dominated by jack pine, such as portions of central and northwest Wisconsin where prescribed burns have not eliminated the pines, are called jack pine barrens. In this document "oak and pine barrens and savanna" will refer to all the above types.

Some of the common species found in the understory of these barrens and savanna habitats are big bluestem grass (*Andropogon gerardii*), blueberry (*Vaccinium angustifolium*), little bluestem (*Schizachrium scoparium*), Indian grass (*Sorghastrum nutans*), butterfly weed (*Asclepias tuberosa*), sweet fern (*Comptonia peregrina*), spotted knapweed (*Centaurea maculosa*), *Rubus* spp., soapwort (*Saponaria officinalis*), beebalm (*Monarda fistulosa*), bracken fern (*Pteridium aquilinum*), New Jersey tea (*Ceanothus americanus*), and goat's rue (*Tephrosia virginiana*) (The Nature Conservancy, in preparation).

Dune and swale habitats are one of the most biologically diverse in the Great Lakes Basin (Rankin and Crispin 1994), originally extending along the shore of Lake Michigan from southern Wisconsin through the Chicago and Gary metropolitan areas and north into southwestern Michigan. The dunes are in close proximity to the swales, creating an extreme diversity of regularly alternating microhabitats from xeric, sandy upland habitats to wetlands, and back to uplands and again to wetlands over distances of less than 50 meters. Karner blue populations can be found in the uplands, oak barrens habitats, but adults will forage on nectar producing plants.

Contemporary anthropogenic habitats. Karner blue also occurs in many habitats dominated by anthropogenic activities. These include powerline and highway rights-of-way, vegetation surrounding airport runways, young commercial forest stands, open areas within developed commercial forest stands, military bases, and many other such areas. These areas all have soils that are suitable for lupine growth, an open canopy, and management that causes soil disturbance or suppression of perennial shrub and herbaceous vegetation (such as by mowing, brush-hogging, chemical control, or prescribed fire). These habitats are very diverse vegetationally, and often have many of the herbaceous species that co-occur with lupine in the native remnant barrens and savanna habitats.

Renewal of Habitat for Karner Blue. Karner blue habitat is maintained in the balance between its decline from canopy closure and its renewal from external disturbance. Natural disturbances, such as fire (Clark 1988) and large animal grazing (Hobbs and Huenneke 1992), that open canopy have decreased since the time of European settlement, so this balance is largely maintained by management activities (refer to Appendix G). These management activities intervene to influence the rates at which suitable habitat declines in quality and is renewed. Thus, an understanding of both natural factors and the interaction with management is essential to understanding the maintenance of Karner blue habitat. It is likely that the gradients in temperature and precipitation that occur from the eastern to western part of the range of Karner blue butterfly affect these rates. In the drier, more variable climates of the western part of the range, it might be predicted that rates of canopy closure will be slower and rates of natural renewal, such as fire will be faster, which would have resulted in a natural landscape with more early successional barrens and savanna, and healthier Karner blue populations.

Many ecological processes act on Karner blue habitat to maintain populations of the butterfly. In the native barrens and savanna habitats, many factors, including deliberate fire, wildfire, disease,

such as oak wilt, and herbivory, probably interacted to maintain the native vegetation and the associated Karner blue populations. In habitats dominated by anthropogenic activities, many management activities probably have been inadvertently beneficial to Karner blue butterfly. In general, the relation between specific management practices and Karner blue populations is not well characterized, yet the persistence of Karner blue on these managed ecosystems, suggests a basic compatibility between Karner blue and alternate land uses that would merit additional study (refer, for example, to Forest Management Guidelines, Lane 1996).

Prescribed fire and targeted removal or suppression of trees and shrubs are methods commonly suggested for renewing Karner blue habitat, and they will be discussed separately below.

Remnant native habitats. The native barrens and savanna ecosystem and its unique combination of species developed from the interplay of natural disturbance processes, edaphic factors, climate, etc. (Faber-Langendoen 1991, Forman 1979, Tester 1989). Fire is recognized as the key element maintaining savanna vegetational structure and species composition (Faber-Langendoen 1991, Haney and Apfelbaum 1990, Tester 1989, Wovcha et al. 1995). Fire influences ecosystem dynamics by decreasing soil nitrogen and organic matter and raising pH (Tester 1989). It exposes mineral soils and reduces woody plant cover, conditions required by many savanna adapted species (Payne and Bryant 1994), and clears the understory but does not eliminate the adapted tree species. These trees survive by resisting fire with thick barks, by resprouting, or by germinating seeds after disturbance by fire. These set-backs of the woody vegetation maintain a mixture of open- to densely-canopied patches of habitat (Nuzzo 1986, Shuey 1994). Fire suppression in recent history has resulted in succession of these barrens and savannas to woodlands.

Mammalian grazing, burrowing, trampling, etc., are considered by some to be a critical element in maintaining the oak savanna ecosystem (Hobbs and Huenneke 1992, Swengel 1994). Elk (*Cervus elapus*) and bison (*Bison bison*) are likely to have once grazed and browsed in Minnesota and Wisconsin (Hamilton and Whitaker 1979, Jackson 1961). During spring, elk feed extensively on grasses, sedges, and weeds. During summer, grasses, shrubs and trees are eaten, and the diet shifts solely to shrubs and trees during fall. Bison feed on species similar to those consumed by domestic cattle, primarily grasses. Deer browse and occasionally graze on legumes and other selected plants. Deer are at very high population levels (for example, an average of 20 deer/sq. mi., and 60-80/sq. mi. in the Whitewater Wildlife Management Area in Minnesota, Jon Cole personal communication) at some sites with Karner blue. Browsing by deer probably has helped to maintain the open canopy that is characteristic of savanna by killing or suppressing tree seedlings. In some areas browsing is so high on oak and jack pine seedlings and selected herbaceous species that several age classes of trees are missing (Lane, personal communication). If browsing by deer continues at these levels, regeneration of trees will be insufficient to maintain savanna. Similarly, deer grazing may reduce reproduction and survival of herbaceous plant species, such as lupine (Packer 1994, Schweitzer personal communication, Straub 1994).

It is possible that extirpation of bison and elk and increased numbers of deer have resulted in changes to the structure and species composition of the remnant barrens and savanna ecosystem. At the Whitewater Wildlife Management Area, grass litter has accumulated in open areas and certain age classes of trees are missing. In Ontario, extremely high deer populations consumed from 30% to 90% of the lupine plants in some areas, and probably contributed to the extirpation of the Karner blue butterfly (Boyonoski 1992, Packer 1994, Schweitzer 1994b).

Soil disturbances created by small mammals, such as plains pocket gopher (*Geomys bursarius*), can also affect the composition and abundance of oak savanna plant species (Reichman and Smith 1985, Davis et al., in prep.). For example, the savanna herb *Penstemon grandiflorus* (Scrophulariaceae) has increased growth rates and earlier reproduction when growing on areas disturbed by the northern plains gopher (Davis et al. in preparation). Lupine germination and growth on gopher mounds has not been studied, however the early successional disturbance-associated niche of lupine suggests that it might benefit from gopher disturbances.

Insects and diseases that remove canopy trees have also contributed to the persistence of barrens and savannas in the central United States. Many high quality oak savanna remnants are in areas where canopy trees have died as a result of oak wilt (*Ceratostyis fagacearum*). Two-lined chestnut borer (*Agilus bilineatus* Weber), jack pine budworm (*Choristoneura pinus* Freeman), and gypsy moth (*Lymantria dispar* L.) are likely to reduce canopy cover in over-grown barrens areas (Coulson and Witter 1984).

Soil type and topography have contributed to the maintenance of barrens and savanna species composition and structure. The sandy, well-drained soils characteristic of Karner blue habitat retain little moisture. These xeric conditions reduce growth of woody species (Burns and Honkala 1990, Klaus Puettmann, personal communication), and only species tolerant of these conditions persist. In combination with soil type, many savanna species owe their persistence to topographic effects, especially in the unglaciated driftless regions in Wisconsin and Minnesota (Lane 1994a, Wilde 1948). The steep slopes exhibit natural slumping, creating exposed mineral soil that favors early successional species. Many of these slopes are south and southwest in aspect, further enhancing their xeric quality and resulting in further suppression of woody plant species. In addition, during spring snow melt and summer rain storms, several valleys experience erosion, exposing the mineral soils that benefits early successional species, such as lupine.

Contemporary anthropogenic habitats. Silvicultural practices can have beneficial or detrimental effects on Karner blue, many of which are summarized in Lane (1997). For example, in some parts of Jackson, Juneau, Wood, and Burnett counties in Wisconsin, summer harvest, road building and maintenance, site preparation, tree planting, slash burning, and other activities may have been beneficial to lupine and Karner blue. Within this complexity of management activity, however, it is important to focus on how various practices affect the balance between local extirpation of butterflies in a stand and recolonization of stands by butterflies. Silvicultural practices disturb habitat and butterflies in ways that can be related to the type of disturbance (mechanical, chemical, or prescribed fire), its spatial extent (area affected), its intensity (direct effect on the soil, lupine, and Karner blue), and seasonal timing (phenology). The effects of these management practices will be quite diverse, but these effects can be categorized as direct effects on populations of the butterfly, effects on important plant species, such as lupine, nectar plants, and competing plants, and effects on the soil that influences these plant responses. All of these effects will depend on many habitat characteristics, such as the spatial distribution and abundance of plant resources, site quality, and topography, the previous history of the site, and the recent history of management. Because there is little scientific information for using silvicultural practices to enhance Karner blue butterfly, management planning should take an adaptive management approach. This will require that clear goals be set that include Karner blue

butterfly, observations be taken before and after implementation of management, and practices modified based on the observations.

Because silvicultural practices are implemented to achieve multiple management goals, there will be inevitable tradeoffs between achieving the various goals. For example, at a particular site, a manager may desire maximum immediate financial returns, minimal risk on investment, maximum sustained yields, optimal wildlife game animal production, and increased Karner blue butterfly populations. In most cases it will not be possible to optimize simultaneously all economic and wildlife goals. Instead, it will be necessary to understand which silvicultural practices are compatible with each of these many possible goals and which practices create tradeoffs among them. For some managers, such compatible practices may be those that, for example, enable sufficient financial return while supporting sufficient butterflies. Understanding how silvicultural practices affect both economic and butterfly needs will be challenging. One possible approach is to evaluate silvicultural practices by commodity [Bill, do you agree, or is there a better way to subdivide silvicultural forms?]. A pine stand managed for saw timber will typically be on better soils, under more intensive timber management, and be planted at higher density, be more valuable on a per acre basis, and take longer to mature compared to a pine stand managed for pulp production. These factors suggest that there will be different suites of tradeoffs associated with each production system. [Bill, can you provide an example to make this more realistic?] Appropriate management for Karner blue on silvicultural lands should recognize potential variation in compatibility when assessing the effects of a silvicultural landscape on populations of Karner blue. Considerable efforts should be extended to understand the complexities of management and their consequences for Karner blue butterfly in working silvicultural landscapes.

Silvicultural practices continually evolve as demand and technology changes. For example, because red pine fiber is now preferred to jack pine fiber in pulp processing, there has been a shift to replacing jack pine plantations with red pine plantations in many commercial forests. The effect of this shift on Karner blue butterfly is not known, but because red pine has a denser canopy at similar stand densities and is grown on a longer rotation than jack pine, this shift may be detrimental to Karner blue butterfly. The effects of these changes in silvicultural practices on Karner blue should be evaluated carefully through an adaptive management process.

Understory legumes, such as lupine, can raise soil nitrogen levels, improve rates of mineral cycling, reduce surface runoff and soil erosion, and may improve soil organic matter content, soil structure, and cation exchange capacity, and inhibit soil-borne pathogens (Smethurst et al. 1986, Turvey and Smethurst 1983). Many of these effects would benefit forestry production. The main cost might be the potential competition between lupine and the establishing trees. Thus, in many situations it may be beneficial for production goals to encourage the growth of existing lupine and associated Karner blue butterflies, as long as it was not necessary to incur the cost of planting lupine.

Military training activities may have been beneficial to Karner blue. The Fort McCoy Military Reservation contains some of the largest populations of Karner blue in Wisconsin (Bleser 1994, Leach 1993), where over 97% of the patches of lupine on the property are occupied by Karner blue. Larsen and Wilder (1994) have hypothesized that military training activities, particularly inadvertent fires caused by artillery and mechanical disturbance by tracked vehicles, have created a mosaic of successional states similar to those in native habitats. Comparative studies

relating the intensity of training activities to the density of butterflies suggest that these activities have indeed been beneficial to Karner blue (Bidwell 1994). Maxwell and Givnish (1995) initiated experiments to determine whether fire and tracked vehicle traffic have beneficial effects on Karner blue. Results are still preliminary, but tracked vehicle traffic does create microsites where lupine germinates in profusion (Maxwell and Givnish 1995, 1996).

Maintenance of suitable Karner blue butterfly habitat on rights-of-way and near airport runways has not been systematically studied, but it is appropriate to focus on how management practices affect the balance between local extirpation of butterflies at a site and recolonization of sites by butterflies. Because of incomplete scientific knowledge, management of these areas will require adaptive management. Broad-scale applications of broad-spectrum herbicides can be detrimental to existing lupine in these habitats, but could be beneficial if they suppress lupine competitors and enable lupine to establish. Spot applications of more selective herbicides and mechanical suppression of woody plants may be more beneficial to existing lupine and Karner blue butterfly. Building, mowing, and grading activities in rights-of-way may have beneficial effects on lupine and butterflies, but the effects may depend on the scale and timing of the activity.

Prescribed fire. Among the possible disturbances, fire has been widely regarded as an effective and efficacious means to reduce canopy cover and the litter layer, thereby maintaining an early successional habitat suitable for growth of lupine in native barrens/savanna ecosystems. Not all fires are effective at reducing canopy cover. A wildfire in 1986 at the Indiana Dunes National Lakeshore top-killed most oaks, but within several years the heavy resprouting from the oak roots resulted in a very dense shrub-like canopy (Martin 1994). The prescribed fires at Ft. McCoy did not reduce canopy cover (Maxwell and Givnish 1996); indeed, oak wilt caused greater canopy reduction in this area than the prescribed fires.

The direct effects of fire on lupine are partially understood. In general, it is expected that fire will release lupine from shade-suppression, but the immediate effects of fire on existing plants and the seeds may be positive, negative, or neutral. At the Oak Openings in Ohio, the short term effects of a moderate-intensity fire on established lupine plants were increased vegetative growth, flowering, and seed set (Grigore 1992). However, at least 95 percent of the seeds on the soil surface and new seedlings were killed. Seeds buried in the soil germinated at similar rates as those in unburned plots (Grigore 1992). At Ft. McCoy in Wisconsin, the occurrence of established lupine was not significantly affected by fire; lupine flowering declined on all plots, but the number of inflorescences declined less in the burned treatments than in the unburned control plots (Maxwell and Givnish 1996). The authors suggested that reduced competition and/or nitrogen volatilization may have resulted in increased germination in previously unoccupied areas. Both of these studies indicate that burning may enhance flowering of established plants, and the meager data suggest that germination of surviving seeds is not affected by moderately intense burning.

Fire may affect Karner blue by long-term improvements in habitat quality or by causing direct mortality to individuals present at the time of burning. It is expected that fire will reduce Karner blue populations during a relatively short period immediately after a fire, but that afterwards the population will increase to levels higher than those in the pre-burn habitat (Givnish et al. 1988). Available evidence, summarized below, supports the first part of this prediction, but there is no data that addresses adequately the second part of the prediction.

Research to date suggests that adult numbers can be reduced and eggs and larvae present in burned areas will be killed by fire (Grundel 1994, Maxwell 1996, Maxwell and Givnish 1994, Swengel 1993a). Eggs and larvae do not survive fire, but they can survive in habitats that are burned. Larvae found in the generation immediately after a fire were all in unburned portions of study sites (Bleser 1993, Swengel and Swengel 1994, Swengel 1993b, 1995), presumably because the eggs that were present during the burns were killed by the fire. Only in one area with an incomplete burn were larvae recovered immediately after a fire (Swengel 1995). Maxwell and Givnish (1996) conducted larval surveys pre- and post-prescribed burning treatments and estimated 50 to 80% mortality on burned plots. The areas where larval feeding was observed in burn plots were at the bases of tree boles and downed logs where the fires skipped. The significance of these fire skips in the population biology of Karner blue remains to be determined. Adults can survive fire. Adults marked before a fire were recaptured after the fire at Necedah National Wildlife Refuge. Several fires were studied and the results indicate that Karner blue butterflies survived fire at rates ranging from 15 to 87 percent (King 1994). Adults presumably moved away from the site when it was burned to nearby adjacent habitat.

The effects of fire on Karner blue populations are not as clear as the effects of fire on individuals. The main complicating factor is the recolonization of burned areas from nearby populations. The rate of recovery after a burn has not been well characterized empirically. One hypothesis is that if colonization of the burned area by adults is slow or the population does not reproduce very fast, the detrimental effects of a burn could potentially last several generations. Conversely, if colonization is rapid and population growth high, then the effects of the burn could disappear rapidly. The available evidence supports these hypotheses.

In Wisconsin, Bleser (1993) and Swengel (1993a) reported findings from studies conducted at four sites in Wisconsin. Each site had areas that were burned and unburned. Estimates of Karner blue butterfly abundance were conducted using transect counts, one visit (sometimes more than one visit) to one transect per treatment area. This methodology provides general population trends following fire. Comparing the counts from the spring flights for 1991 (pre-burn) and 1992 (post-burn) suggests that abundance decreased at four of five burned sites (increase at one), but abundance also decreased at three out of four unburned sites (Swengel 1993a). Doing a similar pre- and post-burn comparison on the summer flight suggests that all sites (burned or unburned) decreased in abundance except for a small increase at one unburned site (Swengel 1993a). The variability in the data is too high to determine if the burned areas suffered a greater decrease than the unburned areas. The weather in 1992 was cool and wet, and sites throughout Wisconsin had low summer flight counts (Bleser 1993, Swengel 1993a), which suggests that annual variation in weather may have larger effects on populations than burning. At one site, Rynearson North in the Necedah National Wildlife Refuge, no adults were found following fire for either the spring or summer flights. Swengel (1995), however, reported that incomplete prescribed fires with a return frequency of once every 3-4 years did not adversely affect Karner blue populations when a source population was nearby to recolonize the burned area. These data suggest that populations can be reduced or eliminated by fire, but it may also be possible that fire has only minor effects on Karner blue populations.

At Indiana Dunes National Lakeshore, selected areas were burned in fall, 1993 (Grundel 1994). Burned areas were adjacent to other areas with Karner blue populations. Compared to adjacent unburned areas, during 1994 first brood leaf feeding in the burned areas was reduced to six percent that of the unburned area, and second brood leaf feeding was still only 33 percent that of

the unburned area. Thus, even when recolonization could be rapid, fire can reduce populations for at least one year post-fire. At Ft. McCoy, burns were conducted in 1993, and evaluated during 1994 and 1995 (Maxwell and Givnish 1994, 1995). The area was surrounded by sites occupied by Karner blue and the burns did not reduce tree or shrub canopy cover. In 1995, trees were removed to reduce cover. First brood larval damage was reduced between 50-80 percent and subsequent adult populations were reduced by about 30-35 percent in the burned areas. Lupine growth was stimulated by the burn, and second brood larval densities were 20-50 percent higher in the burned areas. Subsequent adult populations were similar in the burned and unburned areas. Thus, when recolonization is high, Karner blue populations can recover rapidly from fires. By 1995, populations of Karner blue were similar on burned and unburned sites (Maxwell and Givnish 1996).

In Minnesota, degraded habitat (where no adults or larvae had been observed previously) adjacent to occupied habitat was burned in the spring (Lane in prep.). In two burn plots fifty lupine stems were searched during the summer brood, and five and six larvae (per 50 stems) were found. These larvae probably were the offspring of emigrating female butterflies from the populated adjacent, unburned areas. The spring burn killed many lower tree branches and ground layer vegetation, and the resprouting lupine may have been more apparent or preferable than lupine in the unburned area.

Givnish et al. (1988) provide an historical perspective on the problem of burn frequency. They analyzed historical fire records associated with the Albany Pine Bush and suggested that fires returned once every 6 to 18 years, with once in 10 years a likely average. They recommended that prescribed fire be used at the average historical frequency, or once every 10 years.

Currently available quantitative data suggest that fire can reduce Karner blue populations to 10-50% of previous population densities during the year after the fire. The amount of reduction may depend on the the duration, intensity, and thoroughness of the fire. The effects of fire during the second generation and second year post-fire are not clearly known. The rate of recovery appears to be faster with higher rates of recolonization and population growth. In one case, populations recovered within 2 years post-fire, but longer recovery periods are possible. Until more definitive data are available, fire should not be used too frequently to manage lands with Karner blue (refer to Appendix G).

Removal and suppression of trees and shrubs. Tree and shrub removal and suppression, such as by girdling, herbicide-killing or brush-hogging, can be effective ways of reducing canopy cover. Tree harvesting operations remove canopy and disturb soil, which could have beneficial effects on lupine and Karner blue. The effects of girdling or killing trees with spot application of herbicides is likely to benefit lupine and Karner blue, but this needs to be documented. Some trees may resprout after herbicide application. Suppression of shrubs with herbicides or brush-hogging may have short-term benefits, but the shrubs could resprout vigorously, necessitating additional management. In general, many of the methods for removal and suppressing tree and shrub canopy may have a net positive effect on lupine and Karner blue, but these effects should be documented.

Associated Species. Remnant native Karner blue habitats are home to an impressive variety of additional rare and imperiled plants and animals. Healthy communities once associated with barrens and savanna habitats have declined dramatically because of habitat conversion,

fragmentation and disruption of disturbance regimes. The unique ecological conditions created by the xeric, sandy soils, drought-like conditions, and frequent fire disturbances produced a suite of species that, because of their specialized adaptations, rarely occur outside of barrens and savanna habitats. Thus, while Karner blue butterfly is perhaps the most conspicuous member of this highly specialized community, many other regionally and globally rare species are also dependant upon these same habitats. Because barrens and savannas are rare habitats in many of the states with extant populations of Karner blues, many of the species restricted to these habitats are regionally imperiled. The ecologies of many of these species is not well enough understood to know how adapted these species are to other contemporary anthropogenic habitats. Appendix D lists the occurrence of Federal and state imperiled species known to be associated with savanna and barrens communities in those states with designated recovery units for the Karner blue. These lists were compiled by the State agencies responsible for rare species. Consequently, not all of the species listed will be found in occupied or occupiable Karner blue habitat, and not of the species that are rare in Karner blue habitat will be listed. These listings indicate that preserving and managing these dynamic barrens and savanna habitats is likely to have beneficial effects on ecological and biodiversity values (Table 4).

A bunchberry, *Cornus canadensis* in Indiana and Kirtland's warbler, *Dendroica kirtlandii* in Wisconsin are the only federally endangered species included in these lists. The following species are listed as federally threatened species: bald eagle, *Haliaeetus leucocephalus* in Michigan, and prairie bush clover, *Lespedeza leptostacnya* in Wisconsin.

In Wisconsin, Kirk (1996) conducted a thorough review of the rare species associated with dry prairie, barrens, and savanna in Wisconsin. Of the initial list of 122 species, 41 species were identified as associated with Karner blue habitat in the known range of the butterfly (1994 range). This list was further refined to those species that are highly associated with Karner blue habitat, and eight species were identified. All eight species are insects, including four butterflies, two skippers, and two tiger beetles. A ninth species, sharp-tailed grouse was identified of being of concern because of its large habitat needs.

Table 3. Number of designated State endangered, threatened, or special concern species potentially associated with with Karner blue habitats for each State with extant Karner blue populations. The number of species that are listed as Federal endangered, threatened, or species of concern is in parentheses. The number of invertebrates does not include Karner blue, and not all federally listed species are listed by each State.

State	Vertebrates	Invertebrates	Plants
New Hampshire 0 (0)	0 (0)	3 (0)	
New York 3 (1)	0 (0)	0 (1)	
Michigan 50 (4)	11 (3)	15 (3)	
Indiana 24 (2)	8 (3)	2 (1)	

Wisconsin	26 (5)	42 (5)
50 (5)		
Minnesota	5 (1)	3 (0)
9 (0)		

Population Structure

Spatial Structure of Karner Blue Butterfly Metapopulations. Karner blue butterfly populations have a metapopulation structure. For the purposes of recovery planning, a metapopulation is defined as a "population of populations." Such a metapopulation is distributed across a landscape at relatively discrete sites. Each of the relatively discrete sites that harbors Karner blue butterflies will be referred to as a subpopulation (these are sometimes referred to as local populations). In this definition of metapopulation there is no assumption about the relative importance of different subpopulations or about the significance or magnitude of dispersal between sites. Regardless, the number of subpopulations present at any given time is governed by the spatial structure of suitable and unsuitable habitat and the balance between local extirpation and local colonization.

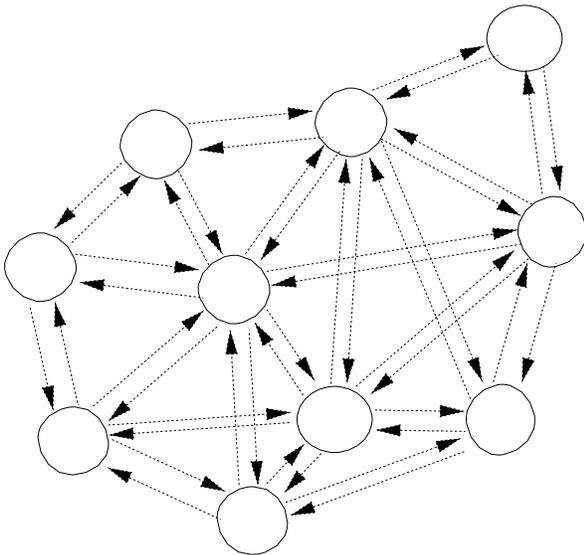


Figure 3. True metapopulation structure, the circles are suitable habitat and the lines are dispersal of butterflies.

Several theoretical spatial population structures are consistent with this definition of metapopulation. Levins (1969) described a population structure that will be referred to for recovery purposes as a true metapopulation (Figure 3). This assumes that all subpopulations are subject to extirpation, and that the probability of extirpation is identical but independent (asynchronous) among subpopulations (the thin white circles in Figure 3 designate that each site is subject to extirpation). Recolonization is slow and occurs at a rate that increases when there are more subpopulations (the dotted lines in Figure 3 indicate that dispersal rates are low). Persistence of a true metapopulation requires that colonization of suitable, unoccupied habitat occurs at a greater rate than subpopulation extirpation. In a true metapopulation each subpopulation could contribute critically to metapopulation persistence. Therefore the destruction of even one subpopulation, or separation of subpopulations by dispersal barriers could result in the extinction of the entire metapopulation. This occurs only in the most

precarious of true metapopulations, but this fact emphasizes that the persistence of a metapopulation is closely tied to both the spatial structure and persistence of all subpopulations and the rate of recolonization of all sites of suitable habitat. Management of true metapopulations must take into consideration all of these factors.

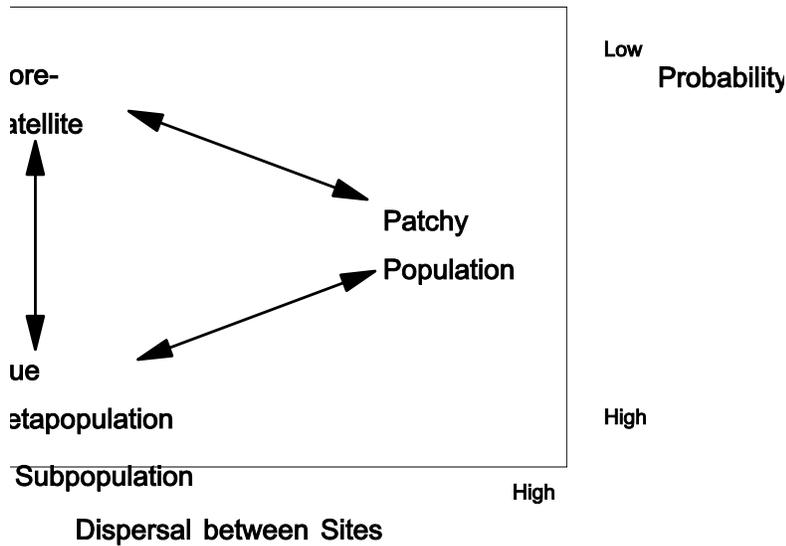


Figure 4. Dependence of population structure on local extirpation rate and between site dispersal rate.

Another theoretical structure consistent with our definition of metapopulation is the core-satellite or mainland-island (Borman and Levitt 1973) structure (Figure 4). This structure differs from the true metapopulation structure by having at least one subpopulation that is immune to extirpation. This immune subpopulation is called the core; the core can have greater immunity to extirpation because of larger size, higher population numbers, better habitat, and so on (the shading in Figure 4 indicates that the core is not extirpated). The bay checkerspot butterfly exhibits this type of metapopulation structure (Harrison et al. 1988). Individuals can disperse between the core and satellite populations, but the core is essential for the persistence of the metapopulation (the importance of dispersal from the core to the satellites is indicated by the thicker dispersal lines from the core to the satellite populations). If satellite populations are extirpated, they are eventually recolonized from the core, but if the core is extirpated, then the satellites will fail too. Management of core-satellite metapopulations must focus on the core.

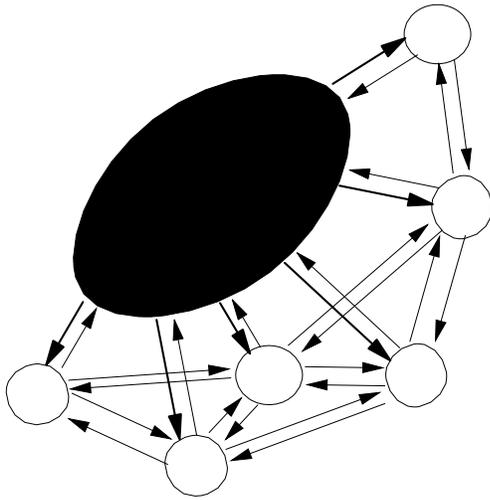


Figure 5. Core-satellite structure. Small circles are satellites to the larger, dark core.

A third theoretical structure that fits our definition of a metapopulation is the patchy population (Figure 5). A patchy population is distributed in discrete sites (or patches) on the landscape, but has dispersal rates that are so high that the subpopulations do not fluctuate independently (the high dispersal rates are indicated by the thick lines connecting sites). Colonization is so rapid that high populations in one subpopulation rapidly disperse to increase population densities in all subpopulations, and subpopulations rarely are extirpated (the rarity of extirpation is indicated by the shading of the sites in Figure 5). The subpopulations actually function as a single integrated deme (a randomly mating population) and all subpopulations fluctuate in more or less in unison. In this case, the metapopulation only superficially has spatial structure because all subpopulations are interacting strongly. Persistence of a patchy population depends on the size and stability of the whole metapopulation and not as much on the structure and relations among subpopulations. Management of a patchy metapopulation can focus on the average behavior of subpopulations across all occupied sites rather than focusing on a few to many critical sites.

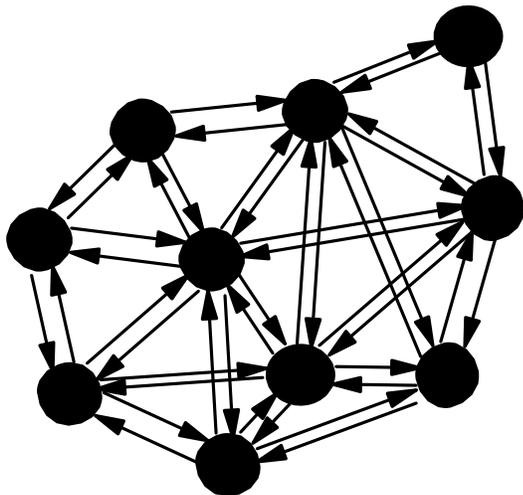


Figure 6. Patchy population structure. Sites are usually occupied and dispersal is very high.

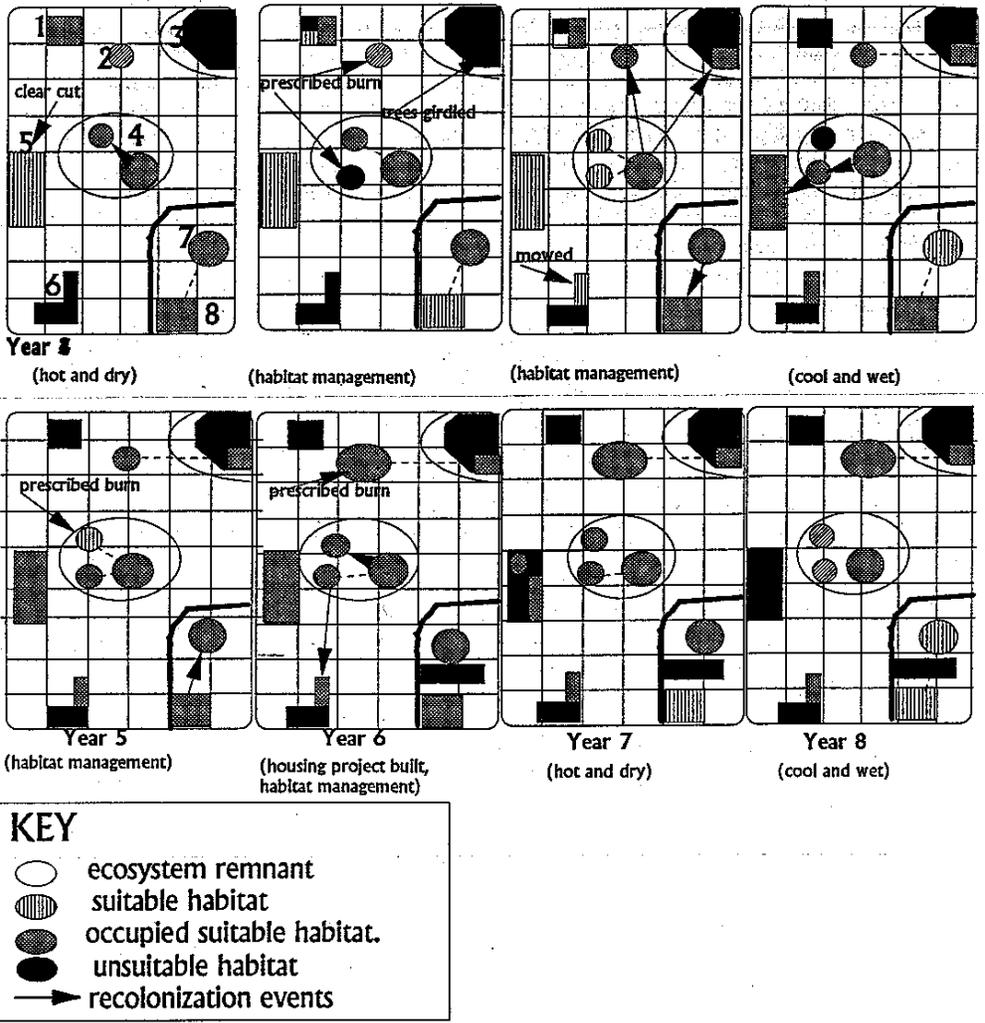
In summary, a core-satellite structure implies that at least one site will never be extirpated (Probability of extirpation = 0), whereas in a true metapopulation all sites have equal probability of going extinct (Probability of extirpation = constant \neq 0). These idealized structures represent extremes along a continuum of extirpation probabilities (Figure 6). Both of these structures (true metapopulation and core-satellite) assume that site colonization rates are not extremely high for

any site. The patchy population structure, in contrast, assumes that colonization rates are very high for all sites. Thus, the patchy population represents an extreme along a continuum of recolonization rates, with both the true metapopulation and core-satellite structures on one end, and the patchy population structure on the other end of the continuum. Again, neither of these extremes are likely to be precisely accurate representations of an actual metapopulation of Karner blue butterfly. Management of a true metapopulation is likely to be more intensive than management of either a core-satellite or a patchy metapopulation, because of the need to keep track of each subpopulation individually in a true metapopulation. Consequently, one management strategy to reduce the cost of management is to use management to change the population structure to be more like a core-satellite or patchy metapopulation.

Together these theoretical structures probably encompass all likely structures of actual Karner blue populations, although none by itself may provide an accurate representation of any Karner blue metapopulation. Actual population structures of Karner blue butterfly are likely to be vastly more complex than any of these three common theoretical abstractions. For example, Karner blue metapopulations are unlikely to have a core-satellite structure because all sites are involved in successional processes that eliminate Karner blue followed by renewal events that rejuvenate habitat; a single site is unlikely to maintain a healthy, stable subpopulation of Karner blue butterflies indefinitely (Givnish et al. 1988). Management efforts can be used to reduce the probability of extirpation of a site, but it may be difficult to manage a single site so that it persists indefinitely into the future. It is also unlikely that Karner blue metapopulations have a true metapopulation structure. All sites will not have a uniformly high probability of extirpation, with some sites being more prone to extirpation than others, and the probability of extirpation among sites is probably correlated in time and space. Protection from extirpation probably exists at many sites that provide refugia from various types of disturbance but not others. For example, mesic areas would be temporary refugia from drought or fire, whereas xeric areas would be temporary refugia from the threats of cold weather and canopy closure. Consequently, the probability of extirpation is unlikely to be constant or independent across sites or at a single site over time. It is unlikely that Karner blue metapopulations are patchy metapopulations. This structure requires high rates of recolonization that integrate the local population dynamics of the spatially distributed metapopulation. Some metapopulations may appear to function as patchy populations because they occupy many sites and the sites are close together, however dispersal must be very high to integrate the population dynamics across the entire metapopulation. Even at the Necedah National Wildlife Refuge in Wisconsin, where dispersal rates are the highest measured for Karner blue (King 1996), subpopulations do not fluctuate together (King 1994).

Figure 7 presents a hypothetical example to illustrate some of the complexity of the functioning of an actual metapopulation, showing how subpopulations might interact, suitable habitat colonized, and occupied sites extirpated. In this example, three local populations are within a remnant of healthy barrens or savanna ecosystem (center oval), and other sites are associated with private and county forest lands or poor quality remnant barrens or savanna ecosystems. The sites are renewed by various disturbances or efforts to restore barrens/ savanna ecosystems. The sites decline in suitability for Karner blue according to plan or because of lack of management. In this example, the small group of subpopulations associated with the remnant healthy barrens or savanna ecosystem together function as a core group of subpopulations. Together they are managed so that one or more of them harbors a strong subpopulation of Karner blue butterfly, and when considered together, Karner blue butterfly may persist indefinitely on them. This kind of metapopulation structure, with a core group of subpopulations, is intermediate to all of the

theoretical abstractions described above, but preserves many of the management advantages of the core-satellite structure.



SITES:

Matrix between sites = closed canopy forest, or agricultural fields.

1. Unevenaged woodlot, allowed to succeed to oak forest
2. Oldfield with dense thickets of sapling size oaks. lupine in patches
3. County forest, jack pine barrens type ecosystem
4. Private preserve, managed for oak barrens ecosystem
5. Jack pine stand, clear cut year 1 and replaced with red pine
6. Old field with remnant lupine and nectar plants.
7. & 8. Remnant jack pine barrens, 7 = xeric site, 8 = mesic site.

Figure 7. Schematic representation of a functioning metapopulation

The broad metapopulation concept used in this recovery plan enables a robust description of a viable metapopulation, because it focuses on the factors that create a healthy metapopulation, including sufficient suitable habitat to support a metapopulation, sufficient connectivity to promote recolonization, and management guidelines to aid decision-making. Because Karner blue metapopulations are likely to exhibit considerable variation in spatial structure, the concept of viable metapopulation must be applicable to all possible spatial structures, including the many variants of true metapopulations, core-satellite metapopulations, and patchy metapopulations.

A viable metapopulation of Karner blue butterfly must be large enough, have a sufficient geographic base, and managed and monitored to persist indefinitely over time. The management and monitoring system must buffer the metapopulation against adverse disturbances and threats to survival, maintain suitable habitat over time in an appropriate spatial structure, and identify appropriate responses to potential declines in the metapopulation. This definition of viable metapopulation is elaborated in Appendices E and F. It should be clear that the definition of a viable population does not depend on assuming that all metapopulations of Karner blue are true metapopulations. If a Karner blue metapopulation is in fact a true metapopulation, however, the definition of viable metapopulation should indicate what would be needed for this true metapopulation to be a viable one. Moreover, the definition of viable metapopulation does not encourage a minimalistic perspective; if the metapopulation can be made more secure, the management and monitoring costs can decrease.

Management is a crucial component of a viable metapopulation, and because complete information is not available, adaptive management for improving or maintaining Karner blue metapopulations is essential. Several adaptive strategies can be pursued. Management can be adapted to change the structure the metapopulation. In today's managed landscapes, we may impose a spatio-temporal structure on a metapopulation to create or maintain a metapopulation more like a core-satellite or patchy structure. These kinds of metapopulations may be more robust to disturbances and threats and will probably be less expensive to maintain. The geographic base of the metapopulation also can be managed adaptively over time. New areas can be added and old areas eliminated from the metapopulation as information about its functioning improves. Monitoring can be adapted as the duration of successful management increases. As confidence is gained in the management practices, the need for monitoring declines.

Metapopulation Persistence. Persistence of a Karner blue metapopulation will be governed by the balance between extirpation of subpopulations and recolonization of unoccupied sites of suitable habitat. Recolonization rates will be related to colonization rates and between site dispersal rates, and as these increase, occupancy of suitable habitat will increase and the metapopulation may become more integrated, functioning like a patchy metapopulation. Subpopulation extirpation rates will be related to the extent and quality of habitat and the rate that habitat degrades from factors such as canopy closure. If management activities operate to reduce the rate of extirpation for one or a cluster of subpopulations, the metapopulation becomes stabilized around the dynamics of that subpopulation(s), functioning more like a core-satellite metapopulation. Both of the rate of recolonization and the rate of extirpation can be influenced by spatial structure of the habitat mosaic.

Recolonization. Recolonization rates will be affected by the rate and pattern of dispersal, and the availability of suitable habitat for colonization. Most adults move short distances (less than 200 meters or 219 yards), and a small percent move more than one kilometer (0.62 miles). The

limited data suggest that the closer the sites and more open the intervening habitat, the more observed between-habitat movements. Therefore recolonization rates are expected to be higher when there is a large number of suitable habitat sites per unit area, which reduces inter-site distance. In addition, dispersal may be facilitated by corridors of open habitat. Refer to Appendix G for suggestions that may help increase recolonization rates.

Extirpation. Savignano (1994b) demonstrated that extirpation of subpopulations does occur. She found that in Saratoga County, NY, only 52 percent of sites that had been recorded previously with Karner blue were still occupied in 1990. Informal observations by numerous researchers have confirmed that subpopulations of Karner blue become extirpated, but the reasons for extirpation remain poorly understood.

The probability of extirpation of a subpopulation may be affected most by the extent and quality of suitable habitat, and secondarily by chance events. Clearly, a healthy, abundant lupine population is essential for continued persistence of a subpopulation. Savignano (1994b) showed that subpopulations on sites with more lupine are more likely to persist than those on sites with less lupine. Microhabitat diversity (as created by variation in canopy cover and possibly by variation in topography, aspect, and soil hydrology) probably should reduce the probability of extirpation, because immature survival is higher in shady microhabitats, by protecting against year-to-year environmental variation. The importance of nectar plants for persistence is less well documented. Lack of nectar plants appears to increase adult mortality rates (Clench 1967, Watt 1979), and it is expected that a diversity of nectar plants would improve persistence. Different nectar plant species are differentially affected by variation in weather. For example, during the 1995 drought at Waupaca, WI, most of the lead plant (*Amorpha canescens*) flowers aborted, while hoary allysum (*Berteroa incana*) and horsemint (*Monarda punctata*) still flowered (Lane, personal communication). Similarly, in NY the phenology of *Ceanothus americanus*, a major second brood nectar source, matches Karner blue phenology poorly in some years and quite well in others (Schweitzer, personal communication).

It is widely believed that uninterrupted, succession will cause extirpation (Givnish et al. 1988, Helmbolt and Amaral 1994, Sommers and Nye 1994, Grigore and Windus 1994, Packer 1994). Lupine is eliminated when tree canopy closure occurs (Celebrezze 1995), but the timing of extirpation of subpopulations of Karner blues is poorly understood (how much before or how much after canopy closure). Moreover, the rate of canopy closure is quite variable from site to site and heterogeneous within sites, so the overall importance of succession as a cause of extirpation is may vary from location to location. Finally, management, or the lack thereof, can influence the rate of canopy closure. Indeed, the lack of management has allowed succession to proceed unimpeded in many habitats, which may have resulted in reduced lupine and reduced Karner blue populations (Givnish et al. 1988, Helmbolt and Amaral 1994, Sommers and Nye 1994, Grigore and Windus 1994, Packer 1994).

Larger areas of suitable habitat will tend to produce more butterflies, which will tend to protect the subpopulation from extirpation. Conversely, very low population numbers may be associated with an increased probability of extirpation because of chance environmental, demographic, and genetic events. Random environmental events can push already small subpopulations to extirpation. This may occur for example if a fragmented and sparsely populated subpopulation is burned by a wildfire. The remaining pockets of individuals and habitat may be so small that inability to find mates, inadequate lupine or nectar plant resources, or inbreeding depression may

push the subpopulation to extirpation (see Lawrence 1994). Recurrent drought may have been involved in the extirpation of the Ontario populations (Packer 1994, Schweitzer 1994a). It is also thought that very small subpopulations are more susceptible to extirpation from demographic stochasticity (skewed sex ratio, chance birth or death rates) (Schonwald-Cox et al. 1983). For example, a widespread, but patchily-distributed European lycaenid *Plebejus argus* L. has higher extirpation rates in small areas of suitable habitat than large ones (Thomas and Harrison 1992).

Spatial structure of habitat mosaic. Many environmental effects that are potentially detrimental to Karner blue can extend over extensive areas, such as large-scale wildfire, extended periods of extraordinary weather (summer-long, hot droughts or extremely delayed and cool summers) or disease epidemics. In these cases, local extirpation is likely to increase throughout the metapopulation, perhaps to the point that the entire metapopulation has no chance of recovery. The importance of these factors on metapopulation persistence has been inadequately investigated, but year-to-year variation in weather may be responsible for some of the large fluctuations in butterfly abundance that have been observed in Wisconsin (Bleser 1993, Lane 1996).

Variation in patch size and quality between local populations should increase persistence of a true metapopulation by producing asynchronous fluctuations in the density of subpopulations. A core-satellite structure might be stabilized against these large-scale disturbances by managing the metapopulation to have more than one core subpopulation or clusters of subpopulations. A patchy population might be stabilized by being spread over a large spatial area.

Threats to Survival

The most important threats to Karner blue rangewide are habitat loss, which has been accompanied by increased fragmentation of the remaining suitable habitat, and habitat degradation, primarily caused by ecological succession. Related to these is the threat of inappropriate management stemming from conflicting and potentially conflicting management objectives. Large-scale disturbances, such as large wildfire and unusual weather, also present a real threat to Karner blue populations. Other factors may pose real threats in particular instances, but for the most part these other factors have not been adequately investigated. Detailed discussion of the threats to Karner blue in each recovery unit is provided in Appendix B.

Habitat Loss, Alteration, and Destruction. The loss and degradation of Karner blue butterfly habitat detrimentally affects its population several ways. Habitat loss has resulted in fewer subpopulations, greater distances between suitable habitat sites, and smaller sites. Habitat degradation has reduced microhabitat diversity, and the abundance and quality of food resource (lupine and nectar plants). New sites with suitable habitat are created infrequently without appropriate management, and areas in between subpopulations may degrade, reducing the colonization rate. Less direct effects could also occur. For example, if disturbance processes are inhibited, then the remaining habitat may become restricted to steep open sand banks. During drought years, lupine may senesce early, decimating the subpopulation and reducing the probability that the metapopulation will persist.

Loss of native habitat. The major threat to native habitats is conversion to alternate uses, such as agriculture, silviculture, industrial, residential and commercial development, and road construction. Originally, barrens and savanna were widespread in central United States but rare in eastern United States. In both regions there has been a precipitous decline in these habitats. Remaining barrens and savanna usually consist of isolated patches which persist because of droughty soils, insects and disease, and human disturbance such as mowing, light grazing and intermittent prescribed fires. This translates into a significant loss of suitable habitat for the Karner blue butterfly and habitat loss continues to threaten butterfly populations across its range.

Degradation of native habitat. The major threats to survival of Karner blue butterfly in native habitats are, succession to woodlands and forests, and management for other wildlife and natural areas goals that do not take into account the needs of Karner blue butterfly, such as restoration and maintenance of native vegetation, encouragement of game animals, and recreational use. Human use of these native habitats and adjacent developed habitats has often resulted in suppression of disturbance and decline of Karner blue butterfly populations. Although in many cases, wildlife and other management goals are concordant with enhancement of Karner blue, in many cases too vigorous a pursuit of these other goals can be detrimental to the butterfly.

Loss of non-native habitat. Karner blue butterfly inhabits several non-native habitats, including some silvicultural habitats, mowed rights-of-way, and roadside verges. These habitats are being lost to more intensive development pressures. Silvicultural habitats that are suitable for Karner blue are being converted to more intensive silvicultural uses that are less compatible and to incompatible residential and commercial uses. Along roadsides, native vegetation is being replaced by a more uniform, exotic vegetation. It is hypothesized that conversion of former jack pine plantations to red pine results in a loss of Karner blue habitat because red pine canopy is thicker and closes more rapidly, but this requires confirmation.

Degradation of non-native habitat. Silvicultural habitats degrade as suitable Karner blue habitat as the crop matures and canopy closure occurs. This is natural part of the production cycle, and as long as other silvicultural habitat is opened up, such as by harvesting, the metapopulation can remain at viable levels. These silvicultural habitats can be degraded for Karner blue in other more subtle ways, such as by changing the management objective for land that was previously suitable for the butterfly. Shifting objectives can change the balance between the duration of a Karner blue subpopulation on a site and the proportion of total area that is suitable for the butterfly. For example, suppose a particular silvicultural objective results in canopy closure occurring by 10 years after planting and maturation and harvest in year 40. If a Karner blue subpopulation uses a site for 8 of the 10 years before canopy closure, then 20 percent of the land managed for that objective could have habitat suitable for Karner blue butterfly. If the land is managed for a different objective, so that canopy closure occurs faster and subpopulations can only persist for 6 years, and stand maturation takes 60 years, then only 10 percent of the land managed for this objective could have habitat suitable for Karner blue. The exact percentage will vary from year to year depending on the proportion of the land harvested, variation in growth among sites, and changes in management objectives for a particular site. The longer the subpopulation can persist at higher population numbers, in general, the better for Karner blue butterfly.

Karner blue butterfly also inhabits power line and railroad rights-of-way. If these are managed with herbicides or mowing from the late spring to the early summer, they would suppress lupine and nectar plants, thereby becoming poor habitat for Karner blue butterfly.

Types of inappropriate management. Inappropriate management practices threaten some populations of Karner blues. These inappropriate practices occur because land managers have several management goals and they either are unaware how pursuit of these other goals could have detrimental effects on Karner blue butterflies or they judge the trade-off with its detrimental effect on the butterflies to be acceptable. Several examples of inappropriate management practices are described in what follows.

(1) Pest control. Poorly timed or poorly located use of herbicides can have a negative effect on Karner blue butterflies, by killing or suppressing lupine or important nectar plants. The direct effect of herbicides on Karner blue larvae is under investigation. Most insecticides are not target-specific and can kill most insects in the treated area. In laboratory tests, even the relatively specific insecticide, *Bacillus thuringiensis kurstaki* (BT), kills all larval instars of Karner blue (Herms 1996). Because the timing of insecticide applications for gypsy moth control typically coincides with the larval stage of the Karner blue, inappropriate application of insecticides could adversely affect Karner blue (Herms 1996). Miller (1990) found that BT reduced the number of non-target Lepidoptera species and suggested that if any of the species had been limited in its distribution, it would have been at high risk of becoming extirpated. The effect of biological control agents on non-target insects is poorly documented. Analysis of the effects of releases of the biological control agent *Trichogramma nubilale* (Andow et al. 1995) showed the risk to be small. An examination of the introduced insect predator *Coccinella septempunctata* in Karner blue habitat (Schellhorn et al. personal communication) suggests that the risk could vary with predator density, prey density, and microhabitat. The direct or indirect effects of fungicide applications on Karner blue butterfly is not known.

(2) Mowing. Mowing between late spring and early summer may have detrimental effects on Karner blue populations. Mowing can damage lupine, eliminating food for larvae. Although it may reduce shade and competition, mowing may favor plant species not used by Karner blue butterflies (Givnish et al. 1988). Mowing during adult nectaring periods can greatly reduce flower number and nectar availability. In addition, mowing can kill larvae that are present during mowing. Mowing of lupine before seeds mature and disperse could reduce reproduction by lupine, and have a long-term detrimental effect on Karner blues.

(3) Prescribed fire. One of the most useful restoration and management tools, prescribed fire, may threaten Karner blue populations if the burning is conducted on the majority of the habitat, and if high intensity fires are used at frequent intervals. Annually conducted prescribed fires will improve barrens and savanna vegetation (Tester 1989), but these would likely be detrimental to Karner blue butterfly.

(4) Deer and grouse management. High deer densities can devastate Karner blue butterfly habitat and cause direct mortality by ingestion of larvae (Packer 1994, Schweitzer 1994). Schweitzer recommends that deer populations be managed to levels where no more than 15 percent of lupine flowers are consumed (Schweitzer 1994), but this recommendation has not been rigorously tested. Grouse habitat does not support lupine, because the dense, shrub vegetation favored by these game birds casts too much shade to allow lupine to thrive.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes. In the past the Karner blue butterfly has been collected (USFW 1992), and this has not been considered a significant factor in population decline. In the parts of its range where only a few small populations remain, however, extensive collections could have a detrimental effect. Although it has been suggested that collecting of Karner blue butterflies in Illinois in the

Kenosha Potential Recovery Unit may have contributed to the recent extirpation of the butterfly in this Unit, only three butterflies were collected and it is highly unlikely that this could have contributed to the extirpation.

Disease or Predation. Very little research has been conducted on the natural enemies of Karner blue butterfly, so the significance of these biotic factors as threats to Karner blue cannot be stated. Similar to most other insects, mortality of immature life stages is very high (Savignano 1990, Lane 1994b). Part of this mortality is caused by predators, parasitoids, or pathogens (Savignano 1990). Larval predators include pentatomid stink bugs (*Podisus maculiventris*), wasps (*Polistes fuscatus* and *P. metricus*), ants (*Formica schaufussi* and *F. incerta*) (Savignano 1990, 1994a), spiders (Packer 1987), and ladybird beetles (*Coccinella septempunctata*) (Schellhorn et al. personal communication). Four larval parasitoids were reared from field collected larvae: a tachinid fly (*Aplomya theclarum*), a braconid wasp (*Apanteles* sp.), and two ichneumonid wasps (*Neotypus nobilitator nobilitator* and *Paranoia geniculate*) (Savignano 1990). Several insect predators have been observed attacking adults including: spiders, robber flies, ambush bugs, assassin bugs, and dragonflies (Bleser 1993, Packer 1987). Disease pathogens of Karner blue butterfly have not been identified, but probably exist.

It is unknown whether birds or mammals cause significant mortality at any life stage of the Karner blue butterfly. Bird beak-marks are occasionally observed on adult wings. Heavy browse

by mammals or insect herbivores on lupine in Karner areas can also have a detrimental effect. Effects will be most dramatic if larvae are ingested when lupine is consumed, or if they starve because lupine is severely defoliated. Browse or herbivory on the flowers or fruits can reduce lupine seed and possibly affect the long term survival of the lupine population (Straub 1994). Insect herbivores, such as painted lady larvae (*Vanessa cardui*) and blister beetles, can defoliate high percentages of the lupine in an area, which may result in larval starvation.

Aggressive plant species may pose a threat by out-competing other plant species required by the Karner blue butterfly. Orange hawkweed (*Hieracium aurantiacum*) and Pennsylvania sedge (*Carex pennsylvanicus*) can dominate some Karner blue habitats and reduce lupine and the diversity and abundance of nectar plants available to the Karner blue adults. Spotted knapweed (*Centaurea maculosa*) is used as a nectar plant, but its dominance can reduce the diversity of nectar plants, increasing the risk of extirpation of the subpopulation. In the absence of management, dense cover of buckthorn (*Rhamnus catharticus*), American hazelnut (*Corylus americana*), or other woody shrubs will eventually eliminate lupine.

Plant diseases of lupine could reduce its food quality or rendering it unsuitable, resulting in larvae mortality or reduced adult fecundity. Lupine leaves are attacked by both powdery mildew (*Erysiphe polygoni*) and a leaf rust (*Puccinia andropogonis*). No research has been conducted to determine whether these diseases result in reduced lupine quality.

Of particular interest is how fragmentation and degradation of habitat influences the population dynamics of natural enemies and competitors of Karner blue butterfly and lupine, and the ultimate effect on Karner blue metapopulations. For example, the abundance of predators and parasitoids varies with tree canopy cover and therefore some microhabitats may provide refugia for Karner blue (Lane 1994b, Schellhorn et al. personal communication).

Inadequate Regulatory Mechanism. Karner blue butterfly is listed as a state endangered species in Minnesota, New York, New Hampshire, Indiana, and Ohio. In Michigan it is listed as threatened, and in Wisconsin it is listed as a species of special concern. It is not listed in Illinois because it has been extirpated from the state.

While most states still supporting butterfly populations have legislation that protects the butterfly, provisions for protection and management of the habitat are incomplete to non-existent (USFW 1992). This is an important gap in that loss and degradation of suitable habitat are primary reasons for population extirpation and decline in numbers, and recovery of the species will depend on ensuring an adequate base of suitable habitat. Implementation of management agreements, development of conservation easements, and outright land purchase could be used to ensure the habitat base. Other, more flexible regulatory mechanisms could be developed to ensure this habitat base.

Populations of Karner blue that occur on Federal and State lands are protected from destruction, but Federal and State land managers might not manage actively for appropriate savanna or barrens habitat. Developing stream-lined procedures for incorporating concerns for Karner blue butterflies into current management plans would be useful.

Other Natural or Man-made Factors Affecting Its Continued Existence. Unusual weather can negatively affect Karner blue populations. Spring and summer drought can stress lupine and

may reduce larval populations, and reduce flowering of nectar plants (Lane, personal communication), which may result in greater adult mortality. Cool springs can delay lupine emergence until after Karner blue egg hatch (Lane, personal communication). Cold, wet weather during the flight periods reduces the time available for oviposition and could increase adult mortality. A combination of drought and cool, wet springs is one of the suspected causes of population extirpation in Ontario (Packer 1994, Schweitzer 1994a).

Large-scale wildfire could destroy a large metapopulation. These events are infrequent, but are devastating nonetheless. Although these rare events would have large detrimental effects for several years, it is possible that the metapopulation could recover if enough healthy unburned populations existed nearby.

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Wisconsin Karner Blue Butterfly

Habitat Conservation Plan and Environmental Impact Statement

Appendix B. Species Associated with the Karner Blue Butterfly and its Habitat

This appendix includes information on species associated with the Karner blue butterfly and its habitat in Wisconsin. It is comprised of two reports that were prepared to support development of the statewide Wisconsin Karner Blue Butterfly HCP:

Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Final Rept. to USFWS (Amendment #38 to Cooperative Agreement #14-16-0003-89-933). Wisconsin Dept. Natural Resources, Madison. (Pages B-3 - B-84)

Borth, R.J. 1997. Karner blue management implications for some associated Lepidoptera of Wisconsin barrens. Unpub. Rept. to HCP partners. Wisconsin Gas, Milwaukee. (Pages B-85 - B-113)

These reports have been reformatted and reproduced here without editing.

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A. "The Karner Blue Community: Understanding and Protecting Associated Rare Species of the Barrens" by K. Kirk

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Introduction

The barrens habitat of central and northwestern Wisconsin is a diverse community of native plants and animals whose lives are intertwined with each other and the natural elements of sun and shade, wind and rain, fire and drought. Each species has evolved mechanisms to ensure the survival of its kind in the context of the large and small-scale disturbances that are integral to the barrens habitat. For many, disturbance has become a necessity to provide the diversity or specificity of habitat elements required. With the arrival of humans, the cycles of disturbance were altered as was the land itself.

The challenge has become one of provision for the native inhabitants while satisfying the needs and desires of human society. Over one hundred and fifty years of change to the landscape has left a long list of the native species in isolated, reduced populations that are increasingly vulnerable to further losses from reduced genetic diversity and the effects of inbreeding depression, stochastic events, inordinate predation pressures, increased interspecific competition, collecting, and inadvertent destruction by human activities.

Most recently the spotlight has fallen on one animal of the barrens community: the Karner blue butterfly. Extensive research is proceeding to illuminate the biological and ecological needs of the species. Since the Karner blue was listed as federally endangered by the U.S. Fish and Wildlife Service in December, 1992, any human activity which may result in the loss of individual butterflies must be carefully scrutinized. The development of a Habitat Conservation Plan (HCP) to ensure no net loss to the species is required by federal law for all lands with Karner blue habitat. The Wisconsin Department of Natural Resources is meeting this conservation challenge with a holistic approach.

First, the development of a comprehensive plan that integrates conservation practices and economic land use on Wisconsin Karner blue habitat will result in a statewide HCP. This plan will be the first creation of its kind by a partnership of public and private landowners with diverse interests. Secondly, the Wisconsin DNR has committed its resources to manage for biodiversity on state lands that support the Karner blue butterfly and, through the HCP process, to encourage a multi-species approach on private lands as well. Such proactive planning for conservation offers the opportunity to better understand and protect the natural community of flora and fauna in which the Karner blue butterfly is but one of the residents.

In the fall of 1994, a list of 122 rare species associated with dry prairie, barrens, and savanna in Wisconsin was reviewed by experts familiar with the various taxa. Forty-one species from the list were identified as associated with barrens in Karner blue butterfly range. The list of species under consideration was further refined in March, 1995 to those rare species highly associated with barrens habitat in Karner blue butterfly range or those species moderately associated but listed or candidates for listing at either the state or federal level. The sharp-tailed grouse is rather a special case. It is only moderately associated with Karner blue butterfly habitat but is of special concern in the state and the large areas needed to meet its breeding and population requirements are primarily within Karner blue range.

Twenty-two species and two subspecies are considered in this document. Thirteen are federally or state listed or under consideration for listing. Of the remaining nine, eight species are insects highly associated with the habitat of the Karner blue butterfly and therefore can be expected to

be particularly affected by environmental alterations made during management for the Karner blue. The ninth species is the sharp-tailed grouse.

The following accounts will introduce each species and describe the range and habitat, taxonomic affiliations, life history, and management concerns. Briefly, the needs of each species are simple: food, water, reproductive success, freedom from bodily harm, maybe shelter. The plants need pollinators, periodic removal of litter, and gaps in the canopy. Response to disturbance appears to vary for the plants. Turtles need stable water levels for hibernation in winter; sunny, sandy, perhaps previously disturbed upland areas for nesting; and safe passage in the uplands.

Roads are lethal to all the reptiles. The massasaugas spend time basking and foraging in the shrubby upland areas around the wetlands and may suffer mortality from burning or mowing. Forest succession reduces their habitat as it does for the slender glass lizard. The glass lizard needs open, grassy areas with lots of invertebrates and mammal burrows. The lizards however, have poor adaptations to fire and require patches of unburned habitat for survival.

Each kind of bird responds to a different but specific habitat structure: shrubs or low trees within fairly tall grasses for shrikes, large stands of small jack pines for Kirtland's warblers, large open areas with additional shrubby areas, some trees, and wooded wintering areas for sharp-tailed grouse. The lepidopteran species need food plants for both larvae and adults. They need protection for vulnerable life stages and/or opportunity to recover from population losses. The species discussed here vary in tolerance of habitat degradation, habitat specificity, and ability to recover after population losses. Eight of the ten lepidopterans are single-brooded indicating a slow recovery time. The phlox moth appears to hibernate in the soil and the frosted elfin may be underground in the winter as well, but the other species hibernate in the leaf litter or within the host plant where the immature animals are vulnerable to winter disturbance. The red-tailed leafhopper requires undisturbed patches of prairie dropseed. Tiger beetles require open patches of sand with abundant insect prey and are most vulnerable in the egg stage to habitat disturbance or degradation.

The land management activities undertaken in barrens habitat where Karner blue butterflies reside and timber is harvested will be moderated by the characteristics of the individual sites involved. Burn management, clearcuts, mowing, and various degrees of soil disturbance each have their places in the complex of the landscape where microhabitats coexist with silviculture. Some sites overlapping in space and time can be managed to provide the needs for the natural community while timber harvest and recreational activities are taken into account. Other sites will not so easily bend to diverse demands.

Close scrutiny of the information included herein will reveal not so much a bewildering array of hopelessly opposing considerations but patterns of nature. These species are but twenty-two snapshots of the life embellishing 'barren' land. Threads of the pattern appear in considering how each of the species manage to survive winter, adapt to a landscape ravaged by wildfire, minimize competition with similar animals for necessary resources, and opportunistically maximize the survival of their kind with the 'help' of other species without destroying those neighbors.

RARE SPECIES ASSOCIATED WITH KARNER BLUE BUTTERFLY HABITAT THAT ARE DISCUSSED IN THIS DOCUMENT

State or Federally Listed Species or Candidates for Listing

<u>Species</u>	<u>Common Name</u>	<u>Status-St.</u>	<u>Status-Fed.</u>
<i>Talinum rugospermum</i>	prairie fameflower	SC	C2
<i>Asclepias ovalifolia</i>	oval-leaved milkweed	PTHR	none
<i>Viola fimbriatula</i>	sand violet	END	none
<i>Aflexia rubranura</i>	red-tailed pr. leafhopper	SC	C2
<i>Schinia indiana</i>	phlox moth	END	C2
<i>Incisalia irus</i>	frosted elfin	THR	none
<i>Phyciodes batesii</i>	tawny crescent	SC	C2
<i>Clemmys insculpta</i>	wood turtle	THR	none
<i>Emydoidea blandingi</i>	Blanding's turtle	THR	C2
<i>Ophisaurus attenuatus</i>	W. slender glass lizard	END	none
<i>Sistrurus c. catenatus</i>	eastern massasauga	END	C2
<i>Lanius ludovicianus</i>	loggerhead shrike	END	C2
<i>Dendroica kirtlandii</i>	Kirtland's warbler	SC	END

Species with High Karner Blue Butterfly Habitat Association

<u>Species</u>	<u>Common Name</u>	<u>Status-St.</u>	<u>Status-Fed.</u>
<i>Incisalia henrici</i>	Henry's elfin	SC	none
<i>Chlosyne gorgone</i>	Gorgone checkerspot	SC	none
<i>Erynnis martialis</i>	mottled dusky wing	SC	none
<i>Erynnis persius</i>	Persius dusky wing	SC	none
<i>Hesperia leonardus</i>	Leonard's skipper	SC	none
<i>Hesperia metea</i>	cobweb skipper	SC	none
<i>Atrytonopsis hianna</i>	dusted skipper	SC	none
<i>Cicindela p. patruela</i>	tiger beetle	SC	none
<i>C. patruela huberi</i>	tiger beetle	SC	none
<i>Pedioecetes phasianellus</i>	sharp-tailed grouse	SC	none

END=State Endangered; THR=State Threatened; PTHR=Proposed State Threatened (1995);
SC=State Special Concern; C2=Federal Category 2 (candidate, under review for listing)

Rough-Seeded Fameflower (*Talinum rugospermum* Holzinger)

Taxonomy and Status. Fameflowers are succulents in the family Portulacaceae. Two species of fameflower occur in the Midwest. Prairie fameflower, *Talinum parviflorum*, is the more common species and occurs in similar habitats to that of the rare rough-seeded fameflower, *Talinum rugospermum*. Rough-seeded fameflower was long thought to be a Midwestern endemic but recent finds in Kansas, Nebraska, and Texas place it within the flora of the Great Plains from which it spread probably by long distance post-Pleistocene dispersal to become disjunct in the Midwest (Cochrane, 1993). Refer to Gleason and Cronquist (1991) for a description of the species. Rough-seeded fameflower is of special concern in Wisconsin but occurs often enough in the state to be apparently secure. The U.S. Fish and Wildlife Service is reviewing the species as a candidate for listing.

Range. Rough-seeded fameflower is found in Kansas, Nebraska, and Texas, eastern Minnesota and Iowa to northern and central Illinois, southern Wisconsin, and northwestern Indiana. Throughout most of its range it is considered rare and localized. At some Wisconsin stations, the species is quite common. Rough-seeded fameflower has been collected from 95 stations in 23 counties of Wisconsin, primarily in the southwest but collections have also been made in Pepin, Polk, Pierce, and St. Croix counties. Historical records exist from Burnett and Jackson counties (Barloga, et al., 1989). The site in Polk County is very near a jack pine savanna site of the Karner blue butterfly (NHI, 1994). Rough-seeded fameflower is extant in oak barrens of Columbia, Iowa, and Monroe counties (Barloga, 1989).

Habitat. *Talinum rugospermum* inhabits open, exposed sites where there is minimal competition from other species. It occurs on xeric prairies, sand barrens, sandy and rocky outcrops, gravel river terraces, old fields, trail edges, openings in sandy woods, and margins of sand blows. In Minnesota the species is found in a barrens habitat of black oak or jack pine with shifting sand dunes along the Mississippi River (Coffin and Pfanmuller, 1988). In Indiana, and Illinois as well, the species is found in black oak barrens habitat with sand dunes. In Iowa, colonies have been found on sand dunes of the Upper Iowa River, sandy bluffs, and sand blowouts. The Kansas stations are in sand prairie where the plants grow on the sides and tops of dunes and in sparsely-vegetated flat areas (Cochrane, 1993).

Associated species in sand prairie and barrens in Wisconsin are *Andropogon scoparius*, *Selaginella rupestris*, *Opuntia compressa*, and *Panicum virgatum*. *S. Rupestris* is a good indicator species for fameflower as are *Allium stellatum*, *Isanthus brachiatus*, *Hedyotis longifolia*, and *Ambrosia artemisiifolia* (Judziewicz, 1994). Species that may co-occur as well, on dry prairies of sandstone bedrock or outcrop are *Tephrosia virginiana*, *Hedeoma hispida*, and *Gnaphalium obtusifolium* (Cochrane, 1993). *Asclepias amplexicaulis*, clasping milkweed, and *Hudsonia tomentosa*, beach heath, occur with rough-seeded fameflower in

Minnesota (Coffin and Pfanmuller, 1988). In Kansas, prairie fameflower, *Talinum parviflorum*, co-occurs with the rare species.

Talinum rugospermum can also be found on open outcrops of Precambrian metamorphic and igneous rock in Wisconsin. It has been discovered on both basalt and granite where it lives in thin soil and is accompanied by brittle prickly pear, *Opuntia fragilis*, a state-threatened

species. In the Baraboo hills *T.rugospermum* has been located on a rhyolite outcrop (Cochrane, 1993).

Life History. *Talinum rugospermum* is a rosette-forming perennial with loose cymes of less than a dozen flowers. Each pink flower opens one day only and strictly in the afternoon in July and August. Morning flowers belong to *T. teretifolium* of western Minnesota. Seeds of the species require light to germinate so that a thick layer of litter or shading from a plant such as *Carex pennsylvanica* will discourage germination (Pavlovic, pers.comm.), though seedlings can emerge from a depth of 12mm in sand. The plants grow slowly; a one-year old may have only six small leaves. With age, plants develop multiple stems. Flowers do not appear until the plant is 3-4 years old. Rainfall may be one factor that initiates blooming synchronous with insect activity. Flowers are capable of autogamy late in the blooming period. There is some evidence that *Talinum* spp. can propagate vegetatively from rhizome pieces if sufficient moisture is available (Pavlovic, 1989).

Management Concerns. *Talinum rugospermum* is a specialist with narrow ecological requirements which restrict it to few habitats. It is not an effective colonizer though it is a pioneer of disturbed ground. It does not colonize old fields or roadsides with other prairie species nor is it found in young fields with weedy species (Cochrane, 1993). Rogers found *T.rugospermum* to appear in old fields only after 11 or more years. Not until the field was over 25 years old did the numbers of rough-seeded fameflower equal that found in unplowed prairie (1979).

Talinum rugospermum is dependent on microsite-scale disturbance, such as the natural sand movements of its dune habitat. Plants often colonize anthropogenic disturbance patches. Activities, including vehicular traffic or soil erosion, that create small areas of open habitat benefit the species. This was recently documented in plots disturbed by soil preparation and herbiciding for subsequent planting of lupine when fameflower was found to occur in much higher densities within the plots than without. For some plots with fameflower, no other plants were found outside the plot boundaries (Maxwell and Givnish, 1994).

Some *T.rugospermum* populations have been found in old wheel tracks. Gopher digging can lead to expanded populations (Rogers, 1979). Disturbance of the soil by all-terrain vehicles and tanks has encouraged *T. rugospermum* at Fort McCoy in Wisconsin (Leach, 1993) and resulted in some areas of dense coverage by the species. At Indiana Dunes National Lakeshore, however, continued ATV use has negatively impacted the populations where the plants are too often uprooted (Pavlovic, 1989). Pavlovic has often observed the populations to suffer from heavy trampling (1995). Unfortunately, aggressive or invasive exotic species which compete with *Talinum* are also encouraged by soil disturbance.

The plant is quite shade intolerant and will not survive under canopy conditions although seed germination may occur before leaves unfurl on black oaks (Pavlovic, pers.comm.). The species is a poor competitor against taller herbs and grasses that create shade. Fire, which reduces competition from shrubs and herbaceous species as well as removing litter from the soil surface, appears to benefit the plant populations. At a site in Illinois, the presence of *Talinum rugospermum* increased after wildfire (Cochrane, 1993). Pavlovic has found that the adults are tolerant of fire, though seedlings are more vulnerable (1995). Plants have been observed to be

killed by fire, presumably because the buds of next year's growth are at the soil surface (Pavlovic, 1989).

In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the above was drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of botanists most familiar with the species and others of its kind. In this case, research into the response of the species to soil compaction and timing and intensity of fire, and the proximity to soil disturbance of a seed source for colonization would be most valuable to generate further informed land management decisions concerning *Talinum rugospermum*.

Oval Milkweed (*Asclepias ovalifolia* Dec.)

Taxonomy and Status. Milkweeds, *Asclepias*, are in the family Asclepiadaceae. The genus *Asclepias* is composed of about 95 species, mostly in the New World. Twelve species occur in Wisconsin and inhabit communities from dry prairie to swamp. Two species are listed Threatened in the state, *A. lanuginosa* and *A. sullivantii*. A third species, *A. purpurascens*, is listed as Endangered in Wisconsin. *Asclepias ovalifolia* is proposed Threatened in Wisconsin. It has no federal status and is moderately associated with barrens habitat. Refer to Gleason and Cronquist (1991) for a description of the species. Sterile stems are difficult to distinguish from stems of the common species, *A. syriaca*.

Range. Oval milkweed ranges from southern Saskatchewan, Manitoba, and the Dakotas to eastern Wisconsin and northern Illinois. Wisconsin state herbaria have specimens from approximately 50 locations in the state where *Asclepias ovalifolia* was collected between 1879 and 1984 (Westad, 1993). A search of 22 historical sites that could be relocated in 1993 by Westad confirmed the species flowering at only six sites with about 500 individuals present at all sites. Those sites are in the counties of Barron, Burnett, Monroe, Oconto, Marinette, and Menominee. Oval milkweed has also been reported from Polk, Jackson, Juneau, Adams, Wood, and Vernon Counties (NHI, 1994; Swengel, 1995).

Habitat. Curtis found *A. ovalifolia* modal in southern dry forest (1959) and did not list the species in dry prairie or barrens habitat. Noamesi and Iltis (1957) report the species on prairies, sandy roadsides, and woodlands. Westad found oval milkweed in prairies, but almost as often in sandy, open, pine-oak woods (1993). The species has been found at Fort McCoy in a dry forest of jack pine with oak sapling understory (Leach, 1993). The largest population in Wisconsin is in a treeless railroad right-of-way mesic prairie (Westad, pers.comm.).

All of the sites found in 1993 are on level to gently sloping sand to sandy loam soils over deep sand or sand and gravel. The pH ranges from 4.5 to 6.0. Most of the soils have 0.5 to 2.0% organic matter but the site with the largest number of individuals has 8.9% organic matter (Westad, 1993).

Life History. The yellowish or greenish flowers of *A. ovalifolia* are present from early June to mid-July (Noamesi and Iltis, 1957). Like other milkweeds, it is insect-pollinated, probably by

species of Diptera (Betz, 1996). Pods harbor mature seeds in October. One collection of wet-stratified seeds had a germination rate of 95% (Westad, 1993).

Management Concerns. Oval milkweed needs gaps in the canopy to create the open environment in which it will thrive. All of the extant populations found in 1993 had received some canopy management, including burning and tree cutting. The railroad right-of-way is open and some other sites are on the edge of woods along roads (Westad, 1993). Leach did not find the species at historic sites at Fort McCoy and observed that white pines were invading the barrens creating a shaded environment for groundcover (1993). Westad did not find the species to be associated with mechanical disturbance although at one site it appears in open areas created by the destruction of woody seedlings by vehicular traffic (1993). In Barron County, however, the species was extirpated from a site that was graded during road leveling (Hoffman, pers.comm.). Like many prairie milkweeds, *Asclepias ovalifolia* probably thrives with management to maintain an open habitat, such as grazing or mowing. Any mowing however, such as is often used along roads and rights-of-way, should be postponed until after seed set in October.

Too small an area of habitat in which the remnant populations are found may not have enough food for insect pollinators, according to Hugh Iltis of the University of Wisconsin Herbarium. In such circumstances the plants may only survive as adults spreading slowly clonally in an area where the pollinators are locally extirpated (Iltis, pers.comm.).

In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the above discussion was drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of botanists most familiar with the species and others of its kind. In this case, research to identify pollinators, best timing and extent of fire management, and the effects of soil disturbance would be most valuable to generate further informed land management decisions regarding *Asclepias ovalifolia*.

Sand Violet (*Viola fimbriatula* J.E. Smith)

Taxonomy and Status. The family Violaceae is composed of 21 genera but two-thirds of the species are in the genus *Viola*. There are between 550 and 650 species of *Viola* in the world, with the greatest diversity centered in western North America, Mexico, the Andes, southwestern Europe, and Asia (Ballard, 1994). The species are difficult to separate, particularly because they hybridize freely, the hybrids exhibiting intermediate characteristics of the parents. *V. fimbriatula* is known to hybridize with eleven other species of violets (Alverson and Iltis, 1981). Voss relied heavily on experts in writing the Violaceae chapter of Michigan Flora (1985) and it would be wise for anyone wandering into the family to do the same. Harvey E. Ballard, Jr. at the UW-Madison Botany Department is one of the few with expertise in violets. Voss lumps *V. fimbriatula* with *V. sagittata*, considering the Michigan specimens of *V. fimbriatula* as perhaps an environmental variant (1985). It is also known as *Viola sagittata* A.T. var. *ovata* (Nutt.) T. and G. (McKinney, 1992)

Good *V. fimbriatula* specimens are densely hairy and the leaves are never lobed in contrast to *V. sagittata* which may be deeply lobed (Ballard, pers.comm.). However, a suspected individuals should be confirmed by an expert. *V. sagittata* is quite common and modal in oak barrens, according to Curtis (1959). Wisconsin considers three violets in the state of special concern, but *Viola fimbriatula* is listed as state Endangered. It has no federal status.

Range. *Viola fimbriatula* ranges from Nova Scotia, New England, and Quebec to western Michigan, southern Ontario and south to the mountains of Georgia, Alabama, and eastern Tennessee. Russell (1965) has suggested that the violet moved into the North from the Appalachian mountains. The Wisconsin stations are considered disjunct from the main distribution of the species. The one station in Iowa, four in Illinois (McKinney, 1992), and the Wisconsin collections represent the most western extent of the sand violet, suggesting it may have been introduced to the area relatively recently (Alverson and Iltis, 1981). There are four to six annotated specimens in Wisconsin, the first collected in Jackson County in 1947. Single collections are also known from Burnett and Portage Counties (Alverson and Iltis, 1981). One

station is on the line between Jackson and Clark Counties (BER, 1993). McKinney lists a station in Rock County (1992). Although habitat appears to be abundant for the violet at Fort McCoy in Monroe County, it has not been found there (Leach, 1993).

Habitat. Throughout its range the sand violet is found in dry, open woods and clearings, forest edges, and dry fields. The Wisconsin collections are from dry, sandy jack pine-oak woods characteristic of the central sands region of the state. The plant does not tolerate shade and prefers to grow where there is little leaf litter. In Michigan the sand violet is found in sand prairies and openings in savannas (Ballard, pers.comm.).

Life History. *Viola fimbriatula* is a perennial, arising from prostrate rhizomes. It flowers in the upper Midwest from April through June (Voss, 1985). Most violets are pollinated by butterflies, moths, or bees (Ballard, 1991). Violets have both cleistogamous and chasmogamous flowers, the former being produced later in the season than the petaliferous flowers and continuing through much of the summer. The cleistogamous flowers remain tightly closed and the self-pollination produces seeds more abundantly than do the outcrossed flowers. The three-valved capsules produce seeds in early-to-mid summer. (Ballard, 1992). Violet seeds are known to be dispersed by ants.

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into specific pollinators, and the effects of fire and soil disturbance would be most valuable to generate further informed land management decisions regarding *Viola fimbriatula*.

Little is known about the ecology of the sand violet. However, management activities are warranted which maintain an open environment in woods or savanna supporting the violets and avoid degradation of the habitat supporting pollinators and ants. It is likely that disturbance favors the species (Dobberpuhl, pers.comm.). Periodic burning to reduce litter and cool season grasses would appear to benefit the low-growing violets. Although the species is itself a cool-

season perennial, early spring burns may not directly injure the populations other than to disrupt flowering for the season as has been observed to be the case for the early prairie species, *Anemone patens* (Eldred, pers.comm.). Mowing and haying, where applicable, may result in the same benefits without loss of spring flowers.

Red-Tailed Leafhopper (*Aflexia rubranura* DeLong)

"Red-veined leafhopper"

Taxonomy and Status. The name, red-veined leafhopper, is a misnomer. The animal does not have red veins, *rubra*(red)-*neura*(nerve), but the male has two red spots near the tail as indicated by the scientific name, *rubra*(red)-*nura*(tail). Hereafter the species will be referred to as the red-tailed leafhopper per Hamilton (1993).

Cicadellidae is one of three families of Homoptera to be intimately associated with the plants of prairies. The other two families are represented by less than a dozen prairie species while the Cicadellidae have over 700 species across the North American grasslands (Hamilton, 1992). The red-tailed leafhopper was first ascribed to the *Flexamia* genus, a group of grass-feeding Cicadellidae. These leafhoppers range from southern Canada to the deserts of Mexico. *Aflexia* is a monospecific taxon, represented solely by the red-tailed leafhopper of the upper Midwest which is found only with the perennial grass, prairie dropseed, *Sporobolus heterolepis*. See DeLong (1948) for a description of the species. Leafhoppers however, are notoriously difficult to identify and suspected individuals should be examined by a specialist. *Aflexia rubranura* is under consideration for Endangered status in Wisconsin and a federal Category 2 species, a candidate for listing.

Range. The actual range of *Aflexia rubranura* is unknown. It may be truly rare or lack of collection may exaggerate its rarity. The species was first described in 1935 from wet, blacksoil prairie near Chicago, Illinois where it occurred in large numbers (DeLong, 1935). Since that time, it has been collected from prairie remnants in Manitoba, Wisconsin, Minnesota, and South Dakota. Recent surveys in Minnesota revealed the species in only 8 high quality prairie remnants. In Wisconsin, the species has been discovered recently on sand prairie in Sauk County (Hamilton, 1993), a dolomite ridge in Monroe County (NHI, 1994), and sand prairie in Kenosha County (Panzer, R. pers.comm.). *Aflexia* was recorded from Columbia and Waukesha Counties in the early 1960's (Hamilton, 1993). A survey of over two dozen sites in 1994 produced no further locations for the species (Ballard, H. pers.comm.).

Habitat. Rather than the deep soil prairie habitat where *Aflexia* was first found, the richest sites for leafhoppers around the Great Lakes are sandy areas and alvar grasslands associated with thin soil over limestone outcrop (Hamilton, 1992). The alvar grasslands are wet in spring but become very dry during the summer. On a few islands in Ontario, the red-tailed leafhopper has been found in large numbers where prairie dropseed grows from crevices in alvar plains accompanied by spike rush, *Eleocharis elliptica* (Hamilton, 1993). The presence of *Aflexia* and other prairie endemics on these islands may be evidence that some Ontario prairies are remnants of a periglacial grassland that spread across the continent from the prairies to at least southern Ontario during the ice age. These grasslands were most likely shifting upland openings in spruce forest. The prairie leafhoppers belong to the group of their kind which moved north with the glacial retreat and are currently represented most strongly in the western Canadian grasslands (Hamilton, 1992). In Minnesota, *Aflexia* has been found on dry prairies on moraine or limestone ridges, though a few individuals have been found in large, unburned hay fields (Hamilton, 1993). Ron Panzer (pers.comm.), studying the species in Illinois, has found the leafhoppers at sites with very different characteristics including black soil, gravel, and deep sand soils.

Life History. Leafhoppers are related to cicadas, spittlebugs, and scale insects. Like these other Homoptera, *Aflexia* undergoes gradual metamorphosis in which there is no pupa stage and the nymphs hatch from the eggs resembling the adults. They live in the same habitat as the adults and eat the same foods. As leafhopper nymphs molt and progress toward adulthood they change primarily in size and body proportion until the stage of maturity is reached. Red-tailed leafhoppers are bivoltine in the Midwest (Panzer, pers.comm.). Adults of the first generation are present from mid-June to mid-July and the second generation of adults is present mid-August to mid-September. Females deposit eggs into the grass tissue. Panzer speculates that *Aflexia* eggs and nymphs are probably located higher in the *Sporobolus* plants than are associated leafhoppers whose populations are less reduced by fire (see below). The species spends the winter in the egg stage.

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into A, B, and C would be most valuable to generate further informed land management decisions in regard to the red-tailed leafhopper.

Presence of *Aflexia* in its chosen habitat is dependent on both the characteristics of prairie dropseed and the animal itself. In Wisconsin, Curtis considers *Sporobolus heterolepis* a prairie indicator. It is present in dry to mesic prairies and is also found in cedar glades (1959). In Wisconsin, the plant is present across the southern part of the state and up the western edge as far north as Polk County (Fassett, 1951). On a Wisconsin sand prairie, a study of the effects of cultivation and gopher disturbance revealed that prairie dropseed was found only on unplowed prairie sites including those unplowed sites disturbed by gopher activity. The species was not found in old field sites, even those that had not been disturbed for 25 years or more (Rogers, 1979). Curtis observed the plant populations to decrease in response to grazing pressure as well (1959). Groundcover disturbance will affect the leafhopper populations in so far as the exact *Sporobolus* plants that are inhabited by the leafhoppers are destroyed (Hamilton, pers.comm.).

Most leafhoppers do not disperse rapidly or over great distances. The females of many prairie-adapted leafhoppers are often entirely flightless, reducing dispersal capabilities (Hamilton, 1992). The size of the animal in this case is of interest. At less than 4.0 mm in length, *Aflexia* is close to the size of a mature floret of *S. heterolepis* which has disarticulated from the persistent glumes of the spikelet. *Aflexia* is usually wingless in both sexes though Panzer has found as much as 10% of the females in the spring brood fully winged. These fully-winged forms are probably also flightless. They have been found only in unburned areas and do not appear to invade adjacent burned areas (Panzer, pers.comm). The leafhoppers Hamilton studied were rare on hill prairies, though low hills had some of the largest populations of *Aflexia* that he found (1993). Hamilton found that small sites of less than 0.1 ha had *Aflexia* only if they were alvar sites (1993).

The red-tailed leafhopper is usually accompanied by a more common cicadellid, *Memnonia nr.grandis* (*Parabolocratas grandis* Shaw) that has flightless females and is common on prairies and alvars. This leafhopper is also a specialist on prairie dropseed (Hamilton, 1993). *Memnonia* appears to be more resistant to fire than is *Aflexia* and has been found to be abundant on

repeatedly burned sites where it seems to recover from fire in one generation (Panzer, pers.comm.).

On a sand prairie in Sauk County, Wisconsin, *Aflexia* and other prairie endemics were found only on a steep slope where prescribed fires were probably cooler and not as close to the ground as in other areas of the site. At a Minnesota prairie wildlife area, the leafhoppers were found only in the unburned areas and not in the areas managed with a 1-2 year fire frequency (Hamilton, 1993). In several fire-managed prairies, *Aflexia* was found confined to sandblows or other areas where the fire presumably had jumped and left refugia (Ballard, H. pers.comm.). *Aflexia* may repopulate from refugia though Panzer reports some survivors even in completely-burned patches (Panzer, pers.comm.). Collection at a number of fire managed sites in recent years have led researchers to suggest that frequent fire management can contribute to a depauperate leafhopper community (Hamilton, 1993). Most leafhoppers, including the red-tailed leafhopper, appear to recover completely from burns within 2-3 years according to Panzer. However, Hamilton suggests four years between burns of the same burn unit to protect population losses of Cicadellids (Hamilton, pers.comm.). Some of the most productive sites where Hamilton searched for leafhoppers are managed by mowing (1993).

Phlox Moth (*Schinia indiana* Smith)

Taxonomy and Status. The phlox moth, *Schinia indiana*, is one of the diurnal *Schinia* species in the family Noctuidae (owlet moths) that occur in Wisconsin. The Noctuidae family has many taxa and includes such illustrious members as the cutworm, the looper moth, and the armyworm. Like most members of the subfamily Heliiothidinae in the world, the genus *Schinia* is best represented in arid to semi-arid regions. *Schinia* reaches greatest diversity in North America in the southwestern United States. The phlox moth is not often described though Hardwick (1958) offers a detailed description. Identification is best learned by field study with one who has experience with the species. Once the moth has been seen however, there is little difficulty in identification as the species is quite distinctive. The phlox moth is a federal Category Two species under review for listing and is listed as Endangered in Wisconsin.

Range. Although the phlox moth was previously reported from Indiana, Illinois, North Carolina, Arkansas, Texas, Nebraska, Wisconsin, Minnesota, and Michigan, only the latter three states currently report populations (Balogh, 1987; Wilsman, 1990; Rattray, 1994). In Wisconsin, *Schinia indiana* was first discovered in 1973 in Eau Claire County, 6 miles east of Eau Claire at the Seymour School Forest, and further verified in the same area (Eau Claire Powerline Barrens) in 1986, 1987, 1989, and 1990. In 1991 and 1992, another population was found at Legend Lake in Menominee County where *Phlox pilosa* (downy phlox), larval food plant of the moth, is widespread along roadsides and trails in the barrens.

At Fort McCoy in Monroe County, a *Schinia indiana* pair was released in 1990 along Hwy. 16 when the Eau Claire powerline site population appeared to be in jeopardy from habitat loss. *Schinia indiana* was found at twenty-six sites on Fort McCoy in 1993-1995, some as far as eight miles from the introduction site (Maxwell and Ferge, 1994; Kirk, 1994; Kirk, 1995) nor does a scatter plot of inhabited sites appear to implicate the introduction. All these populations are unlikely to have been derived from the released pair in just 5 generations (Ferge, pers.comm.).

Two additional sites were located in Burnett County and five sites in Jackson County in 1994 (Ferge, pers.comm.; Swengel, 1994).

Habitat. The phlox moth inhabits sandy, scrub oak-pine barrens and prairies and is known primarily from these habitats in the Midwest. The phlox moth co-occurs with Karner blue butterflies (*Lycaeides melissa samuelis*) in Wisconsin and Michigan (Balogh, 1987; Haack, 1993). There are two subspecies of downy phlox in Wisconsin. *Phlox pilosa ssp.fulgida* is widespread in Wisconsin below the Tension Zone. *P.p.ssp.pilosa* is rare in Wisconsin, having been collected in only a few scattered counties (Smith and Levin, 1966). *Phlox pilosa ssp.fulgida* occurs in a wide variety of grassland habitats in Wisconsin from low, damp areas to dry, calcareous "goat prairies"; in open, sandy oak savanna, open oak woods, railroad rights-of-way, and jack pine stands. Common associates include *Andropogon scoparius*, *Heuchera richardsonii*, *Dodecatheon meadia*, *Fragaria virginiana*, *Lithospermum canescens*, *Rudbeckia hirta*, *Silphium laciniatum*, *Krigia biflora*, and *Comandra richardsiana* (Swink and Wilhelm, 1979). Although *Phlox pilosa* does not appear to be dependent on soil disturbance, it may occur at great densities along roads and trails where it often spreads in response to disturbance and the moth has been found in these sites as well. In open areas of the jack pine-oak barrens community and in damp places below railroad embankments, the plant may be found locally abundant. It also occurs scattered widely but thinly under relatively closed-canopy situations in oak woods in low areas adjacent to roadways or openings. The plant flowers from mid-May to early July in Wisconsin and fruiting occurs from late June to late July.

Life History. In late May adult phlox moths emerge when the downy phlox begins to flower and the moths will often fly up to the third week of June. *S.indiana* is one of a number of *Schinia* species including the leadplant flower moth, *S.lucens*, also in our area, that exhibit a remarkable resemblance in coloration to the flowers of their larval food plants. Hardwick (1958) reports that those diurnal noctuid moths that show the highest degree of protective coloration have the most sedentary habits. However, the fact that *S.indiana* is rarely observed flying is probably more a result of the rapid flight of its kind than is its sedentary nature. The species is best observed on cloudy or drizzly days when resting on or in the blossoms of *Phlox pilosa*. The dusted skipper (*Atrytonopsis hianna*) has been observed nectaring on the same blossoms with *Schinia indiana* (Balogh, 1987).

The species is univoltine. Eggs are laid on the inner surface of the flower sepals next to the corolla tube or sometimes between buds. Like others of its relatives, *Schinia* larvae feed on the flowers and fruit of the host plant. The larvae will feed temporarily on the bud if the flower is still closed but soon heads for the developing seeds. The larva tunnels into the seed capsule and seals itself inside to develop further. Mature larvae will cut the stem below the seed capsule and have been observed on the stem below the cut (Hardwick, 1958). Pupation occurs within 27-35 days of oviposition, apparently in the soil (Schweitzer, 1994; Maxwell and Ferge, 1994).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into dispersal ability, depth of hibernation, and response of the species to fire

management during the larval period would be most valuable to generate further data to inform land management decisions in regard to the phlox moth.

Fire has historically played a part in the maintenance of the prairie and barrens communities in which the phlox moth is found. Downy phlox is known to inhabit recently burned jack pine stands (Smith and Levin, 1966). The moth is much less common than is the food plant, though it has been found in both prairies and barrens. *S.indiana* is thought to be underground during the period August through April when prescribed burns are often used to maintain open habitat. Fire in late spring however, can injure or destroy the plants present as well as killing eggs and larvae. If fire management is used in areas supporting the phlox moth, burns on no less than a 4-5 year rotation with no more than 20-25 percent of the area burned in one year are considered by some lepidopterists to be the minimum strategy which may offer the least threat for rare lepidoptera (Swengel,1991; Maxwell and Ferge,1994).

Several of the phlox moth locations in Wisconsin are rights-of-way where roadside mowing may be safely undertaken in August when presumably the species is underground (Maxwell and Ferge, 1994). Depth of hibernation is unknown for this species, so effects of soil disturbance or fire management during the period August through April cannot be ascertained at this time. Schweitzer considers the underground pupae in the East invulnerable to fire (1994). Prior to August, the species may be susceptible to insecticides sprayed during the larval period (Haack, 1993).

A highly-fragmented landscape often leads to local population extinctions when animals are unable to disperse between small habitat patches. Tree planting removes open areas and creates barriers in the barrens community. Tree planting has been implicated as a factor in habitat loss for the phlox moth (Schweitzer, 1989). Management to maintain openings and edges is most conducive to downy phlox though it is uncertain as to how this management will impact the moth.

Frosted Elfin (*Incisalia irus* (Godart))

Taxonomy and Status. The large butterfly family, Lycaenidae, is composed of numerous tribes. The elfins and hairstreaks form a tribe that is most diverse in the American tropics with about 75 species in North America. The frosted elfin, *Incisalia irus*, is one of five species of *Incisalia* that occur in Wisconsin. A sixth species, the western pine elfin, may have recently entered the state on trees brought from the west. It is possible that *Incisalia irus* is actually two species based on morphological differences and larval food plants (*Lupinus perennis* or *Baptisia* sp.) (Schweitzer, 1994b). The frosted elfin may be difficult to distinguish from other *Incisalia* spp., particularly *Incisalia henrici*, but it associates strongly with wild lupine, the same food plant as that of the Karner blue butterfly. Refer to Opler and Krizek (1984) for a description of the species or Bureau of Endangered Resources for materials and photos to separate similar elfins. The frosted elfin currently has no federal status but is listed as Threatened in Michigan where the lupine-feeding form is most abundant. The species is listed as Threatened in Wisconsin as well.

Range. The frosted elfin ranges from southern Maine across the north to below Lake Michigan and into Wisconsin's central barrens, south along the Atlantic coast and Appalachians to

Alabama and Georgia with isolated populations of *I.i.ssp.hadros* in Louisiana, Arkansas, and Texas.

Ebner was not aware of the frosted elfin in Wisconsin when he wrote "Butterflies of Wisconsin" in 1970, as the species was not collected here until 1977. Kuehn (1983) reported the frosted elfin in Adams and Juneau counties and, in recent years, more sites have been discovered in Jackson and Wood counties as well (Swengel, 1994). In spite of repeated attempts to locate the species in the barrens habitat of Burnett County (Swengel, 1994) the butterfly has eluded investigators.

Habitat. The frosted elfin always occurs in localized colonies across its range (Opler and Krizek, 1984) in habitat of woodland edges, old fields, pine-oak scrub or barrens where the larval host plants grow. It is most often found however, in sand, shale, or serpentine barrens. The species is confined to barrens in Pennsylvania (Opler, 1985) and is an associate of Karner blue butterflies in the grassy openings of pine barrens habitat in New York, Massachusetts, and New Hampshire where the vegetation is much the same as in midwestern openings (Schweitzer, 1994).

In Wisconsin the butterfly inhabits the sandy, open woods habitat of jack pine barrens in the above-mentioned counties, a subset of Karner blue range in the state. Swengel has found the species in patches of high-density lupine in woods openings or within 5-10 feet of canopy cover in a more open landscape (1994). Of the three known lupine-feeding butterflies in Wisconsin, *Lycaeides melissa samuelis*, *Incisalia irus*, and *Erynnis persius* (Persius dusky wing), the frosted elfin is the most localized and uncommon.

Life History. The larvae of *Incisalia irus* feed only on the flowers and developing pods of wild lupine in Wisconsin but also use yellow wild indigo, *Baptisia tinctoria*, in the eastern part of the range. *B.tinctoria* occurs across southern Michigan in sandy openings (Voss, 1985) and has appeared in Wisconsin but is not native to the state. Blue false indigo (*Baptisia australis*) and rattlebox (*Crotalaria sagittalis*) are also used at times (Opler and Krizek, 1984). It is unknown whether the butterfly might make use of other species of wild indigo that occur in Wisconsin.

The frosted elfin is single-brooded. The flight period in Wisconsin is from early May to early June with the prime flight period between May 15 and May 25 just before peak bloom period of lupine (Swengel, 1994). The flight period may be quite short in the northwestern counties. In the eastern states the flight period stretches from the end of April through June (Opler, 1985) probably because of the use of yellow wild indigo for larval food. The males of the hairstreak tribe perch in the afternoon to await females (Opler and Krizek, 1984). The females oviposit eggs singly on flower buds, usually the calyxes. The larvae hatch in 3-5 days and tunnel into the flowers (Cook, 1906). Pupation occurs in a loose cocoon in litter at the base of the host plant (Cook, 1906; Opler and Krizek, 1984). The species winters over in the pupal stage in litter at the base of the host plant (Opler, 1985; Scott, 1986) or underground (Schweitzer, 1985). Location of pupation in Wisconsin has not been determined.

Management Concerns. In an effort to provide land managers with available information on the possible response of the species to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind.

Like the Karner blue butterfly, this species is believed to have always existed in metapopulations characterized by local extinctions and colonizations within a dynamic landscape (Givnish, et al., 1988). The frosted elfin requires open areas and is averse to flight through woods according to the experience of early observers. The ovipositing female never leaves the open, "refusing to fly through dark spots and turning aside to circle a tree rather than come under its shadow" (Cook, 1906). Little is known about the dispersal abilities of the butterfly, but open corridors would be required for recolonization to proceed. The current thought is that management for Karner blues would be equally appropriate for frosted elfins (Schweitzer, 1990; Packer, 1987). Note however, that in Wisconsin the frosted elfin is more restricted than Karners by habitat requirements, abundance, and management tolerances.

Schweitzer has attributed regional declines in the species to fire suppression (1985). Schweitzer believes it unlikely that frosted elfin populations decrease with fire. In fact he knows of sites frequently burned that support the species. Where the species is known to pupate underground, as in New York and New Hampshire, the frosted elfin survives fires between early July and mid-May (Schweitzer, 1985). The butterflies have been observed on new lupine growth within two weeks of a burn (Schweitzer, 1994).

Observations in Wisconsin however raise doubts about fire management of frosted elfin sites. Swengel has found no frosted elfins in 65 fire-managed areas even though those areas had abundant lupine. Fires in May may be particularly detrimental by altering lupine phenology and flower abundance as well as direct egg mortality (Swengel, 1994). Significantly more butterflies have been found however, in areas burned by wildfire over five years previously (Swengel, 1994). Wildfire areas are surrounded by habitat that has been left unburned for much longer than are fire-managed areas where the entire habitat is burned by units on a rotational basis.

Areas managed with late-season mowing and with only part of the habitat cut each year appear to benefit the species according to Swengel's observations at several rights-of-way sites in Wisconsin (1994). Frosted elfins have been observed in these areas as well as at sites with unintensified timber management with about the same frequency as observations in wildfire areas (Swengel, 1994). In Ohio, a bulldozed firebreak in an oak barrens was found later to support lupine populations. The plants were colonized by frosted elfins the following year (Chapman, et al., 1993).

Henry's Elfin (*Incisalia henrici* (Grote and Robinson))

Taxonomy and Status. The large butterfly family, Lycaenidae, is composed of numerous tribes. The elfins and hairstreaks form a tribe that is most diverse in the American tropics with about 75 species in North America. The Henry's elfin, *Incisalia henrici*, is one of five species of *Incisalia* that occur in Wisconsin. A sixth species, the western pine elfin, may have recently entered the state on trees brought from the west. Swengel reports the butterfly difficult to view because it is easily flushed and flies rapidly (1994). Refer to Opler and Krizek (1984) for a description of the species or contact the Bureau of Endangered Resources for materials and photos to separate similar elfins. Henry's elfin has no federal status but is of special concern in Wisconsin due to extreme rarity making it especially vulnerable to extirpation from the state.

Range. Henry's elfin is considered rare throughout its range which extends along the Atlantic Coast from Nova Scotia to central Florida and westward to Texas, Kansas, and Nebraska. *I.h.ssp.henrici* covers most of the range with *I.h.ssp.margaretae* in southern Georgia and Florida and *I.h.ssp.solatus* in central Texas and New Mexico (Scott, 1986). Henry's elfin also inhabits the Great Lakes states, Quebec and Ontario and across Canada to southeastern Manitoba.

Incisalia henrici is decidedly less abundant in Wisconsin than either the frosted elfin or the Karner blue butterfly. In 7 years Swengel has found only 4 individuals (Swengel, 1994). Henry's elfin was collected in the 1950's from Marinette Co. (Ebner, 1970). In the northeastern portion of Wisconsin collections have also been made in Langlade, Oneida (Kuehn, 1983), Shawano, Waushara (Ferge, 1988), and Outagamie counties (Ferge, 1991). Within Karner Blue butterfly range, Henry's elfins have been reported from Douglas, Chippewa, St.Croix, Juneau (Kuehn, 1983), Jackson (Swengel, 1994), and Burnett counties (Ebner, 1970; Ferge, 1989; Swengel, 1994). The latter two counties are the only areas where the species has been found in Karner blue habitat in recent years.

Habitat. Henry's elfin is highly associated with barrens habitat with acidic, sandy, or rocky soils (Opler and Krizek, 1984) and inhabits openings of jack pine-oak woods in Burnett County, especially in areas with heaths (*Vaccinium* spp.) (Swengel, 1994). Henry's elfin is found in Wisconsin with the frosted elfin (*I.irus*) and on Karner blue butterfly sites. Although the food plant of the larvae has not been positively determined for Wisconsin Henry's elfins, researchers agree that heaths, especially blueberry, are the prime candidates (Ebner, 1970; Ferge, 1989; Swengel, 1994). Blueberry and huckleberry (*Vaccinium* sp.) seem to be larval hosts in diverse areas across the range (Opler and Krizek, 1984). Wild plum (*Prunus americana*) (Ebner, 1970) and maple-leaf viburnum (*Viburnum acerifolium*) (Ferge, 1989), have also been mentioned. Redbud (*Cercis canadensis*) appears to be the primary host farther south (Opler and Krizek, 1984). Ferge found violets (*Viola* spp.), puccoon (*Lithospermum* spp.), and rock cress (*Arabis lyrata*) available at Namekagon Barrens for nectar sources (1989). Wild plum, willow, and hawthorn (*Crataegus* spp.) flowers are used in other states (Opler and Krizek, 1984).

Life History. Adults emerge and fly from mid-to-late May. There is one brood. Oviposition varies depending on the host but eggs are laid most often on flowers and buds. The larvae feed on buds and young leaves of the host plant. Henry's elfin overwinters in the pupal stage most likely in the litter at the base of the host plant (Opler and Krizek, 1984).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind.

In Burnett County, Ferge has found the species at Namekagon Barrens in openings of jack pine-oak scrub or along the fire lanes at the edge of areas managed with prescribed burns where nectar sources were most abundant (Ferge, 1989). Because of the rarity of this species, little information is available on land management effects on Henry's elfin populations. The dependence of the species on small trees or shrubs signals concern over zealous clearing of woody species by the use of fire, brushing, or thinning in occupied habitat. Early spring fast-moving fires may have little direct effect on the animals by skipping over the pupae in the litter but the subject has not been adequately studied and the rarity of the species leaves little room for in situ experimentation.

Gorgone Checkerspot (*Chlosyne gorgone* Hubner)

Taxonomy and Status. The Nymphalidae are the brush-footed butterflies, so called because of the reduced forelegs used for chemoreception rather than locomotion. The Nymphalidae is a large, diverse family of about 4,500 species divided into nine subfamilies. The subfamily Nymphalinae which includes the fritillaries and anglewings, are the spiny brush-footed butterflies whose mature larvae are covered with stiff branching spines. Of these, the tribe of checkerspots and crescents occurs throughout the Northern Hemisphere. There are seven representatives in Wisconsin: four checkerspots and three crescents. Only the two pearl crescents are common; the tawny crescent (*Phyciodes batesii*) and the gorgone checkerspot (*Chlosyne gorgone*) are of special concern in Wisconsin by virtue of rarity. The gorgone checkerspot appears to be secure across its range and has no federal status. It is considered to be highly associated with barrens. See Opler and Krizek (1984) for a description of the species.

Range. The gorgone checkerspot occurs from Michigan, Minnesota, and the Canadian Prairie provinces southward through the Mississippi River valley, the Great Plains, and the east coast of the Rockies to northern Mexico. Isolated populations occur in the Appalachians and a subspecies, *C.g. ismeria*, occurs in Georgia, Alabama, and South Carolina.

Ebner reported collections from Douglas, Burnett, and Dunn Counties in the western part of Wisconsin as well as from Shawano, Brown, and even Racine Counties (1970). Kuehn reported the species statewide except in the northcentral area (1983). The Natural Heritage Inventory reports the species in Burnett, Crawford, Dodge, Grant, Iowa, Jackson, Monroe, Sauk, Marquette, Outagamie, and Winnebago Counties (NHI, 1994). In recent years large numbers have been found in Jackson County (Swengel, 1994).

Habitat. *Chlosyne gorgone* inhabits ponderosa pine forests in the Rockies and hardwood forests in the Southeast but is primarily a grassland species across most of its range where it can be found on prairie slopes and ridges as well as grassy areas near streams (Opler and Krizek, 1984). It is not primarily a barrens or savanna species outside Wisconsin and is absent from these habitats east of western Michigan (Schweitzer, 1994). In Wisconsin, the species inhabits both

barrens and dry to dry-mesic prairies (Kuehn, 1983; Swengel, 1994). Barrens habitat in Burnett, Monroe, and Jackson Counties support gorgone checkerspots. Swengel has found the species in sites with up to 50% woody cover (Swengel, 1994b). In analysis of abundance of butterflies in barrens, Swengel found no correlation between Karner abundance and gorgone checkerspot abundance at the same site. This suggests that the conditions favoring the larval food plants of each are not complementary (Swengel, 1994).

Life History. Although the species is univoltine in the northern part of its range and may regularly produce several generations to the south and west (Scott, 1986), at the latitude of Wisconsin it usually produces two generations with adult flight periods in May to early June and again in July. There is some evidence for a third brood in Wisconsin (Swengel, 1994). Adults usually rest with wings spread and males patrol near host plants to find females (Scott, 1986). Males perch on hilltops in the western part of range to await females. This behavior is less often observed in the Midwest.

Larval host plants are in the family Asteraceae and the primary genus used is *Helianthus* which, along with *Aster* spp., are most often reported as host plants in Wisconsin (Ebner, 1970; Kuehn, 1983). Swengel has observed western sunflower (*Helianthus occidentalis*) to be common to the gorgone checkerspot sites she has visited (Swengel, 1994). Larvae have been observed on *Ratibida pinnata* in Winnebago County (Ferge, 1991). The eggs are laid in clusters under the leaves of the host and the larvae feed communally on the leaves. The butterflies hibernate as third-stage larvae (Scott, 1986).

Across the range, adult gorgones nectar primarily on yellow flowers (Scott, 1986; Swengel, 1995). The Swengels have observed spring adults taking nectar from orange hawkweed (*Hieracium aurantiacum*), pucoon (*Lithospermum* spp.), and lyre-leaved rock cress (*Arabis lyrata*) with fewer observations on cinquefoil (*Potentilla* spp.) and groundsel (*Senecio* spp.). Summer individuals have been seen nectaring at silky aster, black-eyed susan (*Rudbeckia hirta*), orange hawkweed, and western sunflower (Kons, 1990; Swengel, 1994). In Illinois, researchers report sunflowers, asters, and milkweeds as nectar sources (Hess and Sedman, 1994).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into larval location, dispersal ability, and response to fire management and timber harvest would be most valuable to generate further informed land management decisions in regard to gorgone checkerspots.

Location of the hibernating larvae is unknown. Thus, the larvae may be vulnerable to early spring burns or winter timber harvest. Fire after mid-May threatens eggs and larvae on the leaves of host plants. If hibernating larvae are in the leaf litter or soil, fall mowing would avoid killing the insects. Any management with concern for this species must be careful to maintain Asteraceae for food plants of both larvae and adults.

Tawny Crescent (*Phyciodes batesii* Reakirt)

Taxonomy and Status. The Nymphalidae are the brush-footed butterflies, so called because of the reduced forelegs used for chemoreception rather than locomotion. The Nymphalidae is a large, diverse family of about 4,500 species divided into nine subfamilies. The subfamily Nymphalinae which includes the fritillaries and anglewings, are the spiny brush-footed butterflies whose mature larvae are covered with stiff branching spines. Of these, the tribe of checkerspots and crescents occurs throughout the Northern Hemisphere. There are seven representatives in Wisconsin: four checkerspots and three crescents. Only the two pearl crescents are common; the tawny crescent (*Phyciodes batesii*) and the gorgone checkerspot (*Chlosyne gorgone*) are of special concern in Wisconsin by virtue of rarity. The tawny crescent has disappeared from much of the Eastern range and is under review for listing by the U.S. Fish and Wildlife Service. It is considered to be moderately associated with barrens. Tawny crescents may be seen flying with the pearl crescent (*Phyciodes tharos*) and the northern pearl crescent (*Phyciodes pascoensis*) with which it can be confused (Maxwell and Ferge, 1994). See Scott (1986) for a description of the three species.

Range. The tawny crescent ranges from Maine, New York, and Pennsylvania to southern Quebec and Ontario to the northern Great Lakes states, Manitoba, Nebraska and Colorado. Scattered populations are reported from the Appalachian states (Opler and Krizek, 1984).

A few reports of the species exist from far northern Bayfield County, Marathon County, and the northeastern counties of Florence, Forest, and Marinette (NHI, 1994). Kuehn reported the species "as far south as Adams and Juneau Counties" (1983). Most recently the butterfly has been reported from Oneida, Oconto (Ferge, 1990; Ferge, 1991), Outagamie (Kons, 1989), and Monroe Counties (Maxwell and Ferge, 1994). In Karner blue range, the tawny crescent has been reported from wetland areas of Namekagon Barrens and Crex Meadows in Burnett County (Ferge, 1990; NHI, 1994).

Habitat. Habitat of the tawny crescent is primarily moist situations in the Midwest (Opler and Krizek, 1984; Ferge, 1990b; Swengel, 1991), though the species inhabits dry, rocky bluffs above rivers or rocky upland pastures with much big bluestem grass in the Appalachians (Opler and Krizek, 1984) and the Northeast (Scott, 1986). At Fort McCoy the species was found in wet areas: sedge meadow, wet trail near a creek, wet-mesic forest, moist opening in oak savanna (Maxwell and Ferge, 1994). In Oconto County the species occurs with the northern blue butterfly in jack pine barrens.

Life History. Unlike the multi-voltine pearl crescent (*Phyciodes tharos*) with which it may be confused, the tawny crescent has only one generation per year. The adults fly from mid-June to mid-July in Wisconsin. The species has been collected July 17 in Outagamie County (Kons, 1989). The larval food plant used by the tawny crescent in Wisconsin is unknown. *Aster undulatus* is the only species of aster mentioned by researchers to support the larvae in the wild. *A.undulatus*, a species of dry habitat, does not occur in Wisconsin (Shinners, 1941; Gleason and Cronquist, 1991; U.W.Herbarium, pers.comm.). Eggs are laid in batches on the underside of aster leaves, hatch in about a week, and the larvae live communally in webs on the underside of the plants, feeding on the leaves of the host plants. The third instar larva enters diapause and completes development in early spring (Opler and Krizek, 1984). Opler states that the larvae overwinter at the base of the host plant (1985).

Management Concerns. Until the larval food plant of the tawny crescent is known, all asters in *P. batesii* sites must be considered necessary to the survival of the butterflies. Specifically, the following species occur in barrens habitats: *Aster umbellatus*, *A. junciformis*, *A. simplex*, *A. puniceus*. The tawny crescent is a univoltine species and may therefore be vulnerable to fire during any period of the year. However, because the species is found in Wisconsin on asters in moist areas, the butterflies may be protected from fire on the landscape. Within the barrens mosaic, populations of the butterfly are vulnerable to isolation.

Mottled Dusky Wing (*Erynnis martialis* Scudder)

Taxonomy and Status. Only two of the four subfamilies of skippers (Hesperiidae) in North America occur in the Midwest, the branded skippers (Hesperiinae) that perch primarily with fore and hind wings at an angle and the open-winged skippers (Pyraginae) that land with wings open. *Erynnis* belongs to the latter group and is the genus of black dusky wing skippers. Ferge (1990) lists eight *Erynnis* species in Wisconsin. Refer to Scott (1986) for a description of the species. The mottled dusky wing has no federal status but is of special concern in Wisconsin because it is especially vulnerable to extirpation from the state. The species is highly associated with barrens.

Range. The mottled dusky wing ranges from Massachusetts and New York westward through the Great Lakes area to western Iowa and southward to Georgia and central Texas. Isolated populations occur in the Black Hills and central Colorado. In Wisconsin, the skipper is considered locally uncommon in the southwest (Swengel, 1991) and "common at times" northward along the western counties (Kuehn, 1983). Early collectors found this skipper common in the area of Racine and Milwaukee and reported the species from Dane and Sauk Counties as well (Ebner, 1970). Kuehn reports the skipper from Burnett, Eau Claire, Douglas, Juneau, and Waukesha Counties (1983). The species was reported in Brown County in the early 1980's but in recent years the mottled dusky wing has been reported only from sand prairies and barrens in Burnett and Jackson Counties (NHI, 1994).

Habitat. The mottled dusky wing is most often found in hilly habitat such as those sites where it occurs in the Loess Hills of Iowa. In the eastern United States it is found in shale or serpentine barrens with acidic soils, often near woods or shrubby areas (Opler and Krizek, 1984). The butterfly is an associate of Karner Blue butterflies in the grassy openings of pine barrens in New York, Massachusetts, and New Hampshire where the vegetation is much the same as in Midwestern openings (Schweitzer, 1994). Mottled dusky wings inhabit both prairies and barrens in Wisconsin and Swengel has found the species in Wisconsin sites with up to 55% woody cover (1994).

Life History. There are two generations per year of mottled dusky wings with adults flying in the last week of May to the first week of June and mid-July to early August in Wisconsin (Swengel, 1994). In the western states, males perch on hilltops awaiting females though this behavior is less common in Wisconsin. Nectaring has been observed on hoary vervain (*Verbena stricta*), gromwell (*Lithospermum* spp.), and bush houstonia (*Houstonia* spp.) (Opler and Krizek, 1984). Eggs are laid singly on the flower pedicels of the host plant. Like most *Erynnis* spp., the larvae live in leaf nests and feed on the leaves of woody plants. In this case, the caterpillars feed strictly on New Jersey Tea (*Ceanothus* sp.) (Opler and Krizek, 1984). *Ceanothus americanus*,

considered the most often used larval food plant in the East, inhabits mesic habitat such as oak openings and mesic prairie in Wisconsin as well as the xeric sites. *Ceanothus ovatus* (*C. herbaceous*) inhabits the pine barrens and is the likely host of *Erynnis martialis* in Karner blue butterfly range (Curtis, 1959). Full grown larvae hibernate in a leaf shelter and pupate in a cocoon the following spring (Opler and Krizek, 1984).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into locations of larvae and cocoons would be most valuable to generate further informed land management decisions in regard to mottled dusky wings.

Schweitzer (1994) has commented that the frequent fires at Crex Meadows in Burnett County may be working reasonably well for this species, but numbers would probably increase with less fire. As mentioned above, larvae and pupae are above the ground. Thus, the species is particularly vulnerable to spring burns until the adults emerge in late May. In the fall, larvae are present in the vegetation as well. At Namekagon Barrens in Burnett County, Ferge (1989) found the species in firebreaks where nectar sources were most abundant rather than in the burn units. The host plant, also known as redroot because of the large gnarly root, is able to withstand fire. Curtis names both *Ceanothus ovatus* and wild lupine as heavy-seeded species that appeared after a fire at Crex Meadows in 1956 (Curtis, 1959). In New York, the mottled dusky wing was very scarce at a large site maintained by August mowing which would presumably eliminate the second brood larvae. Schweitzer suggests mowing sections of habitat during the dormant season if *Ceanothus* is present (1994).

Persius Dusky Wing (*Erynnis persius* Scudder)

Taxonomy and Status. Only two of the four subfamilies of skippers (Hesperiidae) in North America occur in the Midwest, the branded skippers (Hesperiinae) that perch primarily with fore and hind wings at an angle and the open-winged skippers (Pyraginae) that land with wings open. *Erynnis* belongs to the latter group and is the genus of black dusky wing skippers. Ferge (1990) lists eight *Erynnis* species in Wisconsin. The Persius dusky wing is very often confused with the wild indigo dusky wing (*E. baptisiae*) and the columbine dusky wing (*E. lucilius*). These three species are often referred to as the "Erynnis persius complex". Refer to Opler and Krizek (1984) for a description of the species, however these species cannot be reliably separated in the field and usually requires a specimen under magnification (Schweitzer, 1994). A suspected *E. persius* after early June is definitely NOT a Persius dusky wing. A good photo can rule out the species but not confirm it. To complicate matters further, *E. baptisiae* does not confine itself to *Baptisia* species but uses lupine for the larval food plants as well (Schweitzer, 1994).

Other subspecies of *E. persius* occur in the western United States. *Erynnis persius persius*, the subspecies in Wisconsin, has no federal status although some believe it should be a candidate for listing (Schweitzer, 1994). It is of special concern in Wisconsin because it is very vulnerable to extirpation from the state. The species is highly associated with the barrens community.

Range. The historical range of the Persius dusky wing extends through New York, Massachusetts, Pennsylvania, Michigan, Wisconsin, and Minnesota. Records exist from a few other eastern states as well as Quebec and Ontario (Schweitzer, 1986). The species occurs in the central sands region and northwestern barrens areas of Wisconsin (Ferge, 1990). In the last six years the species has been reported from Adams (Ferge, 1989), Juneau, Jackson, Monroe, Clark, and Burnett Counties. A site in Menomonie County was discovered in 1992 (NHI, 1994).

Habitat. In the eastern United States, the Persius dusky wing is said to inhabit wet areas with willows or aspens, open fields, or open areas in forest (Opler and Krizek, 1984). The species is a lupine-feeder and an associate of Karner blue butterflies in the grassy openings of pine barrens in New York, Massachusetts, and New Hampshire where the vegetation is much the same as in midwestern openings (Schweitzer, 1994). In Wisconsin, the skipper inhabits jack pine-oak barrens (Swengel, 1994). Swengel has found species of the Persius dusky wing complex in sites with up to 50% woody cover in Wisconsin (1994). At Fort McCoy in Monroe County, Wisconsin the species is found on sites supporting Karner blue butterflies in both open and shady oak woodland with the groundlayer rich in grass and herbs. The Persius dusky wing has been found at Fort McCoy with the dusted skipper (*Atrytonopsis hianna*), the pine elfin (*Incisalia nippon*), the roadside skipper (*Amblyscirtes vialis*), and several other dusky wings (*Erynnis icelus*, *juvenalis*, *brizo*) (Maxwell and Ferge, 1994).

Life History. The Persius dusky wing flies from mid-May to mid-June in Wisconsin (Ferge, 1990), about one to two weeks earlier than the first Karner blue butterfly flight. Males perch all day on ridges or hilltops awaiting females. Eggs are laid singly on the underside of host leaves. Larvae eat the leaves and live in rolled-leaf nests. Two known larval food plants are *lupinus perennis* and yellow wild indigo (*baptisia tinctoria*) though willows and poplars are reported as the primary hosts in the eastern states (Opler and Krizek, 1984). Yellow wild indigo is primarily a species that occurs east of Wisconsin and has been found in the state only occasionally. Full grown Persius dusky wing larvae hibernate in leaf shelters and pupate in the spring (Opler and Krizek, 1984).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into dispersal ability, response to mowing and timber harvest, and the intersection between sets of Persius dusky wing-inhabited patches of lupine and Karner blue-inhabited patches of lupine would be most valuable to generate further informed land management decisions in regard to Persius dusky wings.

Schweitzer attributes regional declines in the species primarily to fire suppression (1985) which contributes to habitat loss. Schweitzer has stated that management for this species would be essentially the same as for Karner blue butterflies (1990) and recommends no less than five years between fires (1994). The skipper has been found at Fort McCoy in recently burned areas (Maxwell and Ferge, 1994), although this should not be interpreted to mean that these areas support viable populations. The Persius dusky wing spends no part of the year underground, is univoltine, and has poor dispersal ability (Swengel, 1993). These characteristics make the species particularly vulnerable to fire, certainly more so than Karner blues. There is no question

that it is more rare than Karner blues in Wisconsin and the few small populations in specialized habitats make the species especially slow to recover from fire (Swengel, 1995). Plans for corridors and attention to both larval food and nectar plants in burn units can help provide for recolonization following local extirpations. Like the Karner blue, this species is believed to have always existed in metapopulations characterized by local extinctions and colonizations within a dynamic landscape (Givnish, et al., 1988).

Soil disturbance can be beneficial to the species. In Ohio, a bulldozed firebreak in oak barrens produced lupine populations that were colonized the following years by *Persius dusky wings* (Chapman, et al., 1993). Mowing considerations for roadside maintenance indicate that fall mowing may help to maintain the habitat but food plants should not be cut prior to mid-July (Schweitzer, 1986).

Leonard's Skipper (*Hesperia leonardus* Harris)

Taxonomy and Status. Only two of the four subfamilies of skippers (Hesperiidae) in North America occur in the Midwest, the branded skippers that perch primarily with fore and hind wings at an angle and the open-winged skippers that land with wings open. The Leonard's skipper, *Hesperia leonardus*, is a member of the group of branded skippers (Hesperiinae), a group so named for the special scent scales on the forewing of the male. Refer to Opler and Krizek for a description of the species (1984) or the Bureau of Endangered Resources for materials and photos to distinguish the species from others of its kind. The Leonard's skipper has no federal status but is of special concern in Wisconsin and is highly associated with the barrens habitat.

Range. The Leonard's skipper is one of many *Hesperia* species in the eastern United States. However, it is the only butterfly in most of that area that flies only in the fall (Opler and Krizek, 1984). *Hesperia leonardus ssp. leonardus* occurs from New England westward to Ontario and Minnesota and southward into North Carolina, Louisiana, and Missouri. The Pawnee skipper, *H.l.ssp.pawnee*, covers the Plains area and intergrades with *H.l.ssp.leonardus* in Minnesota and Wisconsin and the Loess Hills of western Iowa (Scott and Sanford, 1981; Spomer, et al., 1993). See Scott and Sanford (1981) for a discussion of the distinguishing characteristics of the subspecies. A third subspecies is found only along the Platte River in Colorado (Scott, 1986).

Of the three bluestem-feeding skippers in Wisconsin barrens, (*Hesperia leonardus*, *H.metea*, *Atrytonopsis hianna*) the Leonard's skipper is the most widespread and abundant skipper. It has been reported from Sauk and Juneau Counties, Green County, Grant, Jackson, Burnett, and Bayfield Counties in the western part of the state as well as Menomonee County (Ferge, 1988; 1989; 1990) and Marinette County (Ebner, 1970). Ebner reported possible collections in the Milwaukee area over 70 years ago (1970).

Habitat. Leonard's skipper inhabits open grassy areas or meadows, grassy slopes, pine-oak barrens (Opler and Krizek, 1984), and prairies (Hess and Sedman, 1994), especially ridgetop prairies (Spomer, et al., 1993). In Wisconsin it may be found in both prairies and barrens and in woodland clearings with up to 55% woody cover (Swengel, 1994). *H.l.leonardus* appears to

inhabit moist meadows more often than *H.l.pawnee* which is more closely associated with dry prairie (Scott and Stanford, 1981). The species appears to be associated with small stands of bluestem grass that harbor the dusted skipper (*Atrytonopsis hianna*) (Opler and Krizek, 1984) and the cobweb skipper (*Hesperia metea*) (Swengel, 1994). It is often found in at roadside puddles and concentrations of *Liatris aspera* (Maxwell and Ferge, 1994).

Life History. There is one generation per year of Leonard's skippers. The adults fly from mid-August to mid-September or even into October in Wisconsin (Swengel, 1994) Males perch all day near *Liatris* species awaiting females (Opler and Krizek, 1984). The butterflies choose purple flowers most often for nectar (Opler and Krizek, 1984) and depend most strongly on *Liatris* species (Spomer, et al., 1993; Hess and Sedman, 1994). In Wisconsin they use rough blazingstar (*L.aspera*) and dwarf blazingstar (*L.cylindracea*) but have also been observed at silky and smooth asters (*Aster* spp.) (Swengel, 1994). Elsewhere they have been observed on goldenrod (*Solidago* spp.), Joe Pye Weed (*Eupatorium purpureum*), thistles (*Cirsium* spp.), bergamot (*Monarda fistulosa*), and annual sunflower (*Helianthus annuus*) (Scott and Stanford, 1981; Spomer, et al., 1993; Hess and Sedman, 1994; Maxwell and Ferge, 1994).

Shortly after emerging from the egg, the young larvae hibernate and mature during the following summer (Scott and Stanford, 1981). Like all *Hesperia* spp. they probably live in silken sacs at the base of the grasses and leave the shelter only to feed (Opler and Krizek, 1984).

Native grasses are the larval food plants, both *Andropogon gerardii*, and *A. scoparius* with needlegrass (*Stipa* spp.) and dropseed (*Sporobolus heterolepis*) (Swengel, 1993) as well as *Panicum virgatum*, *Eragrostis alba*, and *Agrostis* spp. (Opler and Krizek, 1984). The larvae pupate in early August probably amid plant debris like other *Hesperia* species (Opler and Krizek, 1984; Schweitzer, 1985).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind.

From early spring to August, the Leonard's skipper is a caterpillar living primarily in the base of the grasses. Like most skippers it is quite vulnerable to fire, though cool, fast-moving fires are likely less lethal (Schweitzer, 1985). Although Leonard's skippers are present at Crex Meadows in Burnett County, Schweitzer believes their numbers would probably increase with less fire management (1994). Among rare grass-feeding skippers, Leonard's skippers appear to be more tolerant of habitat degradation as well as better colonizers than cobweb or ottoe skippers (Swengel, 1994). In Illinois, the species has been observed to decrease in numbers at Lake Argyle State Park. Researchers believe this to be in response to the planting of pines and resulting loss of native habitat (Hess and Sedman, 1994).

Cobweb Skipper (*Hesperia metea* Scudder)

Taxonomy and Status. Only two of the four subfamilies of skippers (Hesperiidae) in North America occur in the Midwest, the branded skippers that perch primarily with fore and hind wings at an angle and the open-winged skippers that land with wings open. The cobweb skipper, *Hesperia metea*, is a member of the group of branded skippers (Hesperiinae), a group so named for the special scent scales on the forewings of the male. The species of branded skippers are numerous in the eastern United States. Refer to Opler and Krizek for a description of the species (1984). The cobweb skipper has no federal status but is proposed Threatened in Wisconsin and is highly associated with barrens.

Range. The cobweb skipper is known from the Gulf coast through the Appalachians to New York and up the Mississippi Valley into the Great Lakes states. *Hesperia metea ssp. licinus* is restricted to Texas and Arkansas (Scott, 1986) with gradation between the subspecies in the Ozarks.

Ebner reported the species to have been common in the Racine area of Wisconsin in the distant past and specimens are known from Marinette and Oconto counties (1970) but within the last five years, the species has been reported from only a few isolated sites of barrens habitat in Burnett, Eau Claire, Monroe, Jackson, and Sauk Counties (NHI, 1994; Swengel, 1994).

Habitat. Habitat of the cobweb skipper has been described as grassy fields or grassy forest clearings (Ebner, 1970; Scott, 1986). Across the midwestern and eastern states however, the species in some cases inhabits primarily shale, serpentine, sand, or pine-oak barrens on dry or rocky sites (Opler and Krizek, 1984). It occurs where bluestem grasses (*Andropogon* spp.), the larval food plants, are dominants of the groundlayer. In the Ozarks and Pennsylvania the skipper inhabits dry, often rocky hillsides closely associated with woodland areas (Shapiro, 1965; Heitzman and Heitzman, 1969) and usually near the top of the slope where the bluestem grasses are most prominent. Some cobweb sites in Wisconsin may have up to 45% woody cover (Swengel, 1994).

The cobweb skipper is found in both dry prairies and barrens in Wisconsin. In the barrens community, locations of the cobweb skipper correlate strongly with the dusted skipper (*Atrytonopsis hianna*) and probably also Leonard's skipper (*Hesperia leonardus*), both species of concern in Wisconsin (Swengel, 1994). In other states as well, the dusted and cobweb skippers are found together (Shapiro, 1965; Heitzman and Heitzman, 1974). At Fort McCoy in Monroe County, the sites of the cobweb skipper coincide with those of the ottoe skipper (*Hesperia ottoe*), another grass-feeding skipper (Bleser, pers.comm.).

Life History. *Hesperia metea* is usually the first branded skipper to fly in the spring. It may be found in mid-to-late May with the dusted skipper which emerges slightly later (Heitzman and Heitzman, 1974; Opler and Krizek, 1984). The cobweb skippers fly for only a few weeks and the less-flighty females can be found in the litter at the base of the host plants where they lay their eggs. Females are known to emerge about six days after the males and the following ten days defines the survey period (Shapiro, 1965) when they are best observed during cooler periods of the day. Although there are skippers similar in appearance to the cobweb skipper, the early flight period is distinctive for this species.

Wild strawberry (*Fragaria* spp.) and bird's-foot violet (*Viola pedata*) are favorite nectar sources (Opler and Krizek, 1984; Heitzman and Heitzman, 1969) which the butterflies visit primarily in the morning hours (Shapiro, 1965). Labrador tea (*Ledum groenlandicum*), winter cress (*Barbarea* spp.), and red clover (*Trifolium pratense*) are also used by the butterflies (Opler and Krizek, 1984) as are wild hyacinth (*Camassia scilloides*), wild larkspur (*Delphinium carolinianum*), and vervain (*Verbena* spp.) by females later in the season (Heitzman and Heitzman, 1969). *D. carolinianum* does not occur in Wisconsin though *D. virescens* occurs in prairies and barrens in Jackson County and north to St. Croix and Dunn Counties. *Camassia scilloides* is an endangered species associated with damp prairies, roadsides, and rights-of-way in a few southern Wisconsin counties that are outside Karner blue range (BER, 1993). Recently,

skippers in Wisconsin have been observed at lyre-leaved rock cress (*Arabis lyrata*) and wood betony (*Pedicularis canadense*) (Swengel, 1994).

The species is single-brooded and, like all *Hesperia*, the larva lives in a silken sac at the base of grasses. The cobweb larva leaves its shelter only to feed on bluestem grasses, particularly *Andropogon scoparius*, but also *A. gerardii* or *A. virginicus* (Shapiro, 1965; Scott, 1986). The later instars actually tunnel below ground where they aestivate for long periods in late summer and early fall. The larvae overwinter in tightly sealed chambers between leaf blades in the center of the grass plant. Mortality appears to be quite high during hibernation (Heitzman and Heitzman, 1969). Pupation occurs early in the spring amid debris (Opler and Krizek, 1984).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into larval location, and timber management would be most valuable to generate further informed land management decisions regarding the cobweb skipper.

The cobweb skipper is narrow in its habitat requirements and tolerance to habitat degradation (Swengel, 1994). Within the barrens habitat in Wisconsin, locations with abundant Karner blue butterflies were not found by Swengel (1994) to favor cobweb skippers or vice versa. The open grassy habitat of cobweb skippers within the barrens may not offer the right conditions for wild lupine.

In Burnett County, Ferge has found the species at Namekagon Barrens in openings of jack pine-oak scrub and, in areas managed with fire, along the fire breaks at the edges where nectar sources were most abundant (1989). Because the animals pupate in the debris in early spring, April or May burns could be expected to result in losses to the populations of skippers. Schweitzer has found survival of cobweb skippers to be good after cool, fast-moving fires (1985). Shapiro found the skippers in burned-over sites the second year following wildfire which has allowed the bluestem grasses to become dominant (1965). Woody growth, of course, will shade out the grasses creating a less desirable habitat for the skippers. Fall mowing and fall or winter timber management activities may be relatively innocuous when the larvae are underground, though information on the depth in the soil to which the larvae tunnel is not yet known.

Dusted Skipper (*Atrytonopsis hianna* Scudder)

Taxonomy and Status. Only two of the four subfamilies of skippers (Hesperiidae) in North America occur in the Midwest, the branded skippers that perch primarily with fore and hind wings at an angle and the open-winged skippers that land with wings open. The dusted skipper, *Atrytonopsis hianna*, is a member of the group of branded skippers (Hesperiinae), a group so named for the special scent scales on the forewing of the male. There are eight species in the genus *Atrytonopsis* that inhabit North America. The dusted skipper is the only species in the eastern United States. See Opler and Krizek (1984) for a description of the species or the Bureau of Endangered Resources for materials and photos to distinguish the species from others of its

kind. *Atrytonopsis hianna* has no federal status but is a species of special concern in Wisconsin and highly associated with barrens habitat.

Range and Habitat. *Atrytonopsis hianna* ranges from southern New England to the Plains states and southern Manitoba. Another subspecies, *A.h.loammi*, inhabits Florida, North Carolina, and Louisiana. Little was known about the dusted skipper when Ebner wrote *Butterflies of Wisconsin* (1970) except its possible occurrence in the Racine area. Dusted skippers have since been found to be locally uncommon in sand barrens and dry prairie in western Wisconsin (Swengel, 1991). It has been reported from Burnett, Eau Claire, Monroe, Jackson, Grant, and Sauk Counties (Ferge, 1988; Ferge, 1989).

Habitat. Across its range the species is found with bluestem grasses in dry habitats including old fields, woodland clearings, cedar glades, and rights-of-way (Heitzman and Heitzman, 1974; Opler and Krizek, 1984). In Wisconsin the species has been found more often in pine barrens than in dry prairies where locations of the dusted skipper correlate strongly with the cobweb skipper (*Hesperia metea*) and probably Leonard's skipper (*Hesperia leonardus*), both species of concern in Wisconsin (Swengel, 1994). The dusted and cobweb skippers are consistently found together in other states as well (Shapiro, 1965; Heitzman and Heitzman, 1974) The dusted skipper has also been found nectaring on the same blossoms as the phlox moth (*Schinia indiana*) in Wisconsin (Balogh, 1987).

Life History. The dusted skipper has one flight period except in the far southeastern portion of the range. Adults fly mid-to-late May into early June in Wisconsin (Swengel, 1994), the dusted normally emerging one to two weeks later than cobweb skippers (Heitzman and Heitzman, 1974). Males perch on the ground or grass stems throughout the day to await

females (Scott, 1986) and are quite aggressive in their territorial displays. Females emerge about six days after the males and the following ten days is the optimum survey period (Shapiro, 1965).

Larvae feed on the leaves of native grasses, primarily *Andropogon gerardii* and *A. scoparius*. They live in rolled or tied leaf tents on the grasses, though higher in the plant than do the *Hesperia* larvae (Scott, 1986). Although both cobweb and dusted skippers use the same food plants during the same time period, resource partitioning appears to minimize competition. *Hesperia metea* instars live at the base of grass clumps while *Atrytonopsis hianna* instars live one to several feet above the ground in the grass plants (Heitzman and Heitzman, 1974).

The dusted skipper is often discovered while visiting flowers in late afternoon and early morning (Shapiro, 1965) though a better assessment of numbers may be made when the skippers are most active during the hotter part of the day. It has been observed nectaring at phlox (*Phlox* spp.), and puccoon (*Lithospermum* spp.) in Wisconsin with fewer observed visits to bird's foot violet (*Viola pedata*) and wild lupine (*Lupinus perennis*)(Swengel, 1994). Other nectar sources are Japanese honeysuckle (*Lonicera japonica*), blackberry (*Rubus* spp.), red clover (*Trifolium pratense*), wild strawberry (*Fragaria* spp.), vervain (*Verbena* spp.), and wild hyacinth (*Camassia scilloides*) (Shapiro, 1965; Opler and Krizek, 1986). The latter three species are most often used by dusted skippers in the Ozarks (Heitzman and Heitzman, 1974). In Wisconsin, *Camassia scilloides* is an endangered species associated with damp prairies, roadsides, and rights-of-way in a few southern counties that are outside Karner blue range (BER, 1993).

Dusted skippers hibernate as mature larvae (Scott, 1986) and overwinter in a sealed nest at the base of the host plant (Opler and Krizek, 1984). Pupation occurs in the spring at the base of the grass clump 1-3 inches above the ground in a case of silk and grass leaves (Heitzman and Heitzman, 1974).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into locations of dusted skippers within Karner blue-inhabited areas would be most valuable to generate further informed land management decisions because the skippers appear to require management differently than would be used for Karners.

Compared to other rare grass-feeding skippers in the barrens community, dusted skippers appear to be more tolerant of habitat degradation and be better colonizers than either the cobweb or ottoe skippers. Within the barrens habitat, locations with abundant Karner blue butterflies were not found by the Swengels' study in Wisconsin to favor abundance of dusted skippers or vice versus (Swengel, 1994). The open grassy habitat of dusted skippers within the barrens may not be the right conditions for wild lupine. Pupation up to three inches above the ground and larvae up to several feet above the ground places this species in a location vulnerable to mortality by any destruction of inhabited grasses throughout the year.

Tiger Beetles (*Cicindela patruela patruela* (Dejean)) and (*Cicindela patruela huberi* (Johnson))

Taxonomy and Status. The subfamily of tiger beetles, Cicindelinae, is in the insect order Coleoptera. Taxonomists have also variously classified them as a subfamily, tribe, or supertribe of the family Carabidae, the carabid beetles. Cicindelids are world-wide with the exception of Tasmania, Antarctica, and remote oceanic islands (Pearson, 1988). There are 2,028 species of tiger beetles in the world with 111 species in the United State (Pearson and Cassola, 1992). Color variation is typical of the family Cicindelidae and is exhibited by a number of the tiger beetles species. Color is also influenced by environment and may even vary by the age of the individual (Graves, 1963; Pearson, 1988).

There are three known races of the tiger beetle, *Cicindela patruela*, which are distinguishable by the predominant color of the individuals in a population. *C.patruela patruela*, the nominate race, is called the green race; *C.p.consentanea*, the black race; and individuals of *C.p.huberi* are predominantly muddy green to bronze brown.(Lawton, 1970; Johnson, 1989). *Cicindela patruela* may be found in Willis' key to the species (1968) and *C.p.huberi* is described by Johnson (1989). Both Wisconsin subspecies are globally rare and vulnerable to extinction though neither have federal status. Both are of special concern in Wisconsin and highly associated with barrens. *C.p.patruela* is rare and uncommon in the state and *C.p.huberi* is of uncertain status because so little occurrence information is available.

Range. The green race occurs in eastern Ontario and ranges across the northeastern United States as far west as Minnesota and south into the southern Appalachians of the Carolinas and

Tennessee. Collections from Wisconsin come from Dane, Shawano, Sauk, Columbia, Jackson, and Douglas Counties (NHI, 1994). The black race has been found only in the New Jersey Pine Barrens and Long Island, New York. *C.p.huberi* has been collected in a few sites in central Wisconsin in Monroe, Juneau, Columbia, Adams, and Iowa Counties (Johnson, 1989; NHI, 1994). Much of this area is within the Great Wisconsin Swamp area of the former Glacial Lake Wisconsin. The population of *C.patrueia* here was most likely isolated during the glacial period and evolved separately, developing its own coloration (Johnson, 1989).

Habitat. Like the majority of North American temperate zone species of Cicindelidae, *C.patruela* inhabits relatively exposed, dry situations with little vegetation including paths, roads, bare fields, and sandy levels (Balduf, 1935). In Michigan it is frequently found in association with the more common species, *C.longilabris*, of the conifer and mixed forests of the Upper Peninsula. *C.longilabris* inhabits the dry, sandy country of jack pine, blueberries, and reindeer moss (*Cladonia* sp.) (Graves, 1963). In Minnesota, Ron Huber describes the habitat of *C. patruela* as sunlit, sandy jackpine openings, often created by roads, clearings, firebreaks (1988). In Ontario, a whole colony lives on a sandy lane (Wallis, 1961). *C.p.huberi* was collected in Wisconsin on sandy lanes in jack pine-oak forest with much blueberry undergrowth, "usually on dry upland, away from the bogs...", and appears to prefer the grass along the lanes (Johnson, 1989). Lawton did not find *C.p.huberi* in areas devoid of grasses (1970).

Life History. Life history of the tiger beetles was first described by Shelford in the Chicago area in 1909. He did not discuss *C.patruela* for which there is still little detailed information. However, the following information from Criddle (1907), Shelford (1909), Balduf (1935), Wallis (1961) and Pearson (1988) is enlightening concerning the genus.

The female beetle lays about 50 eggs, each about 2mm long. Each egg is laid singly in holes she makes 3-5mm deep in bare, open ground. With species observed in Canada this process takes 15-25 minutes (Balduf, 1935). The larva hatches in 9-29 days (Pearson, 1988), digs its way out, then turns around and begins to deepen the burrow, to 10-15cm by beetles in the Chicago area (Shelford, 1909). The larva then excavates somewhat around the entrance and packs it well to the size of its head. The head of the larva and the special chitinized plate behind the head which usually bears sand and soil, plug the top of the burrow and effectively blend with the surroundings. The larva waits with jaws agape and feet and spurred back wedged against the sides of the burrow for passing prey. Then it throws itself out and snaps the mandibles shut, usually on smaller invertebrates.

Cicindela larvae go through three instars (Pearson, 1988). The tunnel is enlarged after each molt and the depth of the tunnel ranges from 15-200cm depending on the species and instar (Pearson, 1988). Typically, the first *Cicindela* instar feeds about 3-4 weeks before crawling to the bottom of the burrow to molt. After 5-7 days the second instar larva enlarges the opening and feeds about 5 weeks. The second instar molts after another week and it is the third instar which deepens the burrow the farthest and overwinters (Shelford, 1909). *C.patruela* requires two years to complete its life cycle. From June eggs, the second or third instar larva overwinters. During the second summer, pupation occurs and immature adults overwinter to appear in May, mate, and leave the next generation of eggs in June. Two groups of the species cycle through the life stages but offset one year from each other with adults of one group mating and laying eggs while the other group is in the larval form preparing for pupation (Smith, W. pers.comm.).

To prepare for pupation, the burrow is closed above. Some species even fill in part of the upper burrow before constructing the special pupal cell or an enlargement of the main burrow shaft. Only a few minutes are required for the third instar larva to change to the pupal form, though the pupal stage may take up to 30 days (Pearson, 1988). Temperature probably affects pupal duration. In captivity, Shelford observed pupation to occur up to one week sooner under moist soil conditions (1909). After transformation the new adult must dig its way up through the column of soil which takes about three days (Pearson, 1988).

Hibernating burrows are usually quite deep. Adults and larvae of the same species usually overwinter in burrows of the same depth (Wallis, 1961). Burrow depths recorded in Manitoba may reach 1.8m, though some may be as short as 15cm (Criddle, 1907). The longer ones angle down about 7-20cm, then drop further vertically, perhaps taking several days to create. The beetle will throw out the dirt for the first 15-30cm, then this upper part is filled in loosely and the last 10-25cm or more are left unfilled. Depth and angle of the burrows varies depending on species. Within species, the depth also varies with substrate, water table, and other edaphic factors. Shelford found that larvae dig deeper burrows if the soil surface temperature is warmer (1909). The burrows may be dug 2-3 times deeper in sandy soil than in clay (Criddle, 1907). Most but not all beetles dig below the frostline to hibernate (Criddle, 1907; Wallis, 1961). Criddle observed that the beetles prefer a south-facing slant and are attracted to shallow holes in which to dig their overwintering burrows. The burrows of adults are often found grouped 2.5-5cm apart within a 60cm-diameter area (Criddle, 1907).

Adults are swift diurnal predators with excellent short-distance acuity. They may be considered the invertebrate equivalent to the cougar or wolf in the insect food chain. Ants are the favorite prey item (Huber, 1988). Some *Cicindela* are more selective of their prey than others which will feed on any kind of land Crustacea. Although the adults avoid predators well, they may become food for larger beetles, robber-flies, dragonflies or black widow spiders as well as small vertebrates such as the kestrel or kingbird (Huber, 1988). Balduf reports predation by skunks in Kansas (1935) and Criddle reports badger predation in Manitoba (1907). Parasitoids are their major enemies, particularly parasitic wasps and bombyliid flies (Pearson, 1988).

Adults may take cover under sticks or stones during the day but usually they dig shallow, quickly-created burrows for shelter from cold, rain, and darkness and also perhaps against extreme heat and drought. These burrows are usually no more than about 3cm deep. The adult beetles respond quickly to weather changes, becoming quite inactive under clouds, but again prompted to activity by sunshine. On rainy or gray days as well as on very hot, dry days, the beetles may remain constantly underground. Some species burrow in for the night by late afternoon and remain until mid-morning (Balduf, 1935). Larvae too have been observed to pass long intervals of inactivity in their burrows during the summer. At these times they plug the openings closed. This behavior is probably a response to extreme heat or dryness (Balduf, 1935).

Management Concerns. Tiger beetles as a group are habitat specialists. This is one reason why *Cicindela* has been suggested as an appropriate indicator taxon for regional patterns of biodiversity (Pearson and Cassola, 1992). However, this specialization and their position as predators makes tiger beetles highly susceptible to habitat changes. On the other hand, they are less area sensitive and able to maintain viable populations in small areas of habitat (Pearson and Cassola, 1992). Temperature and water loss are the most important physical factors for adults. Tiger beetles maintain high body temperatures just below their lethal limits and are primarily ectothermic, requiring behavioral adaptations to maintain temperatures for functioning. The reflectivity of tiger beetle elytra (wings) varies greatly between species and functions in thermoregulation; diurnal beetles being more reflective than those that are active at night, for instance. Color variation probably aids in thermoregulation as well (Pearson, 1988).

The larvae are more sensitive to variation in edaphic factors than are the adults, particularly to soil moisture, soil composition, and temperature. The effect of changes in soil chemistry is yet unknown (Pearson, 1988). Because the beetles require a specific habitat, *C.patruela* is

particularly vulnerable to habitat loss. Throughout its range the species has suffered loss of habitat to development.

Soil disturbance may be detrimental to the larvae depending on the instar and depth of the tunnel. The larvae drop quickly to the bottom of the burrow when threatened. Early season instars remain closer to the soil surface than the later stages. As mentioned above, the hibernating burrows are quite deep, especially in a sandy substrate. Although the hibernating depth of *C.patruela* is unknown, it is likely below the level of vulnerability to winter timber management activities. Because the beetles can dive below ground, fire poses little threat except in June when the eggs are vulnerable (Smith, pers.comm.). Research into the depth of hibernation of the larvae, the effects of soil chemistry changes on the larvae, and the effects of soil disturbance accompanying timber activities on both larvae and adults would be most valuable to generate further informed land management decisions in regard to the rare tiger beetles.

Wood Turtle (*Clemmys insculpta*)

Taxonomy and Status. The wood turtle belongs to the family, Emydidae, the pond and river turtles. Emydidae is the largest turtle family with 85 species worldwide in temperate and tropical climates excluding Australia. Refer to Oldfield and Moriarity (1994) for a description of the species. The wood turtle currently has no federal status but the U.S. Fish and Wildlife Service was petitioned to list the species as Federally Threatened in 1994. It is listed as Threatened in Wisconsin and Minnesota. In Iowa where only one population is known, the species is ranked as Endangered (Christiansen and Bailey, 1988). Most states that harbor the turtle have some legislation for protection. A Wisconsin Threatened species may not be collected without a permit from the Bureau of Endangered Resources of the Wisconsin DNR. In addition, salvaging a dead animal is in violation of the law unless the local conservation warden or the Bureau of Endangered Resources is contacted. Contact BER in Madison at (608) 266-7012.

Range. The turtle is found in Nova Scotia and northeastern United States then westward as far as northeastern Iowa and eastern Minnesota. The range of the species reaches only as far south as northern Virginia. The turtles inhabit Wisconsin primarily north of a line from Green Bay to Prairie du Chien (NHI, 1994; Casper, 1995). South of this line, the wood turtle has been found in counties along the Wisconsin River with scattered reports in counties further east. The Wisconsin Herpetological Atlas Project has documented records of the wood turtle in all counties in Karner blue butterfly range with the exceptions of Barron, Dunn, Clark, and Juneau Counties, though the species is believed to occur in those counties as well (Hay, pers.comm.).

Habitat. In Wisconsin, the wood turtle is present in fast-moving rivers and streams such as the Black, Wisconsin, Brule, St.Croix, and Baraboo Rivers. Smaller tributaries with wood turtles include both warm and cold water streams. Wood turtles are almost exclusively riverine, inhabiting aquatic, riparian, and upland habitats primarily within a forested landscape. Wood turtles are considered semi-terrestrial and spend part of their lives in the uplands, though it appears that western individuals remain closer to the water than do those in the more eastern parts of the range. Vogt has found individuals in the river in July in Wisconsin (1981). In contrast, some individuals spend little time in the water (Nedrelo, 1994). Usually turtles forage in open, grassy meadows and deciduous woods adjacent to the rivers throughout the summer and return to the water in the fall. In Iowa, the turtles are more often seen moving through forest than

in the water (Christiansen and Bailey, 1988). Brewster and Brewster (1991) found sandy stream beds, alder (*Alnus rugosa*) thickets interspersed with grass/sedge openings, upland foraging areas, and sandy, sunny nesting substrates to correlate with preferred wood turtle habitat in northern Wisconsin.

Life History. Wood turtles become active in late March to mid-April and bask on the sides of the river on warm spring days. They are diurnal and forage in midday. The turtles are omnivorous and consume most of their food on land (Ewert, 1985) eating forbs, willow leaves, berries, mushrooms, slugs, insects, and earthworms. They have also been observed consuming dead fish and birds. Vogt found spruce needles eaten by a turtle in Price County (1981).

Wood turtles mature when they are 14 years old or older (Oldfield and Moriarity, 1994) and they produce a single clutch per year. Mating occurs primarily in the spring though fall mating has been observed (Vogt, 1981). The females nest on sandbars, sandy riverbanks, abandoned railroad grades, and open sandy-soil hillsides. Females leave the water for nest sites in the late afternoon in June and nest communally. False nests may be dug before the female ultimately deposits her eggs. She produces a clutch of 4 to 12 (typically 7 to 9) eggs. The nesting process may take three hours or more. Unlike many other turtle species, there is some evidence that the sex of wood turtle embryos are not affected by the influence of incubation temperature (Bull, 1985).

Eggs develop in 58-71 days and the young emerge in mid-to-late August or September (Oldfield and Moriarity, 1994). Little is known about the behavior or habitat of young wood turtles. Very few young are ever found. Certainly the nests are highly predated in the present landscape but Vogt states that Agassiz in the 1890's found hundreds of adults and not one yearling (1981). The Brewsters report the young to remain in close association with the edges of alders near rivers (1991). Wood turtles hibernate individually beginning in October under ice in bank undercuts and near log jams (Oldfield and Moriarity, 1994). They have also been found hibernating in muskrat burrows, under mud at the bottom of the river, or simply resting on the stream bed.

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into the location and habitat uses of juveniles, upland habitat use by adults, and the effects of land management on predator populations would be most valuable to generate further informed land management decisions in regard to wood turtles.

Upland wood turtle habitat has been said to extend within 366 meters of the river (Ewert, 1985). Turtles in northern Minnesota stayed within 100 meters of the river (Oldfield and Moriarity, 1994). Similar data is not yet available from Wisconsin. Upland areas are important to the wood turtle for foraging and nesting. Any soil disturbance in upland areas used by the turtles should be done prior to June or after September.

Adult turtles are usually safe from predation but can be attacked by raccoons and dogs. Like other turtles, wood turtles are vulnerable to death by automobile while traversing the upland areas near rivers. Baby turtles are preyed upon by fish and large birds as well as the raccoons, skunks, and other small mammals that destroy nests. The combination of late maturation, single-

clutches, and low survival of eggs and young creates a situation in which populations are dominated by, if not totally comprised of, adults. Wood turtles are slow, mild mannered animals and continue to suffer losses to collection for the pet trade. Protection of information on turtle sites will help to minimize these threats.

Loss of forested stream habitat to development is a threat to the wood turtle. Degradation of water quality and the resulting loss of the plants and small animals of the stream resulting from industrial activities and agricultural runoff threatens the survival of the turtles. Monocultural management of timber lands removes the diversity of plants and animals that the wood turtle uses for food. Protection and maintenance of nesting sites against predation, collection, and natural succession as well as protection of habitats used by all life stages is needed to aid recovery for the wood turtle.

Blanding's Turtle (*Emydoidea blandingii* (Holbrook))

Taxonomy and Status. Emydidae is the family of pond, marsh, and box turtles. Emydidae is the largest turtle family with 85 species worldwide. The family reaches its greatest diversity in the eastern United States and Southeast Asia. Emydidae are small to medium sized turtles with twelve marginal carapace scutes along each side and six pairs of scutes on the plastron. The elongated hind feet have some webbing. One species, *Emydoidea blandingii*, is recognized in the genus. There are no recognized subspecies. See Ernst and Barbour (1972) or Oldfield and Moriarty (1994) for a description of the species. Blanding's turtle is Threatened in Wisconsin and is under review for listing by the U.S. Fish and Wildlife Service. A Wisconsin Threatened species may not be collected without a permit from the Bureau of Endangered Resources of the Wisconsin DNR. In addition, salvaging a dead animal is in violation of the law unless the local conservation warden or the Bureau of Endangered Resources is contacted. Contact BER in Madison at (608) 266-7012.

Range. Blanding's turtles range from southern Ontario and Quebec south through the Great Lakes region, west to central Nebraska and the southeastern corner of South Dakota, south to Iowa, into the northeast corner of Missouri, the northern half of Illinois and Indiana and the northwestern corner of Ohio extending in that state along the southern border of Lake Erie. The distribution of this species is spotty and disjunct around margins of the range particularly in the East where relic populations may be found in scattered localities in eastern New York, Massachusetts, New Hampshire and Nova Scotia (Ernst and Barbour, 1972; Iverson, 1986).

The Blanding's turtle was formerly more widespread. Archeological records show the species to have inhabited central Missouri, southwestern Kansas and the Oklahoma panhandle during the Pleistocene as well as in Kansas during the late Pliocene (Kofron and Schreiber, 1985; McCoy, 1973). The turtle is found scattered throughout Wisconsin except for the northcentral region and a few counties east and south of Lake Winnebago in eastern Wisconsin (Vogt, 1981). While not documented by museum specimens, the species has also been observed in Bayfield and Barron Counties (Hay, pers.comm.).

Habitat. *Emydoidea* is found in marshes, ponds, swamps, bogs, lake shallows, backwater sloughs, shallow slow-moving rivers, protected coves and inlets of large lakes, oxbows, and pools adjacent to rivers; particularly in waters with a soft bottom and abundant aquatic

vegetation. Blanding's turtles are found in rivers in Michigan (DeGraf and Rudis, 1983) but primarily prairie marsh and ponds in Minnesota (Oldfield and Moriarity, 1994). Prairie marsh or wet prairie is the preferred habitat in the western part of the range, especially associated with sandy soils (Kofron and Schreiber, 1985; Nyboer, 1992).

In Wisconsin, populations of Blanding's turtles studied by Ross and Anderson (1990) used ponds more often than the marshes which were available. Marsh habitat use was highest in early summer. Ross and Anderson think the use of these ponds as well as ditches might be for travel routes between feeding or activity centers (1990). Use of ponds with sand substrate and no aquatic vegetation was minimal in their study. Wetlands in which the cattails had been cleared in some areas were used by the turtles but not those with dense cattail mats indicating that availability of open water affects wetland use, at least by adults. Marsh habitat use was highest in early summer. Higher water quality encourages invertebrate prey populations and those habitats in Wisconsin with higher dissolved oxygen (>5.0ppm) had greater use by the turtles. Eutrophic conditions are attractive to Blanding's turtles (Graham and Doyle, 1977; Kofron and Schreiber, 1985; Ross and Anderson, 1990) particularly in mid to late summer due perhaps to increased competition during times of high feeding rates (Rowe and Moll, 1991).

In Minnesota, the preferred habitat is calm, shallow water with rich aquatic vegetation. The turtles are found in marsh areas in large river floodplains in the state adjacent to sandy upland areas for nesting (Coffin and Pfannmuller, 1988). In Michigan the turtles use shallow weedy bodies of water such as permanent ponds or open marshes (Harding, 1992). In Ohio, the turtles have been reported uncommon in deeper or more exposed parts of lakes but frequently found in protected coves (Carr, 1952). In states bordering the Great Lakes the turtles are found in central marshes or sedge meadows of islands, peninsulas, or sandspits stretching into the large water bodies (Bleakney, 1963; Adams and Clarke, 1958; Petokas, 1986).

Female turtles avoid nesting in cool, shaded sites (Petokas, 1986). Wisconsin turtles nested in large (>6 ha.) contiguous grassland habitat in Ross and Anderson's study in 1990. 50.6% of the cover at the Wisconsin nest sites was comprised of grasses and Pennsylvania sedge (*Carex pensylvanica*) (Ross and Anderson, 1990). The females in Petokas' study in Ontario chose areas with little or no vegetation. However, nests were found in a clustered distribution, likely because of herbaceous cover along the perimeter of the chosen site where turtles could hide and survey the area before advancing into the open to seek a nest site (1986). They often choose disturbed sites. Petokas suggests that the turtles probably nested in available clearings, on sand and gravel bars, and on muskrat lodges or beaver lodges and dams prior to the modification of the landscape by man. However, all the females in his study chose areas disturbed by humans: tilled plots, cemeteries, a powerline right-of-way, and a road. No nests were on the available beaver dams (1986). Turtles have been known to cross open, sandy soil to nest in a tilled cornfield (Linck, et al., 1988).

Life History. Onset of nesting seems to be correlated with temperatures in April encouraging females to complete vitellogenesis. Nesting takes place within the period June 12-July 2 in central Wisconsin though it may vary by as much as two weeks in the same area. The turtles normally nest in the evening beginning when it is still light but rarely completing the nesting until after dark which takes an average time of 2.5 hours from first digging to leaving the nest (Congdon, et al., 1983; Linck, et al., 1988). Turtles in southeastern Ontario have been observed to average slightly less than 2 hours to complete nesting (Petokas, 1986). Because adult

Emydoidea are fairly invulnerable to predators, they do not have to nest during the day like other turtles that are more easily preyed upon. Eggs are buried 2-3 inches below ground.

Clutch size is usually about 10-11 eggs (DeGraaf and Rudis, 1983; Pope, 1939; Congdon, et al., 1983) although clutches of 20 eggs have been reported for very large females (Petokas, 1986). As in other turtle species, clutch size varies with adult size, not adult age. Incubation period depends on temperature but is relatively short as a selective advantage for a species nesting on ephemeral or unstable substrates such as sandbars and beaches. Incubation may take over 80 days at 24C but only 48 days at 30-32C (Ewert, 1979). *Emydoidea* exhibits temperature-dependent sexual differentiation that favors males if nesting habitats are cool with average incubation temperatures at less than 26⁰C. and favors females if nests are in open habitats and incubation temperatures average warmer than 26⁰C. Hatching begins in mid-to-late August in Wisconsin and continues into September.

Unlike most aquatic turtles, Blanding's turtles will eat food both in the water and out of the water (Pope, 1939; Vogt, 1981). *Emydoidea* are omnivorous (Graham and Doyle, 1977) and may take advantage of abundant sources of high nutrient foods when available. Blandings turtles have been observed consuming pondweed seeds (*Potamogeton* sp.), golden shiners, and brown bullheads where high nutrient levels from sewage effluent have stimulated the growth of high protein foods in Massachusetts (Graham and Doyle, 1977). Crustaceans and crayfish comprise about 50% of the diet, insects 25% and other invertebrates and vegetable matter 25% for turtles in New England (DeGraaf and Rudis, 1983) and Michigan (Lagler, 1943). Missouri turtles are primarily carnivorous, specializing in crayfish, followed by insects. They eat fish, fish eggs, and frogs as well, with small amounts of duckweed and algae always in association with animal food (Kofron and Schreiber, 1985). In Nova Scotia where crayfish are absent, the turtles eat dragonfly nymphs, aquatic beetles, and other aquatic insects as well as snails and some fish.

Blanding's turtles most often hibernate partially buried in the organic substrate of ponds and creeks. Five of the six overwintering turtles in the Wisconsin study used one of their summer activity centers for overwintering. Most moved from marshes, shallow ponds, and ditches to deeper ponds after September 1. The deeper ponds probably provide stable water levels during the critical overwintering period and a longer period of warmer water temperatures in early fall. Water temperatures ranging from 10-13 C., probably combined with changes in photoperiod, food supply, and rainfall, encourage turtle hibernation in Wisconsin between September 20 and October 22 (Ross and Anderson, 1990). Turtles in Missouri entered hibernation when water temperatures were 6.2C - 7.5C and were found in shallow marsh areas under 15cm mud below 9.5-21cm of water. At these temperatures the turtles would frequently change locations, moving as much as 13m (Kofron and Schreiber, 1985). In states south of Wisconsin, turtles have been known to hibernate beneath brush piles (Rowe and Moll, 1991) and leaves several feet from water (Conant, 1951).

Blanding's turtles live to be 30-40 years old and one individual in Minnesota is thought to have lived 77 years (Brecke and Moriarity, 1989). The longevity of Blanding's turtles is a life history characteristic of the K-strategist. Combined with delayed maturity, single clutches, and a short annual reproductive period, this species is banking on many productive years. According to Congdon, et al. 23-48% of the females in a population will reproduce in a given year (1983) and adults, barring death on the highway, can look forward to at least 15 years of reproductive activity. In this way, populations can be maintained through sufficient reproduction effort and an

occasional good year in spite of long periods of low recruitment due to nest failure, predation, or hatchling mortality (Petokas, 1986).

Terrestrial Movement. The Blanding's turtle is semi-terrestrial although the degree to which it is terrestrial in Wisconsin is poorly understood. Gibbons only found turtles on land between aquatic areas in April and in September as well as females in June (1968). Conant considers it to be unusual for turtles in Ohio to be more than 100 yards from the water (1951). However, Rowe and Moll found that terrestrial excursions were a significant part of Blanding turtle activity in Illinois (1991). In Eau Claire County, Wisconsin, researchers have noted terrestrial behavior including aestivation in deciduous forest in summer (Hay, pers.comm.).

Other than movement by females to locate nesting sites, Blanding's turtles may be said to have three other types of terrestrial movement, as noted by Rowe and Moll (1991). During reproductively-active periods, males may move long distances overland to locate mates. Secondly, short overland excursions to other water bodies are common and probably indicate explorations for improved ecological conditions or in response to social interactions. Thirdly, turtles have been observed to remain on land for several hours to several days perhaps to avoid cold water temperatures (Ross and Anderson, 1990; Rowe and Moll, 1991) or in aestivation, as in Eau Claire County, during hot summer weather.

Females do not usually nest in areas adjacent to their home ponds. In 1927, Brown observed that a female Blanding's turtle nested 0.5 mi (805m) from the water body that the turtle presumably inhabited in Ontario. Illinois females wandered overland for 5-17 days and up to 1670m away before nesting 650 to 900m from their home ponds (Rowe and Moll, 1991). Turtles traveled 200 to 1200m to nest in Massachusetts (Congdon, et al. 1983). Turtles in Nova Scotia were nesting 5 miles across a lake from their probable activity centers (Bleakney, 1963). Wisconsin females traveled 246m from non-nesting activity centers to nest on average

168 m from the nearest water body (Ross and Anderson, 1990). Congdon, et al. found females traveling up to 1115m. away from the nearest water body (1983). There is some evidence that Blanding's turtles exhibit nest site fidelity (Congdon, et al., 1983; Petokas, 1986).

Size of activity centers (where daily activities are carried out for several days at a time) do not appear to differ for male and female turtles and range from 0.1 ha to 1.2 ha (Ross and Anderson, 1990; Rowe and Moll, 1991). The activity centers may be quite widely separated however; up to 400-600m in some cases. Activity centers of females in Wisconsin overlapped with other females (average overlap: 26%) and juveniles (7.4%) as well as males (12%). Male activity centers did not overlap with those of other males (Ross and Anderson, 1990) although there is no substantiated evidence for territoriality in freshwater turtles. Daily movements have been recorded between 30m and 50m (Ross and Anderson, 1990; Rowe and Moll, 1991) although females may move as far as 95m in a day during nesting periods.

Management Concerns. Little data is available on the extent of habitat needed by *Emydoidea* populations. In the case of this turtle species, nesting site availability is more likely the limiting factor for population size than is wetland habitat. Population densities appear to range from 6 to 16 individuals per hectare in marshes (Gibbons, 1968; Graham and Doyle, 1977; Congdon, et al., 1983) and up to 55/ha in ponds (Kofron and Schreiber, 1985). Ross and Anderson found 27.5/ha in ponds in Wisconsin (1990).

Considering both the probability of an egg hatching and nest predation, the reality of recruitment is discouraging. A 1983 study in Michigan found the probability for survival to emergence to be only 0.18 (Congdon, et al., 1983). Trails left by females to and from nests are easily followed by predators, especially if the turtle marks the trail in any way for the nestlings to follow. In some turtle studies, 100% of the nests were predated (Petokas, 1986; Ross and Anderson, 1990). The primary predators are usually skunks, raccoons, or red fox.

Age class structures of *Emydoidea* populations that have been studied are highly skewed toward adults (Lagler, 1943; Gibbons, 1968; Graham and Doyle, 1977). Senescence of the populations has been observed in Missouri (Kofron and Schreiber, 1985), Illinois (Fogel, 1992), and Wisconsin (Hay, pers.comm.). Even prior to the 1950's young turtles were rarely reported (Carr, 1952). Perhaps recruitment is periodic to avoid problems of competition. The turtles are not aggressive nor territorial and perhaps have always lived in groups of primarily older adults. Cyclic flushes of juveniles may have been historically the result of cyclic predation due to environmental conditions inhibiting nest detection, decreased presence of predators, or population explosions of alternate prey during some years. It has been suggested that trapping techniques and locations may be missing the juveniles who do not share the same habitat as the adults. Whether the young turtles are absent or elsewhere is a question yet to be answered.

Habitat manipulation affecting the wetlands in which Blanding's turtles reside has been implicated in the depletion of populations in several states. Cultivation to the edge of the water and use of pesticides, especially those used to destroy aquatic vegetation (Kofron and Schreiber, 1985), as well as actual inundation or drainage of wetlands for agriculture or river channelization (Nyboer, 1992; Coffin and Pfanmuller, 1988) has reduced available habitat. Drawdowns to remove undesirable fish and pesticides sprayed on the exposed lake bottom when the turtles are already moving in late spring are detrimental to turtle survival (Nyboer, pers.comm.; Dorff, pers.comm.). Winter drawdowns have been documented in Minnesota to cause heavy mortality due to freezing (Dorff, pers. comm.).

Blanding's turtles are also suffering from losses due to collection for the pet trade, development of upland nesting sites, and road mortality. The turtles' habit of wandering long distances may be a limiting factor in their ability to adapt to the anthropogenic landscape. However, some researchers believe more nesting habitat has been created by human activities allowing populations in some areas to expand beyond presettlement numbers (Petokas, 1986). However, routes from wetlands to nesting areas are often hazardous for the turtles. Turtle tunnels under existing roadways and sensitive routing of new and widened highways may be required to allow the animals to carry out reproductive activities. Habitat succeeding to shrubs creates a cooler incubation environment and skews sex ratios toward males. Nest site fidelity, if significant in this species, compels longterm protection of specific sites for existing populations. Genetic variability is most secure when populations are within ranging distance by males moving along wetland corridors.

Western Slender Glass Lizard (*Ophisaurus a. attenuatus* Cope)

Taxonomy and Status. There are six *Ophisaurus* species in North America. *Ophisaurus attenuatus*, the slender glass lizard, is a limbless lizard. It can be distinguished from a snake by its

movable eyelids, external ear openings, and a rigid body. See Vogt (1981) for a description of the subspecies, *O.a.attenuatus*. The western slender glass lizard has no federal status but was listed in Wisconsin in 1979 as Endangered.

Range. The western slender glass lizard, *Ophisaurus a. attenuatus*, ranges from northwestern Indiana and southcentral Wisconsin through the Mississippi Valley to southeastern Nebraska and central Texas. In Wisconsin, at the northern edge of its range, the lizard occurs in scattered populations in the central part of the state but was probably historically more widespread in pine barrens, oak savannas, and sand prairies. The species has been found in LaCrosse, Monroe, and Jackson Counties as well as Adams, Juneau, Marquette, Waushara, Sauk, Columbia, and Dane Counties. Old records exist from Green Lake and Rock Counties (NHI, 1994). The northern prairie skink (*Eumeces septentrionalis septentrionalis*) inhabits the comparable dry, sandy soils in the northwestern section of the state (Casper, 1991).

Habitat. The habitat of the slender glass lizard is primarily oak savanna and sand prairie where the lizards are most often seen in clumps of sedge (*Carex pensylvanica*) in areas with lichens and small pines (Vogt, 1981). Hay (pers.comm.) reports them from short-grass prairies dominated by little bluestem (*Andropogon scoparius*) and often at or near habitat borders where adjacent habitats consist of oak savanna. In Kansas, they prefer a tall-grass prairie habitat (Fitch, 1965). Trauth found the lizards in Arkansas most often along grassy roadbanks (1984).

Pleyte studied the lizards in Waushara County, Wisconsin where 94% of all animals captured were found in oak openings and mowed grass areas along the roads (1975). In fact, 143 of Pleyte's 210 captures were in the roadside anthropogenic "habitat". He described the optimal habitat for the animal as having grass with not too much open sand, and cover (usually logs and brush) within 8 meters. The savanna groundcover was dominated by grasses (*Andropogon* spp., *Stipa spartea*, and others) but also included *Lupinus perennis*, and *Carex pensylvanica*. Pine plantations searched by Pleyte did not reveal glass lizards and were probably too shaded to have enough grass as well as having too high a percentage of open sand. The old fields searched appeared to be lacking in cover. The oak barrens studied were dominated by Hill's oak (*Quercus ellipsoidalis*) with a large component of dead oak trees due to oak wilt. Pleyte assumed they had too much grass to be preferred glass lizard habitat. There are glass lizard sites in Wisconsin, however, that are pine plantations or grassy areas with young jack pines (NHI, 1994).

Fitch (1989) considers tall grass essential for the slender glass lizards. Even thick brome (*Bromus inermis*) fields in his Kansas study area had many lizards. Most of the lizards that Fitch studied were captured in the tall grass of former pastures. Because of their sleek shape the glass lizards move well through grass and likely take cover there when threatened. Slender glass lizards have been found in old fields and barrens in Wisconsin. After grazing is halted the tall grass habitat of early old field succession is rich in small mammals. When woody plants replace grasses, the numbers of small mammals decrease but good shelter for the lizards is available in the abandoned tunnels (Fitch, 1989).

Life History. Slender glass lizards exhibit a bimodal activity pattern. In April and May during the breeding season, five times as many adults were observed than in the fall in Arkansas (Trauth, 1984). Late May to early June would be the comparable period of activity in Wisconsin. A second peak of activity is in the fall as the animals prepare for hibernation.

Slender glass lizards may reach sexual maturity in two years in the southern part of the range (Trauth, 1984) but 2-3 years is more typical (Fitch, 1989). They mate in May or early June and six to seventeen eggs are laid in mid-June to early July in hollow stumps, abandoned mammal dens, or spaces under rocks and logs. During the incubation period, the female is very inactive, eating little and remaining with the clutch probably to turn the eggs or keep them moist (Fitch, 1965). The young hatch in August and enter hibernation in the fall. Pleyte found no activity of glass lizards after September 21 in Waushara County (1975). For hibernation, the lizards remain in the same area as they inhabited during the summer but move to below the frostline. Because they do not dig well, they are dependent for hibernation sites on the old burrows of mammals. They wriggle backwards into the loose soil of the burrow to protect themselves from attack during hibernation (Fitch, 1989).

The slender glass lizard becomes inactive at lower body temperatures than other lizards. For this reason, the lizards are most often found active in late afternoon or early evening, especially after rain showers. Pleyte found a marked preference for evening activity in Waushara County (1975). They are most active on days with temperatures between 70 and 77 degrees Fahrenheit (Pleyte, 1975; Fitch, 1989). Pleyte found no lizards above ground in Waushara County when the air temperature rose above 86 degrees Fahrenheit (1975).

Especially in loose soil habitats, the lizards spend extended periods underground in the summer where they burrow and forage for worms, snails, slugs, and other edible lifeforms of the soil. Olfaction plays an important role in *Ophisaurus* foraging (Fitch, 1989). Above ground, the lizards consume a variety of invertebrates. Caterpillars, beetles, snails, and spiders, particularly the wolf spider, are important foods early in the season (Pope, 1944; Fitch, 1989). Later in the summer, katydids, crickets, and especially grasshoppers form the bulk of the diet (Fitch, 1989). Pleyte found grasshoppers, crickets, and scarabid beetles in the Waushara County animals' diet (1975). The lizards will also consume the eggs of ground-nesting birds and reptiles, young mammals, small snakes, and frogs. They daily forage within an area of only a few square meters (Fitch, 1989).

As prey, the slender glass lizard has been taken by red-tailed and broad-winged hawks (Ross, 1989), raccoon, skunk, and snakes. In Kansas, the red-tailed hawk is an especially important predator on this species (Fitch, 1965). If caught the lizard may shed its tail, but only once in its lifetime can it use this avenue of escape. Unlike snakes, the glass lizards do not have scutes or scales to move themselves forward and thus require debris or vegetation to push against. As a result, they are trapped on smooth surfaces such as highways. Unfortunately, the pavement-grass interface is attractive because prey is often more active here and the pavement offers a surface for basking. By avoiding pavement and predators, glass lizards can live to be 8 or 9 years old but Fitch did not find them to survive for more than a few seasons in Kansas (1989).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In

this case, research into anthropogenic grasslands as glass lizard habitat and preserve size and habitat requirements minimizing predation would be most valuable to generate further informed land management decisions in regard to slender glass lizards.

Slender glass lizards have suffered habitat loss through succession to forest, plantations, and agricultural uses. Commercial insecticide spraying and the resulting accumulation of toxins from consumed invertebrates may adversely affect reproduction and survival (Vogt, 1981). Because the lizards are unable to cross roads, they are highly sensitive to habitat fragmentation. Croplands and wetlands are probable barriers to slender glass lizard dispersal.

Slender glass lizards have no obvious adaptations to fire although they inhabit a community dependent on fire. The lizards perhaps escape the fire underground. Prescribed burning may help the lizards by providing more escape cover through an increase in biomass as a result of the burn. Temporarily, however, the loss of vegetation may make them more visible and thus vulnerable to predation. In this case they may be limited to patches of habitat within a burned area such as gulleys, brush patches, woodland edges, or rock outcrops where vegetation remains until regrowth occurs. On a fire-managed prairie remnant in Kansas, Fitch found the lizards present only along the edges and in very low numbers compared to the old pasture sites he studied (1989).

Glass lizards can't live in heavily-grazed fields and are slow to recolonize new areas where prairie grasses have been restored (Fitch, 1965). As succession proceeds in abandoned fields, *Ophisaurus* numbers decline as brush and trees replace grasses. The combination of a slow breeding rate due to late maturity and, at most a single yearly clutch, plus the slow growth rate of young compared to that of other lizards leaves the slender glass lizard poorly prepared to recover from population losses (Fitch, 1965).

Home range sizes vary from 0.14 ha for juveniles to 0.44 ha for adult males (Fitch, 1989) though the ranges are without a focal point "den" and shift as the animal moves about, resting below the mat of groundcover when needed. Fitch found 400-700 individuals in a 7-ha site during a three-year MRR study (1989). Pleyte observed a population density of between 1.3 and 2.4 lizards per hectare, with home ranges between 2.0 and 0.7 hectare (1975). Fitch also reports 33.5 per acre with a home range of about 0.5 acre (1965). An estimate by Curtin of 400-480 acres for the size of habitat needed to support a minimum viable population of 400 glass lizards is the only such attempt to quantify preserve size for this species (1990).

Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus* Raf.)

Taxonomy and Status. The family of pit vipers, Crotalidae, is composed primarily of the rattlesnake genera, *Crotalus* and *Sistrurus*. There are seven species or subspecies of *Sistrurus* distributed from Mexico and Texas through Kansas and into the northern Midwest. Two other subspecies of *S. catenatus*, the western massasauga and the desert massasauga, occur southwest of Wisconsin. The massasauga, by most accounts, entered the Midwest during the Hypsithermal about 5,000-7,000 years ago along the prairie corridor created during that warmer post-glacial period (Cook, 1992). The massasauga is a federal candidate for listing and is listed as Endangered or Threatened in most states within its range. The species is Endangered in Wisconsin. See Vogt (1981) for a description of the subspecies.

Range. *Sistrurus c. catenatus* was first described in 1818 from prairies near Kansas City, Missouri (Beltz, 1990). The subspecies ranges from Missouri and Iowa with a few stations in southeastern Minnesota to southern Ontario, New York, and Pennsylvania (Beltz, 1990). In the 1800's the snakes could be found throughout Wisconsin below the Tension Zone. The Wisconsin Herpetological Atlas reports occurrences of the animal in 16 counties from Pepin and Wood to Walworth and Racine (Casper, 1995). Reliable records indicate isolated populations currently in Buffalo/Pepin, Jackson, Juneau, Walworth, and Trempealeau/LaCrosse counties (Casper, 1992).

Habitat. Habitat of the eastern massasauga is often composed of two communities, the wetland habitat and a drier upland area. In Minnesota and extreme western Wisconsin today, the animal is primarily restricted to river bottom forests and adjacent fields (Land and Karns, 1988; Vogt, 1981). In other states and central Wisconsin, the massasauga continues to inhabit prairie marshes (Christansen and Bailey, 1990), swamps, bogs and fen peatlands with low shrubs. In the Chicago area, the rattlesnakes are found in the ecotone between woodland and wet prairie, areas of clay hardpan with uplands of scattered shrubs, or savanna-like communities where sunlight provides for a grassy, herbaceous layer (Mierzwa, 1992). In Ontario, the snakes have been found to inhabit lowland conifer forest (Weatherhead and Prior, 1992). Seasonal wetlands are critical to the species and fens and marshes are preferred over swamps. They prefer habitat with canopies less than 10m in height (Hay, 1992).

Seasonal movements of the massasauga appear to vary with locality. In Missouri, a study showed the animals to be in wet prairie in spring, moving in summer to drier uplands and old fields, and then in fall returning to the wet prairie and associated marshes to overwinter (Siegel, 1986). Telemetry studies on Bruce Peninsula in Ontario tracked the animals and found that they used upland areas with low tree heights or shrubs in the spring but avoided grass-dominated open areas in preference to fairly closed marshes, shrubby swamps, and fens in the summer (Hutchinson, et al., 1993). In the fall, the snakes either remained in those wetland habitats or found hibernation sites in nearby white cedar (*Thuja occidentalis*) swamps (Weatherhead and Prior, 1992). In central Wisconsin where the snakes are being tracked in the upland areas of Necedah NWR, individuals are known to travel one-third mile (0.53km) or more from wetlands into the surrounding upland areas (King, R. pers. comm.).

The massasauga uses a combination of open, sunlit areas such as openings in conifer forest or old field (Weatherhead and Prior, 1992) and shady woodland or shrubland for thermoregulation. Both uplands and wetlands provide opportunity for foraging. Snakes have been found to move 9.1m per day in Pennsylvania with home ranges of slightly less than 1 hectare (Reinart and

Kodrich, 1982). In Ontario, however, snakes move an average of 56m per day (Weatherhead and Prior, 1992). The Ontario researchers found activity ranges of 25 hectares with the females having smaller ranges than the males.

Unlike many other snakes, massasaugas hibernate singly. Areas with the water table near the surface are chosen for hibernation where they may spend the winter underwater. There is some evidence of site fidelity to overwintering locations (Hay, 1992). In Wisconsin and Missouri, massasaugas overwinter at or near the water level in crayfish burrows in bottomlands as well as mammal burrows or sawdust piles (Seigel, 1986). "The presence of crayfish burrows for hibernating may be a very important factor limiting the habitable areas within the range of the massasauga" (Vogt, 1981). Farther north, in Michigan, the snakes use rock crevices and tree root systems for hibernation (Moran, 1992). Tree root hollows are also used for hibernation in swamp forests in Ontario as well. They may move over 2.4km between summer activity areas and hibernacula (Hay, 1992).

Life History. Massasaugas emerge in late April during spring flooding in Wisconsin and move to upland areas as waters recede (Oldfield and Moriarity, 1994). During spring and fall they are diurnal but restrict themselves to crepuscular and nocturnal periods in summer (Oldfield and Moriarity, 1994). Massasaugas reach breeding age in 2-3 years. They breed in spring primarily, but fall breeding has also been reported. There is some evidence of a biennial reproductive cycle (Reinert, 1981). Three to twenty live young are born in late August in mammal burrows or under fallen logs (Oldfield and Moriarity, 1994).

The snakes feed primarily on mice, shrews, and voles (Vogt, 1981; Christansen and Bailey, 1990; Oldfield and Moriarity, 1994), though they will consume other cold-blooded vertebrates if necessary, such as garter snakes, spring peepers, or leopard frogs. In the Chippewa River bottoms, more than 85% of the diet is voles (Vogt, 1981). Massasaugas are themselves prey for hawks, owls, large wading birds, skunks, racoons, and foxes. The loggerhead shrike has been known to prey on the massasauga (Chapman and Casto, 1972).

Management Concerns. In an effort to provide land managers with available information on the possible response of the species in question to land management activities, the following may be drawn from a variety of sources. This discussion is not exhaustive nor is it meant to be prescriptive. Where studies are lacking, current knowledge depends heavily on the educated observations of biologists most familiar with the species and others of its kind. In this case, research into the location of the snakes throughout the season would be most valuable to generate further informed land management decisions in regard to massasauga rattlesnakes.

Wetland loss has been the greatest threat to massasaugas. In areas where the wetlands are protected, adjacent upland areas visited by the animals need protection as well. The snakes prefer low shrubby habitat over forested habitat. Forest succession due to timber management or natural processes threatens habitat (Hay, 1992). Protection of information on massasauga sites helps to minimize collection pressures and losses to willful destruction suffered by this species. Massasaugas won't hibernate in flowages or other flooded areas. Also water level control is a threat to hibernating snakes. Drawdowns may cause the animals to freeze to death (Hay, pers.comm.).

Frequent burning of swales in Iowa has resulted in declines in the species (Beltz, 1990), mortality due to late season burning has been observed in Missouri, and Illinois researchers have observed losses from summer mowing (Hay, 1992). Hay recommends controlled burns be performed in the spring before emergence and mowing be conducted when temperatures are cool enough to avoid injuring basking snakes. Also, rotation of management between burning and mowing on management units that include a variety of habitats may help maintain a higher prey base and maintain adequate habitat for normal massasauga activities (Hay, 1992).

Sharp-Tailed Grouse (*Pedioecetes phasianellus*)

(*Tympanuchus phasianellus*)

Taxonomy and Status. Grouse belong to the order Galliformes which also includes turkeys, pheasants, chachalacas, quails, and partridges. There are six representatives native to Wisconsin: wild turkey, spruce grouse, ruffed grouse, sharp-tailed grouse, greater prairie chicken, and the northern bobwhite quail. The ring-necked pheasant and gray partridge are Gallinaceous birds introduced to the state. Like the prairie chicken, the sharp-tailed grouse is native to prairies. The grouse has no federal status but is of special concern in Wisconsin where the birds primarily exist in areas of managed habitat.

Range. The sharp-tailed grouse ranges from Alaska and northern Canada south and east into the Plains states, Wisconsin, Michigan, Ontario, and western Quebec. In Wisconsin it inhabits counties in the northwestern and central areas of the state as well as a few northeastern counties. Douglas and Burnett Counties have populations of the grouse as do to a lesser degree Jackson, Wood, and Clark in Karner blue range. Records exist from Polk and St. Croix Counties as well (Faanes, 1981).

Habitat. Sharp-tailed grouse habitat is generally the pine-shrub-grassland community, savanna, or brush prairie. Grouse habitat in Douglas County, for instance, is mixed grasslands with scattered oaks, aspens, or shrubs and patches of jack pine (Faanes, 1981). The birds use different areas depending on the stages of mating and nesting. Preferred courtship sites are slightly elevated clearings such as ridges or grassy knolls in meadows or fields with good visibility. Males may visit these areas for ten months of the year. The area must be very open. Tall conifers within 1/2 mile will result in the eventual abandonment of the site as a dancing grounds (Shively and Temple, 1994).

Nesting sites will be chosen within 1/2 mile of the dancing grounds in grassy areas with dense cover. The chicks are raised in areas with young trees or shrubs for shade but with clearings for an abundance of insects. Later in the summer the brood moves back into denser cover. Wintering areas are in mixed forests where the birds can feed on woody browse. Suitable habitat has been lost over the years in the southern part of the state due to agricultural conversion but logging created habitat in the North. Habitat has decreased however, since the 1930's when fire suppression combined with forest regrowth and pine plantations left the birds in isolated remnant populations (Shively and Temple, 1994). Currently the birds are maintained on managed state wildlife areas and adjacent private lands that consists of about 1,000 square miles of sharptail habitat. The grouse travel extensively and may move 2-3 miles per day and 10 miles seasonally.

Life History. Young male sharptails may begin to establish breeding display territories during their first fall. They will return to these leks year after year in early spring to perform the elaborate and competitive courtship display rituals each morning and evening to attract females. After mating occurs the females do not remain with the males but leave the dancing grounds to locate nest sites. There are no pair bonds created in this promiscuous mating system where presumably, there is no advantage for the male to help raise the young. On each lek there is normally a dominant male who mates with most of the females. In one study, a single male grouse performed 17 of 24 matings (Ehrlich, et al., 1988).

The female lays one egg per day until the 10-14 egg clutch is complete. The nest is usually a lined shallow depression in grass or under a shrub. Incubation requires 23-24 days. The young begin to fly about 10 days after hatching and are fully independent in 6-8 weeks. Young sharptails may move several miles from their hatching sites. In winter the grouse form mixed-sex flocks of usually 10-35 birds (Ehrlich, et al., 1988).

Sharp-tailed grouse young are highly insectivorous but the adults eat primarily vegetative matter such as weed seeds, waste grain, wild forb leaves and sprouts in spring; flowers, leaves, and fruits of many green plants in summer; seeds and fruits of trees and shrubs in fall; twigs and buds of paper birch, aspen, and hazel in winter. The adults augment their diet with beetles, grasshoppers, crickets, and caterpillars in summer.

Management Concerns. To maintain the shrubby, open habitat required by sharp-tailed grouse, management often consists of a combination of mowing, burning, herbiciding, clearing, and bulldozing. Many Karner blue butterfly sites on public lands are already being managed for sharptail grouse. Areas of Burnett County, for instance, have been managed since the 1950's for brush prairie and support healthy populations of Karner blue butterflies (Evenson, D. pers.comm.). Both species are creatures of a dynamic, disturbed landscape and require a diverse habitat though on different scales.

Loggerhead Shrike (*Lanius ludovicianus*)

Taxonomy and Status. Shrikes are in the family Laniidae. Only two species of shrikes occur in North America, the loggerhead shrike and the northern shrike, *L.exubitor*. Elsewhere in the world are 315 additional species. The loggerhead shrike is considered relatively stable west of the Mississippi but is declining in the East (Fruth, 1988) and is under review for listing by the U.S. Fish and Wildlife Service. The bird was listed as Threatened in Wisconsin in 1979 and reclassified to Endangered in 1982.

Range. The loggerhead shrike ranges from the Pacific to the Atlantic coast and from southern Canada to Mexico. Approximately the southern half of the breeding range constitutes the wintering range. Although 11 subspecies have been described, the AOU recognizes only 8 subspecies (Fruth, 1988). The Wisconsin subspecies is *L.l.migrans* which breeds from southern Manitoba to eastern Texas. Eastward, the breeding range intergrades with subspecies *L.l.ludovicianus* along a line through Louisiana, Tennessee, West Virginia and Maryland. To the north the shrike was formerly a resident of the Maritime Provinces but is now found only in limited numbers in Quebec and Ontario. Populations have declined for several decades throughout the species' range in the Midwest, New England, and the mid-Atlantic states. The

Breeding Bird Survey showed the upper Midwestern shrike population to be declining by 6% per year from 1966-1987 (Hands, et al., 1989).

The loggerhead shrike was formerly considered a common summer resident throughout Wisconsin except for the northeastern and northcentral regions. Populations of the shrike began declining in the 1930's and suffered another precipitous drop in the 1960's. Between 1979 and 1987, the average number of breeding pairs per year in Wisconsin was 4.0. In 1987, five pairs were reported in the state (Fruth, 1988). These birds were found nesting in central and westcentral Wisconsin and Door County (Hallowell and Gieck, 1987).

Swengel reported a loggerhead shrike in Burnett County in 1991 (pers.comm.). That same year a bird was reported from Waupaca County and another from Forest County. A nesting pair was reported from Green County. Oconto County produced two nests and 14 birds were seen in that county through the nesting season (Soulén, 1992). The following year shrikes were reported from Green, Iowa, Rock, and Taylor Counties (Soulén, 1993). Two pairs nested in Oconto County in 1993 and one bird was reported from that county in 1994 (Soulén, 1994).

Habitat. Shrikes are birds of open country though they require shrubs and low trees for nesting and perching such as those found in native savanna and upland shrub carr. Nests are built in a variety of trees, shrubs, and vines at heights ranging from 1.3 feet in shrubs to 25 feet in trees (Hands, et al. 1989). In Wisconsin, nests are typically 4-8 feet above the ground (Robbins, 1991). Prairies and deserts (in the West) are the natural habitat of shrikes. In the altered landscape, they are found using pastures and old fields containing scattered trees, shrubs or adjoining hedgerows. In Wisconsin in recent years, shrikes have been reported nesting adjacent to marsh habitat and in hedgerows surrounded by corn fields or near housing developments (Fruth, 1988).

Trees such as hawthorn (*Crataegus* spp.), locust (*Robinia pseudoacacia*), or wild plum (*Prunus americana*) that the shrikes prefer for nesting have thorns on which to impale their prey. Structural qualities of the habitat, however, are as important as the plant species, providing concealed nest sites and suitable perches. Habitat in western Canada often includes dense willow (*Salix* spp.) or clumps of thorny buffaloberry (*Shepherdia argentea*) whereas hawthorn (*Crataegus* spp.) is commonly used in eastern Canada (Telfer, 1987). In Minnesota, shrikes prefer to nest in isolated red cedars (*Juniperus virginiana*) amid agricultural fields (Brooks, 1988). In South Carolina, shrikes prefer to nest in red cedar and enjoy greater nesting success there than in other trees (Gawlik, 1988). Red cedars provide greater protection from nest loss due to adverse weather than do deciduous trees or shrubs. Red cedar as well as wild grape are also commonly used for nesting in Wisconsin.

Shrikes nesting in scattered shrubs or trees appear to suffer fewer losses due to predation than do those nesting along fencelines or hedgerows (Yosef, 1992). In Alberta, however, scattered shrubs were less often occupied than were shrubs stretching along the margin of a railway embankment (Prescott and Collister, 1993). Dead stems or utility wires for perches are a necessary component of the habitat.

Shrikes find their prey in grass, however the type of grassland preferred appears to vary with availability. Active pasture often offers the best opportunity in the context of row crops or lawns (Brooks, 1988; Novak, 1986; Gawlik, 1988). Although Telfer reports the birds across Canada hunting over closely-grazed pastures (1987), in Alberta the birds preferred to nest in areas of

taller undisturbed grasses (20.0cm vs. 15.8cm) where short grass areas were the result of heavy grazing (Prescott and Collister, 1993). Although short grasses improve prey capture, such areas contain fewer invertebrates.

Shrikes are the only songbirds that regularly prey on other vertebrates. They typically perch on branches, fences, or telephone wires for a view of the surrounding open terrain and are known for the unique behavior of impaling their prey on thorns or barbed wire in order to tear off small pieces. In early morning and at dusk they actively hunt by making frequent trips to the ground from perches 0.5-6 feet high. During the rest of the day they wait and observe from higher posts where they can detect prey from up to 150 feet (Fruth, 1988). During the breeding season they are primarily insectivorous, capturing mostly grasshoppers and scarab beetles (Mizell, 1993). During the winter vertebrates become the main prey including small birds, lizards and snakes, mice and shrews (Hall and LeGrand, 1989).

Life History. Loggerhead shrikes arrive in Wisconsin in early April, find mates, and nest from April 21-July 5 producing 4-6 eggs (Robbins, 1991). Incubation takes an average of 17 days with another 17-21 days for fledging occurring in early June. Robbins reports that double-brooding (April and July) may be possible for this species (1991). Often the youngest nestling perishes from starvation. Predation by snakes can contribute to further losses. Adverse weather has also been implicated as a contributor to nest losses. Fledging success is 50-88% in Missouri (Kridelbaugh, 1983) and Minnesota pairs produce 3-4 fledglings per female (Brooks, 1988). The shrikes are most easily observed in June and July when both parents are feeding the nestlings. After fledging, the male is primarily responsible for care of the young (Hall and LeGrand, 1989). The shrikes defend a territory of about 3.14ha in Alberta (Prescott and Collister, 1993) and from 1ha to 12ha in Missouri (Hands. et al. 1989). Territory size varies with quality of habitat and nesting stage, being largest during incubation. Two to three clutches are common in the southern states. The birds may begin leaving in August and are usually gone from Wisconsin by October 10 (Robbins, 1991).

Management Concerns. Several explanations for the decline of the species since the 1930's have been proposed including loss of breeding habitat, mortality on the wintering range, and poor reproduction. Numerous researchers have concluded that the shrike populations are not limited by availability of breeding habitat (Brooks, 1988; Gawlik, 1988; Kridelbaugh, 1983). In contrast, Prescott and Collister in Alberta found preferred habitat with tall grass to be at a premium in a context of heavily-grazed pastureland (1993) and suggested management for short grass to be contradictory to the needs of the shrikes in southwestern Canada.

Various studies of reproductive success have concluded that the shrike populations are reproducing normally (Gawlik, 1988; Kridelbaugh, 1983). Conversion of grasslands to row crop agriculture in the southern states (Kridelbaugh, 1983) has created dramatic increases in populations of Icteridae that feed primarily on grain (Brooks, 1988). Competition with burgeoning European starling populations in particular, make life difficult for shrikes in some areas (Novak, 1986). Mortality during overwintering probably contributes to losses in the northern loggerhead shrike populations. The resident shrikes in the southern states defend winter territories making it harder for the migratory birds to find hunting grounds (Gawlik, 1988).

Because of the position of shrikes near the top of the food chain and habit of foraging along the edges of fields where pesticides have been applied (Novak, 1986), loggerhead shrikes, particularly the immature birds, are vulnerable to the accumulation of residues from ingested toxins. DDT residue concentrations have been found to be higher in loggerhead shrikes two years after application than during the first year (Fruth, 1988). Researchers have implicated ground beetles as an important source of contaminants ingested by shrikes (Anderson and Duzan, 1978).

Kirtland's Warbler (*Dendroica kirtlandii* Baird)

Taxonomy and Status. The Kirtland's warbler, *Dendroica kirtlandii*, "The Jack Pine Warbler", is probably the rarest member of the wood warbler family, Parulidae. Because of its habitat specificity and endemism, it has been under intense scrutiny since it was first discovered. A good field guide can offer a description of the species, however Kirtland's warblers are best located by listening for the singing males in potential habitat. The song of the warbler is loud and the singers usually persistent. Most people can hear the singing male for at least 0.2mi (0.3km). A suspected individual should be verified by a photograph or identification by a qualified observer. The Kirtland's warbler is critically imperiled globally and listed federally as Endangered. In Wisconsin the species is of special concern because it has been found a few times in the state but only as a nonbreeding species. The Kirtland's warbler requires jack pines barrens as its breeding habitat.

Range. Jack pine, *Pinus banksiana*, did not enter the upper midwest until the retreat of the Wisconsin glaciers 10,000 years ago. Prior to that time, jack pine was abundant in the southern Appalachians and the southeastern coastal plain where presumably the Kirtland's warbler resided in its chosen habitat, migrating in winter to the nearby Bahama Islands. Recent pollen analysis has indicated that jack pine was absent from the sand outwash plains beyond the glaciers in the Midwest, so the warbler is thought to have entered the area from the southeast with the retreat of the glaciers and the advance of *Pinus banksiana* (Mayfield, 1992).

The Kirtland's warbler was first collected in 1851 on its migration route near Cleveland, Ohio and described in 1852 (Harrison, 1984). In 1903, the breeding habitat of the species was identified. The Kirtland's warbler is endemic to an area that today is about 120 by 160 km in northern lower Michigan. 485 singing males were counted there in 1993. Michigan has conducted censuses for the bird since 1951 and set aside state-owned lands for the warbler beginning in 1956. After the population declined by 60% between 1961 and 1971, yearly censuses were begun in that state (Weinrich, 1994).

Ninety percent of nests found since the first Michigan find in 1903 have been in the drainage of the AuSable River in western Oscoda County, Michigan (Mayfield, 1992). Today, there are approximately 134,000 acres of jack pine designated for Kirtland's warbler nesting habitat in Michigan (Mangold and Richter, 1994). The species is continuing to increase in numbers in Michigan due to intensive recovery efforts including habitat creation and cowbird control (Weinrich, 1994). Areas of likely habitat have been checked since 1977 in several states and provinces. Warblers were found in Ontario, Quebec, and Wisconsin but no nests have been found outside of Michigan (Weinrich, 1994). There are nine verified records of the Kirtland's

warbler from Wisconsin from the mid-1880's to 1977. All these birds were found in May in the eastern half of Wisconsin and only two were in counties with jack pine, giving credence to the belief that they were probably migrants. During that period, the only record near Karner blue butterfly range was from Waushara County in 1971 (Tilghman, 1978).

In 1978, the Wisconsin Department of Natural Resources conducted a search for the warbler in the state. Two males were found in a 90-acre jack pine stand in Jackson County where they had set up territories and remained from at least June 10 to July 31 (Tilghman, 1978). An unconfirmed sighting was also reported in northern Juneau County that year (Robbins, 1991). One and perhaps three males were heard in the same area of Jackson County in 1979 (Hale, 1979). One warbler was heard in Jackson County in 1980 (Tessen, 1980). No further evidence of Kirtland's warblers was reported until 1988 when six males were observed in Douglas, Jackson, and Washburn Counties. A single male was heard in Douglas County in 1989 (Robbins, 1991). One bird was heard through June, 1991 in Jackson County (Soulen, 1992) and one bird was reported from Washburn County in 1992 (Soulen, 1993). The likelihood of the Wisconsin males finding mates is quite slim (see below). However, it does indicate that suitable nesting habitat exists in the state.

Habitat. The nesting habitat for this warbler is quite specific and is a major limiting factor for the species. Jack pine must predominate and be between 1.3m and 6.0m in height (Harrison, 1984; Morse, 1989; Probst and Weinrich, 1993), though Ryel (1981) has found that the birds no longer use areas when trees are taller than 4.9m and Probst and Weinrich found that populations begin to decrease in an area with trees reaching 3.8m (1993). All the nests found during the 1993 Michigan census were in areas of young or middle-aged habitat (Weinrich, 1994). Morse (1989) and Mayfield (1992) have found birds in areas with trees from six to twenty-two years old. The birds appear to prefer naturally-grown jack pines over planted trees (Ryel, 1981) though 34% of the males found in the 1993 census were in areas specifically planted for warbler habitat (Weinrich, 1994). Morse (1989) reports that the birds sometimes nest in red pine plantations where they have moved from adjacent jack pine habitat within the Michigan breeding range. Large stands are required, at least 80 acres and perhaps 200 acres or more (Harrison, 1984). This is quite large for warblers, however the habitat includes less vegetation than do most forests inhabited by warblers (Mayfield, 1992). The low

ground cover typical of this sandy soil habitat is most naturally maintained by fire. The 1980 Kirtland's warbler survey found three-quarters of the singing males on wild fire sites (Ryel, 1981). Controlled burns have become part of Kirtland's warbler management in Michigan.

Nesting territories have been recorded to range from 0.6ha to 6.7ha (Mayfield, 1992). The Kirtland's warbler recovery team recommends 12ha of young jack pine for a breeding pair (1976). Typically an area is used for only ten to twelve years but use may range from six to nineteen years (Mayfield, 1960). The population generally builds for 3 to 5 years after colonization, levels off for 5 to 7 years, and then declines rapidly. Tree cover in newly-colonized stands is approximately 15-20%, during the years of highest warbler density tree cover may reach up to 60%, and tree cover typically exceeds 60% during the period of decline (Probst and Weinrich, 1993). Kirtland's warbler habitat in Michigan occurs on Grayling sand soils (Mayfield, 1992). The most similar soils in Wisconsin are the Plainfield loamy sands of central Wisconsin and the Vilas, Omega, and Hiawatha sands of northern Wisconsin (Tilghman, 1978).

Life History. Male warblers usually arrive on the nesting grounds between May 3 and May 20 with females arriving a few days later. Female Kirtland's warblers build their nests on the ground which is unusual for *Dendroica*. The nest is typically hidden in thick grass, sweet fern, or blueberries under the jack pines and the sandy soil allows the warbler to recess the nest in the ground (Morse, 1989). Egg-laying begins in late May. Females incubate generally 5 eggs for fourteen days which is the longest incubation time for a North American warbler. The eggs hatch in mid-June. Males feed the females and assist in feeding the young (Harrison, 1984). The nestlings fledge by the ninth day after hatching. The young may be cared for by the parents for up to 44 days after leaving the nest but usually parental feeding ceases by the fifth week (Mayfield, 1960).

The warblers eat a variety of insects from the ground, air, or pine foliage. They tend to hover at the ends of branches and pluck insects out of the pine needle clusters. They also eat berries (Woodard, 1980). There is some evidence that nesting will be unsuccessful in areas that can suffer below-freezing temperatures in early June, thus restricting the species to only the most southern jack pine areas in North America (Mayfield, 1992).

The small area inhabited by Kirtland's warblers is problematic for the species. By missing the Michigan habitat by the width of two counties when returning northward in the spring, a warbler may not find a mate and lose the opportunity to produce a brood (Mayfield, 1992). As a species of successional habitat, the Kirtland's warbler is inclined to occupy new areas. This can also lead to difficulties in finding mates. On the positive side, the species is semi-colonial. Clusters of two to thirty pairs have been found separated by substantial distances of similar habitat (Morse, 1989). Although yearling male Kirtland's warblers may be wide-ranging in their search for territories, females tend to nest closely to the area where they were hatched (Tilghman, 1978). Ecologists speculate that it is this semi-colonial breeding behavior and site fidelity that has kept the species from extinction thus far (Ehrlich, et al., 1988). In the fall, the majority of Kirtland's warblers have left the state for the winter migration to the Bahamas by the first week of September though some remain until early October. The hatching year young leave before the adults, having finished the final molt by September (Sykes, et al., 1989). The overwintering survival rate for adults is about 65% but is much lower for yearlings (Harrison, 1984).

Management Concerns. Should introduction of the species to sites outside Michigan be conducted as recommended by the Kirtland's Warbler Recovery Plan, jack pine management practices are generally suitable for provision of habitat for Kirtland's warblers (Tilghman, 1978). In Michigan, management of Kirtland's warbler habitat consists of logging, burning, and planting on a rotational basis to provide a constant supply of early-to-mid successional jack pine as required by the birds for nesting habitat (Mangold and Richter, 1994).

Studies of cowbird parasitism between 1951 and 1971 found that half to three quarters of the Kirtland's warblers nests were parasitized by cowbirds (Morse, 1989). The warblers have no mechanism against nest parasitism. Since 1972, Michigan has been removing an average of 4,025 cowbirds annually from Kirtland's warbler habitat (Mangold and Richter, 1994).

Phenology Charts

Butterflies

The elfins are alike in their yearly life cycles. Both are possibly found where Karner blue butterflies reside. The frosted uses wild lupine as its host plant. Henry's elfin uses a plant most likely of the heath family. Henry's nectars at violets, puccoons, and perhaps, rock cress. Gorgone checkerspot and tawny crescent are of the same family. Both uses plants of the Compositae: asters for tawny and asters or *Ratibida pinnata* or *Helianthus* sp. for gorgone. The checkerspot also chooses yellow-orange flowers for nectaring; i.e. puccoon, orange hawkweed, rock cress. The latter two butterflies are less likely to be found in the same microhabitats of the barrens landscape as are the Karner blues. The tawny crescent, for the most part, inhabits moist areas.

	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	WINTER
FROSTED ELFIN		P	ADULT	Larvae in lupine flowers, eating flowers, pods				Pupae
	Eggs laid singly on flower buds. Pupae in loose cocoon in litter at base of plant or underground.							
HENRY' ELFIN		P	ADULT	Larvae feed on buds and leaves of host shrub				Pupae
	Eggs laid on flower buds. Probably (?) in litter at base of host plant.							
Gorgone Checker-Spot		P	ADULT	P	ADULT	Larvae feed together on leaves		Larvae
	Pupae where? Eggs laid clustered under leaves. Where?							
Tawny Crescent	Larvae		P	ADULT	Larvae in communal webs under leaves			Larvae
	Eggs laid in groups under leaves. Probably (?) at base of host plant.							
Karner	Eggs	P	AD		P	ADULT	Larvae feed on leaves	Eggs

Plants

	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	WINTER
ROUGH SEEDED FAMEFLOWER				FLOWERING				
	Plants must be older than three years to flower							
OVAL MILKWEED			FLOWERS				SEEDS MA- TURE	
cf. Diptera pollinators								
SAND	FLOWERING			Lepidoptera or Hymenoptera pollinators				
VIOLET			Mature Seeds		Ant Dispersal			

Folded-wing Skippers

These skippers live on grasses, primarily little bluestem. Leonard's skipper is known to use big bluestem, needlegrass, dropseed, and others. Within the barrens landscape, these skippers are not likely to be found where Karner blues reside on wild lupine because of the dominant grasses needed by the skippers. The skippers visit flowers for nectar. The cobweb has been observed on rock cress, wood betony, and violets. The dusted skipper may be found on downy phlox with the phlox moth and nectars at wild lupine and violets as well. Leonard's skipper chooses purple flowers: asters and *Liatris* spp.

	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	WINTER
Cobweb Skipper		P	ADULT	Larvae in base of grasses and feeding on leaves				Larvae
	Pupae in debris. Eggs laid singly on leaves. Aestivation underground. Center of grass plant.							
Dusted Skipper		P	ADULT	Larvae in leaf tents 1+ ft. up in grasses				Larvae
	Pupae 1-3" up in plant. Eggs laid singly on leaves.						At plant base.	
Leonard's Skipper	Larvae			P	ADULT	Egg...		Larvae
	Where?	Pupae cf. in debris.		Eggs laid singly on leaves.		Where?		

Spread-Wing Skippers

These skippers are likely to be found at Karner blue microsites. The Persius lives on wild lupine. The mottled duskywing requires the shrubs, *Ceanothus ovatus* or *C. americanus*. Nectar sources for these species are less well known than the skippers mentioned above. The mottled has been observed using verbena and *Lithospermum* sp.

	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	WINTER
Persius Dusky-wing	Larvae	P	ADULT	Larvae in rolled leaf nests, feeding on leaves				Larvae
	Pupae in cocoon. Eggs laid singly under leaves.				In leaf shelter.			
Mottled Dusky-wing		P	ADULT	Egg....	ADULT	Larvae in leaf nests		Larvae
	Pupae in cocoon.		Eggs laid singly on flower pedicels.			In leaf shelter.		

Birds

Sharp-tailed grouse consume a variety of plant matter. Shrikes nest in trees or shrubs with spines such as hawthorn, wild plum, or locust but also use red cedar. Kirtland's warblers usually require jack pines.

	APRIL	MAY	JUNE	JULY	AUG	SEPT..	WINTER
SHARP TAILS	Courting	Hatch		Fledge		establish	Mixed
	Lay	Incubate	Nestling	Independent		leks	sex flocks
Food:	grain, seeds, sprouts,forbs		grasshoppers, beetles, caterpillars, flowers			seeds,fruit	twigs,bud
SHRIKE	Arrive	Nesting	Incubation		Fledge		
	Mate	4-8 ft. up	Egg laying		Nestling	Migrate by October 10	
	INSECTIVOROUS: Beetles, grasshoppers, etc.						
KIRTLAND'S WARBLER	Arrive, mate		Fledge		Young leave		
	Ground Nest	Lay	Incubate	Nestling	Parental Care	Sept: Parents migrate	
	Semicolonial nesting. Food: berries, insects, esp. from pine needles						

Additional Invertebrates

The Phlox moth larvae live on downy phlox. The red-tail leafhopper lives on prairie dropseed.

	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	WINTER
PHLOX MOTH		P	ADULT	Egg..Larvae	Pupae			Pupae
	cf. underground							
TIGER BEETLE	Yr.1:		Eggs	Larvae (underground during heat)			Larvae	
	Yr. 2:	Larvae	Pupation	Adults (3 cm burrows for heat, rain, etc.)			Adults	
	Yr.3:	Adults	Eggs (only 3-5 mm into the soil)					
	Larvae live in burrows at least 15 cm deep							
Red-tail Leafhopper	Egg...	Nymph		ADULT	Nymph	ADULT	Egg	Egg
	Nymphs remain on grasses			Eggs are deposited in plant tissue				

Herptiles

The wood turtle nests communally in sandy, sunny open areas. The Blanding's turtle uses open grassland habitat for nesting and lays eggs 2-3" below the soil surface. Both turtles are omnivorous, but the wood turtle makes greater use of vegetation outside of the wetland area. The massasauga also spends large amounts of time outside the wetland. The slender glass lizard has very specific habitat needs to consider.

	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	WINTER	
WOOD TURTLE	Mating at 14+ years old		Nesting		Emerge		Hibernation under ice, log jams, muskrat burrows		
	Forage in upland woods, meadows for forbs, leaves, berries, insects, worms < 1/4 mi. from river								
	Little time spent in water during the active season.								
BLAND- ING'S TURTLE	Mating		Nesting		Young emerge and go to water		Hibernation in mud below water		
	Females travels upland 1/4-1/2 mi to nest								
	Shallow ponds, marshes			Feeds both in and out of the water		To deeper ponds			
MASSA- SAUGA RATTLE- SNAKE	Diurnal		Nocturnal-Crepuscular			Diurnal			
	Breeding at 2-3 years of age		Sunny openings and shady woodland or shrub areas for basking, foraging			Live young born		Moves up to 1.2 mi. to hibernate. Crayfish burrows, tree roots near water table	
	may be over 1/3 mi from wetlands Food: mice, shrews, voles, frogs								
WESTERN SLENDER GLASS LIZARD		Mating	Nesting	Incubate			Hibernation in old mammal burrows below frostline		
	at 2-3 yrs. of age			Hatch					
	caterpillars, beetles, spiders		Foraging underground and above for katydids, crickets, grasshoppers						

References Cited

Prairie Fameflower

- Barloga, R., J. Dobberpuhl, and T.A. Meyer. 1987. Status surveys and habitat assessment of plant species. IV. *Cirsium hillii* (Canby) Fern., *Napaea dioica* L., and *Talinum rugospermum* Holz., Unpub. Rept. Wisconsin Dept. Natural Resources, Madison.
- Cochrane, T.S. 1993. Status and distribution of *Talinum rugospermum* Holz. (Portulacaceae). *Nat. Areas J.* 13(1):33-41.
- Gleason, H.A. and A. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. New York Botanical Garden, New York.
- Judziewicz, E. 1994. St. Croix National Scenic Riverway rare plants. Unpub. Rept. to SACN and U.S. Dept. Interior.
- Leach, M.K. 1993. Survey for rare plants at Fort McCoy, Wisconsin: Final Rept. The Nature Conservancy, Madison.
- Maxwell, J. and T. Givnish 1994. Research on the Karner blue butterfly at Fort McCoy, Wisconsin: Progress report for the 1994 field season. Unpub. Rept. to U.S. Fish & Wildlife Service and U.S. Dept. Army.
- Natural Heritage Inventory. 1994. Wisconsin Dept. Natural Resources, Madison.
- Pavlovic, N.B. 1989. Proposal to inventory and design a monitoring plan for *Talinum rugospermum* at the St. Croix National Scenic Riverway. Indiana Dunes Natl. Lakeshore, Porter.
- Pavlovic, N.B. 1994. Disturbance-dependent persistence of rare plants: Anthropogenic impacts and restoration implications. In M.L. Bowles and C.J. Whelan (eds.). *Restoration of Endangered Species*. Cambridge Univ. Press, Great Britain.
- Pavlovic, N.B. 1995. Habitat disturbance, density dependence and the abundance of fameflower (*Talinum rugospermum*). Thesis. Univ. Illinois, Chicago.
- Rogers, D. 1979. Patterns of colonization following gopher disturbance and cultivation in a sand prairie region. M.S. Thesis. Univ. Wisconsin, Madison.

Oval-leaved Milkweed

- Betz, R. 1996. Address to The Prairie Enthusiasts. Monroe, Wisconsin.
- Curtis, J.T. 1959. *The Vegetation of Wisconsin*. Univ. Wisconsin Press, Madison.
- Gleason, H.A. and A. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. New York Botanical Garden, New York.
- Leach, M.K. 1993. Survey for rare plants at Fort McCoy, Wisconsin: Final Rept. The Nature Conservancy, Madison.
- Naomesi, G.K. and H.H. Iltis 1957. Preliminary reports on the flora of Wisconsin. No. 40. Asclepiadaceae-Milkweed family. *Tran. Wisconsin Acad. Sci., Arts, Letts.* 46:107-114.
- Swengel, A.B. 1995. Comments on HCP Biological Subteam's list and text on associated species. April 15th letter.
- Westad, K.E. 1993. Distribution of *Asclepias ovalifolia* in Wisconsin. Unpub. Rept., Madison.

Sand Violet

- Alverson, W.S. and H.H. Iltis. 1981. Wisconsin's Endangered Plants. Unpub. Rept. Univ. Wisconsin Herbarium, Madison.
- Ballard, H.E., Jr. 1992. *Michigan Violets*. Unpub. Manuscript. The Nature Conservancy, East Lansing.
- Ballard, H.E., Jr. 1994. *An Overview of the Violet Family (Violaceae)*. Unpub. Rept. Botany Dept., Univ. Wisconsin, Madison.
- Bureau of Endangered Resources 1993. *Guide to Wisconsin's Endangered and Threatened Plants*. Wisconsin Dept. Natural Resources, Madison. [Pub.ER-067]
- Curtis, J.T. 1959. *The Vegetation of Wisconsin*. Univ. Wisconsin Press, Madison.
- Leach, M.K. 1993. Survey for rare plants at Fort McCoy, Wisconsin: Final Rept. The Nature Conservancy, Madison.
- McKinney, L.E. 1992. A taxonomic revision of the acaulescent blue violets (*Viola*) of North America. *Sida: Botanical Misc.* No.7. Bot. Res. Inst. Texas, Fort Worth.
- Russell, N.H. 1965. Violets (*Viola*) of central and eastern United States: An introductory survey. *Sida* 2:1-113.
- Voss, E.G. 1985. *Michigan Flora, Part II: Dicots*. Bull. (59). Cranbrook Inst. Sci. and Univ. Michigan Herbarium, Ann Arbor.

Red-tailed Prairie Leafhopper

- Ballard, H. 1993. Range-wide status survey of the red-veined leafhopper (*Aflexia rubranura*) Region 3 Endangered Species Grant Proposal to USFWS.
- Curtis, J. 1959. *The Vegetation of Wisconsin*. Univ. Wisconsin Press, Madison, WI.
- DeLong, D.M. 1935. Some new species of deltocephaloid leafhoppers (Homoptera-Cicadellidae). *Annals Entomol. Soc. America* 28:154-159.
- DeLong, D.M. 1948. The leafhoppers, or Cicadellidae, of Illinois (Eurymelinae-Balcluthinae). *Illinois Nat. Hist. Surv. Bull.* 24(2):93-376.
- Fassett, N.C. 1951. *Grasses of Wisconsin*. Univ. Wisconsin Press, Madison, WI.
- Natural Heritage Inventory, 1994. Wisconsin Dept. of Natural Resources, Madison.
- Hamilton, K.G.A. 1992. Leafhopper evidence for origins of northeastern relict prairies (Insecta: Homoptera: Cicadellidae). Presented at Thirteenth N. American Prairie Conf. August 6-9, 1992. Windsor, Ontario.
- Hamilton, K.G.A. 1993. Survey for the red-tailed leafhopper *Aflexia rubranura* (DeLong) (Rhynchota: Homoptera: Cicadellidae). Unpub. Rept.
- Hamilton, K.G.A. 1994. Evaluation of leafhoppers and their relatives (Insecta: Homoptera: Auchenorrhyncha) as indicators of prairie preserve quality. (In press)
- Rogers, D. 1979. Patterns of colonization following gopher disturbance and cultivation in a sand prairie region. M.S. Thesis. Univ. Wisconsin, Madison.

Phlox Moth

- Balogh, G.J. 1987. New localities for *Schinia indiana* (Smith) (Noctuidae). *Ohio Lepidop.* 9(2):15-16.
- Gleason, H.A. 1952. *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada*. MacMillan Publ. Co., New York.
- Haack, R.A. 1993. Phlox moth *Schinia indiana* Smith. USDA Forest Service, North Central Forest Experiment Station, E. Lansing.

- Hardwick, D.F. 1958. Taxonomy, life history, and habits of the elliptoid-eyed species of *Schinia* (Lepidoptera: Noctuidae), with notes on the Heliiothidinae. *Canadian Entomol.* 90 (Sup.6).
- Kirk, K. 1994. Report on a survey of the distribution of downy phlox (*Phlox pilosa*) and the phlox moth (*Schinia indiana*) (Lepidoptera: Noctuidae) on Fort McCoy, Monroe County, Wisconsin. 1994 Progress Rept. The Nature Conservancy, Madison. Unpub. Rept.
- Kirk, K. 1995. Report on a survey of the distribution of downy phlox (*Phlox pilosa*) and the phlox moth (*Schinia indiana*) (Lepidoptera: Noctuidae) on Fort McCoy, Monroe County, Wisconsin. 1995 Progress Rept. The Nature Conservancy, Madison. Unpub. Rept.
- Maxwell, J.A. and L.A. Ferge 1994. Report on a Survey of Lepidoptera at Fort McCoy, 1992-1993. Unpub. Rept.
- Rattray, K. 1994. Draft species overview: Phlox moth. USFWS, Green Bay.
- Schweitzer, D.F. 1989. A review of category 2 Insecta in USFWS Regions 3, 4, and 5. The Nature Conservancy, Boston.
- Schweitzer, D.F. 1994. Letter to Cathy Bleser, Wisconsin Dept. Natural Resources (Dec.22, 1994).
- Smith, D.M. and D.A. Levin. 1966. Preliminary reports on the flora of Wisconsin, no.57: Polemoniaceae - Phlox family. *Trans. Wisconsin Acad. Sci., Arts, Letts.* 55:243-253.
- Swengel, A.B. 1991. Management and monitoring recommendations for butterfly populations. Unpub. Rept.
- Swengel, A.B. 1994. Research on the barrens butterfly community, 1988-1994. Unpub. Rept.
- Swink, F. and G. Wilhelm 1979. *Plants of the Chicago Region*. Morton Arboretum, Lisle, IL.
- Wilsmann, L.A. 1990. Phlox moth, *Schinia indiana* (Smith). Draft species abstract for Michigan Heritage Program, Michigan Dept. Natural Resources, Lansing.

Frosted Elfin

- Chapman, K.A., M.A. White, M.R. Huffman and D. Faber-Langendoen. 1993. Ecology and stewardship guidelines for oak barrens landscapes in the upper Midwest. Rept. to Midwest Heritage Task Force, The Nature Conservancy, Minneapolis.
- Cook, J.H. 1906. Studies in the genus *Incisalia*. *Canadian Entomol.* 38(5):141-144.
- Ebner, J.A. 1970. The Butterflies of Wisconsin. *Popular Sci. Handbook* (12). Milwaukee Publ. Mus., Milwaukee.
- Givnish, T.J., E.S. Menges and D.F. Schweitzer. 1988. Minimum area requirements for long-term conservation of the Albany Pine Bush and the Karner blue butterfly: An assessment. Unpub. Rept. to City of Albany. Malcolm Pirnie, Inc, Albany.
- Kuehn, R.M. 1983. New Wisconsin butterfly records. *J. Lepidop. Soc.* 37(3):228-235.
- Opler, P.A. 1985. Invertebrates. Pp. 120-121 In R.M. West (ed.). *Spec. Publ.* (11). Carnegie Mus. Nat. Hist., Pittsburgh.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. Johns Hopkins Univ. Press, Baltimore. 100 pp.
- Packer, L. 1987. The status of two butterflies, Karner blue (*Lycaeides melissa samuelis*) and frosted elfin (*Incisalia irus*), restricted to oak savannah in Ontario. Pp. 253-271 In G.M. Allen, P.F. Eagles and S.D. Price (eds.). *Conserving Carolinian Canada, Conservation Biology in the Deciduous Forest Region*. Univ. Waterloo Press.
- Schweitzer, D.F. 1985. Effects of prescribed burning on rare Lepidoptera. Memo to The Nature Conservancy, Eastern and Midwestern Regions. March 27, 1985.
- Schweitzer, D.F. 1990. The 1990 status of selected Karner blue remnants in Saratoga and Albany Counties, New York with a discussion of monitoring methods. Unpub. Rept. to New York Dept. Environ. Conserv. - Endangered Species Unit.
- Schweitzer, D.F. 1994a. Swengel KB reports and other KB related matters. Memo to Karner Blue Recovery Team and others.
- Schweitzer, D.F. 1994b. Personal communication to Cathy Bleser, Wisconsin Dept. Natural Resources, Madison. December 22, 1994.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford. 370 pp.
- Swengel, A. 1994. Research on the barrens butterfly community, 1988-1994. Unpub. Rept.
- Voss, E.G. 1985. *Michigan Flora Part II: Dicots*. Bull. (59). Cranbrook Inst. Sci. and Univ. Michigan Herbarium, Ann Arbor.

Henry's Elfin

- Ebner, J.A. 1970. The Butterflies of Wisconsin. *Popular Sci. Handbook* (12). Milwaukee Publ. Mus., Milwaukee.
- Ferge, L.A. 1988. 1987 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 15(1):3-5.
- Ferge, L.A. 1989. Lepidoptera observations at Namekagon Barrens, Burnett Co., Wis. Unpub. Rept.
- Ferge, L.A. 1991. 1990 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 18(1):3-7.
- Kuehn, R.M. 1983. New Wisconsin butterfly records. *J. Lepidop. Soc.* 37(3):228-235.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. Johns Hopkins Univ. Press, Baltimore.

Schweitzer, D. 1994. Swengel KB reports and other KB related matters. Memo to Karner Blue Recovery Team and others.

Scott, J.A. 1986. *The Butterflies of North America*. Stanford University Press, Stanford. 370 pp.

Swengel, A. B. 1994. Research on the barrens butterfly community, 1988-1994. Unpub. Rept.

Gorgone Checkerspot

Ebner, J.A. 1970. The Butterflies of Wisconsin. *Popular Sci. Handbook* (12). Milwaukee Publ. Mus., Milwaukee.

Ferge, L.A. 1991. 1990 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 18(1):3-7.

Hess, D.F. and Y. Sedman 1994. Butterfly (Rhopalocera) fauna of the oak barrens and adjacent habitats of Lake Argyle State Park and McDonough County, Illinois. In Fralish, J.S., et al. (eds.). Proc. N. American Conf. on Savannas and Barrens. October 15-16, 1994. Normal, IL.

Kons, Jr., H. 1990. *The Outagamie Co. Area Entomology News Letter* 3(November).

Kuehn, R.M. 1983. New Wisconsin butterfly records. *J. Lepidop. Soc.* 37:228-235.

Natural Heritage Inventory. 1994. Wisconsin Dept. Natural Resources, Madison.

Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. Johns Hopkins Univ. Press, Baltimore.

Schweitzer, D.F. 1994. Swengel KB reports and other KB related matters. Memo to Karner Blue Recovery Team and others.

Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford. 370 pp.

Swengel, A.B. 1994a. Research on the barrens butterfly community 1988-1994. Unpub. Rept.

Swengel, A.B. 1994b. Conservation of the prairie-savanna butterfly community. Pp.133-138 In Fralish, J.S., et al. (eds.). Proc. N. American Conf. on Barrens and Savannas. October 15-16, 1994. Normal, IL.

Swengel, A.B. 1995. Comments on HCP Biological Subteam's list and text on associated species. Letter. April 15, 1995.

Tawny Crescent

- Ferge, L.A. 1990a. 1989 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 17(1):4-7.
- Ferge, L.A. 1990b. Checklist of Wisconsin butterflies. *Wisconsin Entomol. Soc. Spec. Publ.* (1).
- Ferge, L. A. 1991. 1990 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 18(1):3-7.
- Gleason, H. and A.Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*, 2nd. Ed. New York Botanical Garden, Bronx.
- Kons, H.L., Jr. 1989. 1989 Lepidoptera season summary. *Outagamie Co. Area Insect News Letter*.
- Kuehn, R.M. 1983. New Wisconsin butterfly records. *J. Lepidop. Soc.* 37(3):228-235.
- Maxwell, J.A. and L.A. Ferge. 1994. Report on a survey of Lepidoptera at Fort McCoy, 1992-1993. Unpub. Rept.
- Natural Heritage Inventory, 1994. Wisconsin Dept. Natural Resources, Madison.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. Johns Hopkins Univ. Press, Baltimore.
- Opler, P.A. 1985. Invertebrates. Pp. 120-121 In R.M. West (ed.). *Spec. Publ.* (11). Carnegie Mus. Nat. Hist., Pittsburgh.
- Schweitzer, D. 1985. Effects of prescribed burning on rare Lepidoptera. Memo to The Nature Conservancy, Eastern and Midwestern Regions. March 27, 1985.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford.
- Shinners, L.H. 1941. The genus *Aster* in Wisconsin. *American Midl. Nat.* 26(2):398-420.
- Swengel, A.B. 1991. *Butterflies of Southwestern Wisconsin*. Madison Audubon Soc., Madison.

Mottled Duskywing

- Curtis, J.T. 1959. *The Vegetation of Wisconsin*. The Univ. Wisconsin Press, Madison.
- Ebner, J.A. 1970. Butterflies of Wisconsin. *Popular Sci. Handbook* (12). Milwaukee Publ. Mus., Milwaukee.
- Ferge, L.A. 1989. Lepidoptera observations at Namekagon Barrens, Burnett County, Wisconsin. Unpub. Rept.
- Ferge, L.A. 1990. Checklist of Wisconsin butterflies. *Wisconsin Entomol. Soc. Spec. Publ.* (1).
- Kuehn, R.M. 1983. New Wisconsin butterfly records. *J. Lepidop. Soc.* 37(3):228-235.
- Natural Heritage Inventory. 1994. Wisconsin Dept. Natural Resources, Madison.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. The John Hopkins Univer. Press, Baltimore.
- Schweitzer, D.F. 1994. Swengel KB reports and other KB related matters. Memo to Karner Blue Recovery Team and others.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford.
- Swengel, A.B. 1991. *Butterflies of Southwestern Wisconsin*. Madison Audubon Soc., Madison.
- Swengel, A.B. 1994. Research on the barrens butterfly community, 1988-1994. Unpub. Rept.

Persius Duskywing

- Chapman, K.A., M.A. White, M.R. Huffman and D. Faber-Langendoen. 1993. Ecology and stewardship guidelines for oak barrens landscapes in the Upper Midwest. Rept. to Midwest Heritage Task Force, The Nature Conservancy, Minneapolis.
- Ferge, L.A. 1989. 1988 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 16(1):3-6.
- Ferge, L.A. 1990. Checklist of Wisconsin butterflies. *Wisconsin Entomol. Soc. Spec. Publ.* (1).
- Givnish, T.J., E.S. Menges, and D.F. Schweitzer. 1988. Minimum area requirements for long-term conservation of the Albany Pine Bush and the Karner blue butterfly: An assessment. Unpub. Rept. to City of Albany. Malcolm Pirnie, Inc, Albany.

Leonard's Skipper

- Ebner, J.A. 1970. The Butterflies of Wisconsin. *Popular Sci. Handbook* (12). Milwaukee Publ. Mus., Milwaukee.
- Ferge, L.A. 1988. 1987 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 15(1):3-5.
- Ferge, L.A. 1989. 1988 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 16(1):3-6.
- Ferge, L.A. 1990. 1989 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 17(1):4-7.
- Hess, D.F. and Y. Sedman 1994. Butterfly (Rhopalocera) fauna of the oak barrens and adjacent habitats of Lake Argyle State Park and McDonough County, Illinois. In Fralish, J.S., et al. (eds.). Proc. N. American Conf. on Savannas and Barrens. October 15-16, 1994. Normal, IL.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. Johns Hopkins Univ. Press, Baltimore.
- Schweitzer, D.F. 1985. Effects of prescribed burning on rare Lepidoptera. Memo to The Nature Conservancy, Eastern and Midwestern Regions. March 27, 1985.
- Schweitzer, D.F. 1994. Swengel KB reports and other KB related matters. Memo to Karner Blue Recovery Team and others.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford. 370 pp.
- Scott, J.A. and R.E. Stanford. 1981. Geographic variation and ecology of *Hesperia leonardus* (Hesperiidae). *J. Res. Lepidop.* 20(1):18-35.
- Spomer, S.M., L.G. Higley, T.T. Orwig, G.L. Selby and L.J. Young. 1993. Clinal variation in *Hesperia leonardus* (Hesperiidae) in the Loess Hills of the Missouri River Valley. *J. Lepidop. Soc.* 47(4):291-302.
- Swengel, A.B. 1993. Research on the community of tallgrass prairie butterflies, 1988-1993. Unpub. Rept. to USFWS and Wisconsin Dept. Natural Resources.
- Swengel, A.B. 1994. Research on the barrens butterfly community, 1988-1994. Unpub. Rept.
- Maxwell, J.A. and L.A. Ferge. 1994. Report on a survey of Lepidoptera at Fort McCoy, 1992-1993. Rept. to Fort McCoy Military Reservation, Madison.
- Natural Heritage Inventory. 1994. Wisconsin Dept. Natural Resources, Madison.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. The John Hopkins Univ. Press, Baltimore.
- Schweitzer, D.F. 1985. Effects of prescribed burning on rare Lepidoptera. Memo to The Nature Conservancy, Eastern and Midwestern Regions. March 27, 1985.

- Schweitzer, D.F. 1986. Element occurrence report: *Erynnis persius persius*. The Nature Conservancy, New York.
- Schweitzer, D.F. 1990. The 1990 status of selected Karner blue remnants in Saratoga and Albany Counties, New York with a discussion of monitoring methods. Unpub. Rept. to New York Dept. Environ.Conserv. - Endangered Species Unit.
- Schweitzer, D.F. 1994. Swengel KB reports and other KB related matters. Memorandum to Karner Blue Recovery Team and others.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford.
- Swengel, A.B. 1993. Observations of Karner blues and the barrens butterfly community in Wisconsin, 1987-1993. Unpub. Rept. to USFWS and Wisconsin Dept. Natural Resources.
- Swengel, A.B. 1994. Conservation of the prairie-savanna butterfly community. Pp.133-138 In Fralish, J.S., et al. (eds.). Proc. N. American Conf. on Barrens and Savannas. October 15-16, 1994. Normal, IL.
- Swengel, A.B. 1995. Comments on HCP Biological Subteam's list and text on associated species. Letter. April 15, 1995.

Cobweb Skipper

- Bureau of Endangered Resources. 1993. *Guide to Wisconsin's Endangered and Threatened Plants*. Wisconsin Dept. Natural Resources, Madison.
- Ferge, L.A. 1989. Lepidoptera observations at Namekagon Barrens, Burnett County, Wisconsin. Unpub. Rept.
- Heitzman, J.R. and R.L. Heitzman. 1969. *Hesperia metea* life history studies (Hesperiidae). *J. Res. Lepidop.* 8(4):187-193.
- Heitzman, J.R. and R.L. Heitzman. 1974. *Atrytonopsis hianna* biology and life history in the Ozarks. *J. Res. Lepidop.* 13(4):239-245.
- Natural Heritage Inventory. 1994. Wisconsin Dept. Natural Resources, Madison.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. Johns Hopkins Univ. Press, Baltimore.
- Schweitzer, D.F. 1985. Effects of prescribed burning on rare Lepidoptera. Memo to The Nature Conservancy, Eastern and Midwestern Regions. March 27, 1985.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford. 370 pp.

Dusted Skipper

- Balogh, G.J. 1987. New localities for *Schinia indiana* (Smith) (Noctuidae). *Ohio Lepidop.* 9(2):15-16.
- Bureau of Endangered Resources. 1993. *Guide to Wisconsin's Endangered and Threatened Plants*. Wisconsin Dept. Natural Resources, Madison.
- Ebner, J.A. 1970. Butterflies of Wisconsin. *Popular Sci. Handbook* (12). Milwaukee Publ. Mus., Milwaukee.
- Ferge, L.A. 1988. 1987 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 15(1):3-5.
- Ferge, L.A. 1989. 1988 Wisconsin Lepidoptera season summary. *Wisconsin Entomol. Soc. Newsl.* 16(1):3-6.
- Heitzman, J.R. and R.L. Heitzman. 1974. *Atrytonopsis hianna* biology and life history in the Ozarks. *J. Res. Lepidop.* 13(4):239-245.

- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. Johns Hopkins Univ. Press, Baltimore.
- Schweitzer, 1985. Effects of prescribed burning on rare Lepidoptera. Memo to The Nature Conservancy, Eastern and Midwestern Regions. March 27, 1985.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford. 370 pp.
- Shapiro, A.M. 1965. Ecological and behavioral notes on *Hesperia metea* and *Atrytonopsis hianna* (Hesperiidae). *J. Lepidop. Soc.* 19(4):215-221.
- Swengel, A.B. 1991. *Butterflies of Southwestern Wisconsin*. Madison Audubon Soc., Madison.
- Swengel, A.B. 1994. Research on the barrens butterfly community, 1988-1994. Unpub. Rept.

Cicindela patruela

- Balduf, W.V. 1935. *Bionomics of Entomophagous Coleoptera*. New York.
- Criddle, N. 1907. Notes on Manitoba Cicindela. *Canadian Entomol.* 39.
- Graves, R.C. 1963. The Cicindelidae of Michigan (Coleoptera). *American Midl. Nat.* 69:492-507.
- Huber, R. 1988. Tiger Beetles. Pp. 407-420 In Coffin, B. and L. Pfanmuller (eds.). *Minnesota's Endangered Flora and Fauna*. Univ. Minnesota Press, Minneapolis.
- Johnson, W.N. 1989. A new subspecies of *Cicindela patruela* from westcentral Wisconsin. *Cicindela* 21(2):27-32.
- Natural Heritage Inventory. 1994. Wisconsin. Dept. Natural Resources, Madison.
- Pearson, D.L. 1988. Biology of the tiger beetles. *Ann. Rev. Entomol.* 33:123-147.
- Pearson, D.L. and F. Cassola 1992. World-wide species richness patterns of tiger beetles (Coleoptera: Cicindelidae): Indicator taxon for biodiversity and conservation studies. *Conserv. Biol.* 6(3):376-391.
- Lawton, J.K. 1970. A new color variant of *Cicindela patruela*. *Cicindela* 2(2):1-3.
- Shelford, V.E. 1909. Life histories and larval habits of the tiger beetles (Cicindelidae). *J. Linn. Soc.* 30:157-184.
- Wallis, J.B. 1961. *The Cicindelidae of Canada*. Univ. Toronto Press, Toronto.
- Willis, H.L. 1968. Artificial key to the species of *Cicindela* of North America north of Mexico (Coleoptera: Cicindelidae). *J. Kansas Entomol. Soc.* 41:303-317.

Wood Turtle

- Brewster, C. and K. Brewster. 1991. Status and conservation of Wisconsin's wood turtles (*Clemmys insculpta*). Presented at The Conservation of Wisconsin's Cold-Blooded Animals Symposium. March 9, 1991. Madison.
- Bull, J.J. 1985. Non-temperature dependent sex determination in two suborders of turtles. *Copeia* 85:784-86.
- Casper, G. 1995. Wisconsin Herpetological Atlas Project. Milwaukee Publ. Mus., Milwaukee.
- Christiansen, J.L. and R.M. Bailey. 1988. The lizards and turtles of Iowa. *Nongame Tech. Ser.* (3), Iowa Dept. Natural Resources, Des Moines.
- Ewert, M.A. 1985. Assessment of the current distribution and abundance of the wood turtle (*Clemmys insculpta*) in Minnesota and along the St. Croix National Scenic Waterway in Wisconsin. Unpub. Rept. to Nongame Wildlife Program, St. Paul.
- Nedrelo, D.A. 1994. Survey for endangered, threatened and watch reptile and amphibian species at Fort McCoy, Wisconsin: 1993 Report. The Nature Conservancy, Madison.

- Oldfield, B. and J.J. Moriarity 1994. *Amphibians and Reptiles Native to Minnesota*. Univ. Minnesota Press, Minneapolis. 240 pp.
- Vogt, R.C. 1981. *Natural History of Amphibians and Reptiles of Wisconsin*. Milwaukee Publ. Mus., Milwaukee. 205 pp.

Blanding's Turtle

- Adams, M.S. and H.F. Clarke. 1958. A herpetofaunal survey of Long Point, Ontario, Canada. *Herpetologica* 14(1):8-10.
- Bleakney, J.S. 1963. Notes on the distribution and life history of turtles in Nova Scotia. *Canadian Field-Nat.* 77(2):67-76.
- Brecke, B. and J.J. Moriarty. 1989. *Emydoidea blandingii* longevity. *Herpetol. Rev.* 20(2):53.
- Brown, J.R. 1927. A Blanding's turtle lays its eggs. *Canadian Field-Nat.* 41(7):185.
- Carr, A. 1952. *Handbook of Turtles*. Comstock Publ. Assoc. Ithaca.
- Coffin, B. and L. Pfannmuller. 1988. *Minnesota's Endangered Flora and Fauna*. Univ. Minnesota Press, St. Paul.
- Conant, R. 1951. The reptiles of Ohio. *American Midl. Nat.* 29(2):257-312.
- Congdon, J.D., D.W. Tinkle, G.L. Breitenback, and R.C. van Loben Sels. 1983. Nesting ecology and hatching success in the turtle *Emydoidea blandingii*. *Herpetologica* 39:417-429.
- Ernst, C.H. and R.W. Barbour. 1972. *Turtles of the United States*. Univ. Press Kentucky, Lexington.
- Ewert, M.A. 1979. The embryo and its egg. Pp.333-413 In Harless, M. and H. Morlock (eds.). *Turtles: Perspectives and Research*. John Wiley and Sons, New York.
- Fogel, N. 1992. Personal Communication. Michigan Natural Heritage Program.
- Gibbons, J.W. 1968. Observations on the ecology and population dynamics of the Blanding's turtle (*Emydoidea blandingii*). *Canadian J. Zool.* 46:288-290.
- Graham, T.E. and T.S. Doyle. 1977. Growth and population characteristics of Blanding's turtles, *Emydoidea blandingii* in Massachusetts. *Herpetologica* 33:410-414.
- Iverson, J.B. 1986. *A Checklist with Distribution Map of the Turtles of the World*. Paust Printing, Richmond.
- Kofron, C.P. and A.A. Schreiber. 1985. Ecology of two endangered aquatic turtles in Missouri: *Kinosternon flavescens* and *Emydoidea blandingii*. *J. Herpetol.* 19(1):27-40.
- Lagler, K.F. 1943. Food habits and economic relations of turtles of Michigan with special reference to fish management. *American Midl. Nat.* 29(2):257-312.
- Linck, M.H., J.A. DePari, B.O. Butler, and T.E. Graham. 1989. Nesting behavior of the turtle, *Emydoidea blandingii*, in Massachusetts. *J. Herpetol.* 23:442-444.
- McCoy, C.J. 1973. *Emydoidea*, Blanding's Turtle. *Cat. American Amphibs. Repts.* 136:1-4.
- Natural Heritage Inventory. 1994. Wisconsin Dept. Natural Resources, Madison.
- Oldfield, B. and J.J. Moriarity. 1994. *Amphibians and Reptiles Native to Minnesota*. Univ. Minnesota Press, Minneapolis.
- Petokas, P.J. 1986. Patterns of reproduction and growth in the freshwater turtle *Emydoidea blandingii*. Ph.D. Thesis. Univ. Center at Binghamton, NY.
- Pope, C.H. 1939. *Turtles of the United States and Canada*. A. Knopf, New York.
- Ross, D.A. and R.K. Anderson. 1990. Habitat use, movements, and nesting of *Emydoidea blandingii* in central Wisconsin. *J. Herpetol.* 24:6-12.
- Rowe, J.W. and E.O. Moll. 1991. A radiotelemetric study of activity and movements of the Blanding's turtle, (*Emydoidea blandingii*) in northeastern Illinois. *J. Herpetol.* 25:178-185.

Vogt, R.C. 1981. *Natural History of Amphibians and Reptiles of Wisconsin*. Milwaukee Publ. Mus., Milwaukee.

Slender Glass Lizard

- Casper, G.S. 1991. The Wisconsin Herpetological Atlas Project. Presented at The Conservation of Wisconsin's Cold-Blooded Animals Symposium. March 9, 1991. Madison.
- Curtin, C. 1990. Reserve design and habitat protection for glass lizards (*Ophisaurus attenuatus*) in the vicinity of Page Creek, Marquette County, Wisconsin. Unpub. Rept.
- Fitch, H.S. 1965. Ecological studies of lizards on the University of Kansas Natural History Reservation. Pp. 30-44 In W.W. Milstead (ed.). *Lizard Ecology: A Symposium*. Univ. Missouri Press.
- Fitch, H.S. 1989. A field study of the slender glass lizard, *Ophisaurus attenuatus*, in northeastern Kansas. *Occ. Paps. Mus. Nat. Hist. Univ. Kansas* (125).
- Natural Heritage Inventory 1994. Wisconsin Dept. Natural Resources, Madison.
- Pleyte, T.A. 1975. The slender glass lizard (*Ophisaurus attenuatus*) in Waushara Co., Wisconsin. M.S. Thesis. Univ. Wisconsin, Milwaukee.
- Pope, C.H. 1944. *Amphibians and Reptiles of the Chicago Area*. Chicago Nat. Hist. Mus. Press, Chicago.
- Ross, D. 1989. Amphibians and reptiles in the diets of North American raptors. *Wisconsin Endang. Resources Rept.* (59). Wisconsin Dept. Natural Resources, Madison.
- Trauth, S.E. 1984. Seasonal incidence and reproduction in the western slender glass lizard, *Ophisaurus attenuatus attenuatus* (Reptilia, Anguillidae) in Arkansas (USA). *Southwestern Nat.* 29(3):271-276.
- Vogt, R.C. 1981. *Natural History of Amphibians and Reptiles of Wisconsin*. Milwaukee Publ. Mus., Milwaukee.

Eastern Massasauga Rattlesnake

- Beltz, E. 1990. Distribution and status of the eastern massasauga rattlesnake, *Sistrurus catenatus catenatus* in the United States and Canada. Pp. 26-31 In Johnson, B. and V. Menzies (eds.). Intl. Symp. and Wrkshp. on Conserv. of Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*). Metro Toronto Zoo, West Hill.
- Casper, G.S. 1992. Massasauga rattlesnake records collected by the Wisconsin Herpetological Atlas Project, 1986-1991. Pp. 80-85 In Johnson, B. and V. Menzies (eds.). Intl. Symp. and Wrkshp. on Conserv. of Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*). Metro Toronto Zoo, West Hill.
- Casper, G. 1995. *Wisconsin Herpetological Atlas Project*. Milwaukee Publ. Mus., Milwaukee.
- Chapman, B.R. and S.D. Casto. 1972. Additional vertebrate prey of the loggerhead shrike. *Wilson Bull.* 84:496-497.
- Christansen, J.L. and R.M. Bailey. 1990. The Snakes of Iowa. *Nongame Tech. Ser.* (1). Iowa Dept. Natural Resources, Des Moines.
- Cook, F.R. 1992. After an Ice Age: Zoogeography of the massasauga within a Canadian herpetological perspective. Pp.19-25 In Johnson, B. and V. Menzies (eds.). Intl. Symp. and Wrkshp. on Conserv. of Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*). Metro Toronto Zoo, West Hill.
- Hay, R. 1992. Summary report of management concerns and guidelines for the eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*) Pp.107-108 In Johnson, B. and V.

- Menzies (eds.). Intl. Symp. and Wrkshp. on Conserv. of Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*). Metro Toronto Zoo, West Hill.
- Hutchinson, B. C. Duchesne, and H. Schryver, 1990. GIS analysis of habitat use by massasauga rattlesnakes in Bruce Peninsula National Park. Pp.45-47 In Johnson, B. and V. Menzies (eds.). Intl. Symp. and Wrkshp. on Conserv. of Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*). Metro Toronto Zoo, West Hill.
- Lang, J.W. and D. Karns. 1988. Reptiles and Amphibians. P. 345 In B.Coffin and L. Pfanmuller (eds.). *Minnesota's Endangered Flora and Fauna*. Univ. Minnesota Press, Minneapolis.
- Mierzwa, K.S. 1992. Habitat utilization and status of the eastern massasauga rattlesnake, *Sistrurus catenatus catenatus*, in the Chicago region. Pp.66-70 In Johnson, B. and V. Menzies (eds.). Intl. Symp. and Wrkshp. on Conserv. of Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*). Metro Toronto Zoo, West Hill.
- Moran, T.R. 1992. Massasauga rattlesnake conservation in Missouri. Pp.78-79 In Johnson, B. and V. Menzies (eds.). Intl. Symp. and Wrkshp. on Conserv. of Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*). Metro Toronto Zoo, West Hill, Ontario.
- Oldfield, B. and J.J. Moriarity. 1994. *Amphibians and Reptiles Native to Minnesota*. Univ. Minnesota Press, Minneapolis.
- Reinert, H.K. 1981. Reproduction by the massasauga (*Sistrurus catenatus catenatus*). *American Midl. Nat.* 105:393-395.
- Reinert, H.K. and W.R. Kodrich. 1982. Movements and habitat utilization by the massasauga, *Sistrurus catenatus catenatus*. *J. Herpetol.* 16:162-171.
- Siegel, R.A. 1986. Ecology and conservation of an endangered rattlesnake, *Sistrurus catenatus*, in Missouri. *Biol. Conserv.* 35:333-346.
- Vogt, R.C. 1981. *Natural History of the Amphibians and Reptiles of Wisconsin*. Milwaukee Publ. Mus., Milwaukee.
- Weatherhead, P.J. and K.A. Prior. 1992. Preliminary observations of habitat use and movements of the eastern massasauga rattlesnake (*Sistrurus c. catenatus*). *J. Herpetol.* 26(4):447-452.

Sharp-tailed Grouse

- Ehrlich, P.R., D.S. Dobkin and D. Wheye. 1988. *The Birder's Handbook*. Simon and Schuster, New York.
- Faanes, C.A. 1981. *Birds of the St. Croix Valley, Minnesota and Wisconsin*. Publication (73). USFWS, Washington, D.C.
- Shively, M.M.R. and S. Temple. 1994. An Ecosystem Recovery Plan for Wisconsin Pine-Shrub-Grassland Ecosystems (Pine Barrens). Unpub. Rept., Madison.

Loggerhead Shrike

- Anderson, W.C. and R.E. Duzan. 1978. DDE residues and eggshell thinning in loggerhead shrikes. *Wilson Bull.* 90:215-220.
- Brooks, B.L. 1988. The breeding distribution, population dynamics, and habitat availability and suitability of an upper midwest loggerhead shrike population. M.S. Thesis, Univ. Wisconsin.
- Fruth, K.J. 1988. The Wisconsin loggerhead shrike recovery plan, *Wisconsin Endang. Resources Rept.* (38). Wisconsin Dept. Natural Resources, Madison.

- Gawlik, D.E. 1988. Reproductive success and nesting habitat of loggerhead shrikes, and relative abundance, habitat use, and perch use of loggerhead shrikes and American kestrels in South Carolina. M.S. Thesis. Winthrop Coll., Rock Hill, SC.
- Hall, S.P. and H.E. LeGrand, Jr. 1989. Element stewardship abstract for *Lanius ludovicianus*, loggerhead shrike. North Carolina Nat. Heritage, Dept. Natural Resources and Comm. Dev., Raleigh.
- Hallowell, A. and C. Gieck. 1987. Loggerhead Shrike (*Lanius ludovicianus*), *Life Tracks* #ER-525, Wisconsin Dept. Natural Resources, Madison.
- Hands, H.M., R.D. Drobney, and M.R. Ryan 1989. Status of the loggerhead shrike in the northcentral United States. USFWS, Twin Cities.
- Kridelbaugh, A.L. 1983. Nesting ecology of the loggerhead shrike in central Missouri. *Wilson Bull.* 95:303-308.
- Mizell, K. 1993. The impaling behavior of the loggerhead shrike in eastern Texas. M.S. Thesis, Austin State Univ., Austin.
- Novak, P. 1986. Possible factors influencing the distribution, status and abundance of the loggerhead shrike (*Lanius ludovicianus*) in New York State. *The Kingbird* 36:177-181.
- Prescott, D.C. and D.M. Collister. 1993. Characteristics of occupied and unoccupied loggerhead shrike territories in southeastern Alberta. *J. Wildl. Mgmt.* 57(2):346-352.
- Robbins, S.D., Jr. 1991. *Wisconsin Birdlife*. Univ. Wisconsin Press, Madison.
- Soulen, T.K. 1992. The summer season: 1991. *Passenger Pigeon* 54(1):85-94.
- Soulen, T.K. 1993. The summer season: 1992. *Passenger Pigeon* 55(1):81-92.
- Soulen, T.K. 1994. The summer season: 1993. *Passenger Pigeon* 56(1):73-82.
- Telfer, E.S. 1987. Recovery plan for loggerhead shrike, Draft #1., Canadian Wildlife Service, Edmonton.
- Yosef, R. 1992. Territoriality, nutritional condition, and conservation in loggerhead shrikes (*Lanius ludovicianus ludovicianus*). Ph.D. Thesis. Ohio State Univ., Columbus.

Kirtland's Warbler

- Ehrlich, P.R., D.S. Dobkin and D. Wheye 1988. *The Birder's Handbook*. Simon and Schuster, New York.
- Hale, J.B. 1979. Kirtland's warbler in Wisconsin: Perf. Rept. Wisconsin Dept. Natural Resources, Madison.
- Harrison, H.H. 1984. *Wood Warblers' World*. Simon and Schuster, New York.
- Kirtland's Warbler Recovery Team, 1976. Recovery Plan. USFWS.
- Mangold, L. and J. Richter 1994. 1994 Kirtland's Warbler Summary. USFWS, East Lansing.
- Mayfield, H.F. 1992. Perspective on the Kirtland's warbler. In briefing book on Kirtland's Warbler Pop. Hab. Viability Assess. Wrkshp. Captive Breeding Specialist Group, IUCN Species Survival Commission.
- Morse, N.H. 1989. *American Warblers: An Ecological and Behavioral Perspective*. Harvard Univ. Press, Cambridge.
- Probst, J.R. and J. Weinrich 1993. Relating Kirtland's warbler population to changing landscape composition and structure. *Landscape Ecol.* 8(4):257-271.
- Robbins, S.D. 1991. *Wisconsin Birdlife*. Univ. Wisconsin Press, Madison.
- Ryel, L.A. 1981. Population change in the Kirtland's warbler. *Jack Pine Warbler* 59(3):76-91.
- Soulen, T.K. 1992. The summer season: 1991. *Passenger Pigeon* 54(1):85-94.
- Soulen, T.K. 1993. The summer season: 1992. *Passenger Pigeon* 55(1):81-92.

- Sykes, P.W., C.B. Kepler, D.A. Jett and M.A. DeCapita. 1989. Kirtland's warbler on the nesting ground during the post-breeding period. *Wilson Bull.* 101(4):545-558.
- Tessen, D. 1980. Exceptional Record Doc. Wisconsin Soc. Ornithol. July 27, 1980.
- Tilghman, N. 1978. Range determination and study of the Kirtland's warbler in Wisconsin: Final Rept. Wisconsin Dept. Natural Resources, Madison.
- Weinrich, J. 1994. The Kirtland's warbler in 1993. Wildlife Division Rept. (3201). Michigan Dept. Natural Resources, Madison.
- Woodard, D.W. 1980. Kirtland's Warbler. Coastal Ecosystems Project. Office of Biological Services, USFWS, Slidell.

B. "Karner Blue Management Implications for Some Associated Lepidoptera of Wisconsin Barrens" by R.J. Borth with contributions from G.J. Balogh, T.S. Barina, L.A. Ferge, H.L. Kons, Jr., M.C. Nielson, J.C. Parkinson and A.B. Swengel.

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Introduction

Barrens ecosystems were once dependent on natural disturbance to maintain a diverse community of flora and fauna, but are becoming increasingly dependent on informed management to preserve early successional stages. In 1992 the Karner blue butterfly, which is largely associated with barrens habitat, was listed as a federally endangered species by the U. S. Fish and Wildlife Service (USFWS, 1992). After conducting surveys to better understand this species and its remaining stronghold in Wisconsin barrens, a partnership between the Wisconsin Department of Natural Resources and various public and private interests was formed to develop a habitat conservation plan (HCP) pursuant to Section 10 of the Federal Endangered Species Act. Partnership goals were expanded to encourage consideration for other barrens associated species that co-occur with the Karner blue and could therefore be impacted by Karner blue management. This report is designed as a reference summarizing current information on the basic biology of ten other species with varying degrees of association with the barrens community in Wisconsin for those interested in protecting other lepidoptera when managing for the Karner blue.

The Wisconsin barrens are associated with sandy soils and consist of a continuum of communities stretching across the state from southwestern treeless sand barrens and central oak barrens to northwestern jack pine and burr oak barrens. Wild lupine (*Lupinus perennis*), the Karner blue's exclusive hostplant, achieves its maximum presence in the oak barrens (Curtis, 1959). The Karner blue's dependence on ephemeral lupine populations, which are subject to succession and have historically been dependent on wildfires to open new sites of invasion, implies a dynamic mosaic of Karner blue populations with some going extinct as others colonize new sites (Givnish, Menges and Schweitzer, 1988).

The ten species covered in this report were initially treated by Kathryn Kirk in a November, 1996 report to the U.S. Fish and Wildlife Service entitled "The Karner Blue Community: Understanding and Protecting Associated Rare Species of the Barrens." Reviews which questioned certain information in that report, including comments based on broad geographical generalizations not always applicable to Wisconsin, were the catalyst for this report, which substantiates summarized charts for these same 10 species with detailed field observations primarily by Wisconsin lepidopterists and photos in natural habitat by the author. Each of these 10 species has some association with barrens and is classified as either endangered, threatened or "of special concern" in Wisconsin. Because there are varying degrees of overlap between habitat occupied by Karner blues and these other species there was no consensus among the contributors on which species to include (aside from the Frosted elfin and Persius dusky wing which are host specific on lupine). The fact that only one moth species is included is indicative that current knowledge of moths and their habitat associations is even more limited than for butterflies.

Certain Karner blue sites may not contain any of these other species, while other barrens habitats may include various combinations of species and no lupine or Karner blues. The HCP can benefit associated species where they co-occur with the Karner blue, but it must not be viewed as an overall strategy to preserve the entire barrens ecosystem in Wisconsin or these associated lepidoptera and other insects. This would require an ecosystem based approach including many sites where the Karner blue is absent. Despite many unknowns about barrens species and their habitat preferences, conservation strategies and management must cautiously proceed.

Species Accounts

The following species accounts are based on current but incomplete information as these species (especially their immature stages) have not been given the same attention as the Karner blue. When Wisconsin information is unavailable, other sources are cited, but these should be used carefully as there may not be consistency between geographic regions. Species identifications were the responsibility of the individual contributors.

Range Maps: The range maps provide each associated species' documented range in Wisconsin based on voucher specimens or photos from the following sources: George Balogh, Thomas Barina, Susan Borkin, Robert Borth, Leslie Ferge, Hugo Kons Jr., Judy Maxwell, James Parkinson, Thomas Rocheleau, Ann Swengel, the Milwaukee Public Museum (identifications checked by R. Borth) and published accounts by Kuehn (1983). The Karner blue data was obtained from the HCP. Figures of each species (actual size) are also shown. It is anticipated that further survey work will yield additional county records.

Life History: The "Life History" summary provides information on the life stages of each species including the Karner blue. Because little basic life history research on the immature stages is available for these species in Wisconsin, this chart and additional comments on the egg, larvae and pupae rely largely on published studies from outside the state. The life cycle may vary between seasons due to differences in weather and other factors as well as between different parts of the state.

Known Larval and Adult Resources: Typical adult nectar sources, which are based primarily on the observations of Wisconsin lepidopterists contributing to this report, and larval host plants are listed. Frequent Karner blue nectar resources are also provided from Bleser (1994).

Status: Status refers to current perceptions, which may be biased by inadequate survey, of how local/restricted in habitat and how numerous a species may be where present in Wisconsin. Ambiguous or inconsistently used terms such as "rare" are deliberately avoided. There is an enormous amount of interesting habitat in Wisconsin that has never benefited from the attention of a lepidopterist. Time and again various species are proclaimed "rare" when as Ferge (1997) notes "what is rare is the intense and time consuming effort to locate and document new populations in the field."

Similar Species: This section highlights other species, using scientific names, that make identifications difficult due to similar appearance and overlapping flight season. Separation from similar species is best learned by studying either an institutional or personal reference collection with large series of similar species where inter and intraspecific variability (e.g. genetics/environment, sex, season, geography, age, etc.) can be studied in detail. In addition, Scott (1986) has color plates, illustrating upper and underwing surfaces, and descriptions of each of the 9 butterfly species covered here. Voucher specimens or photos showing diagnostic features should be obtained to validate reported occurrences.

Habitat: This section discusses types of habitat where the associated species have been documented in Wisconsin. While the habitat requirements of each species actually include the habitat needs of both adult and immature stages, most observations are based only on the adults.

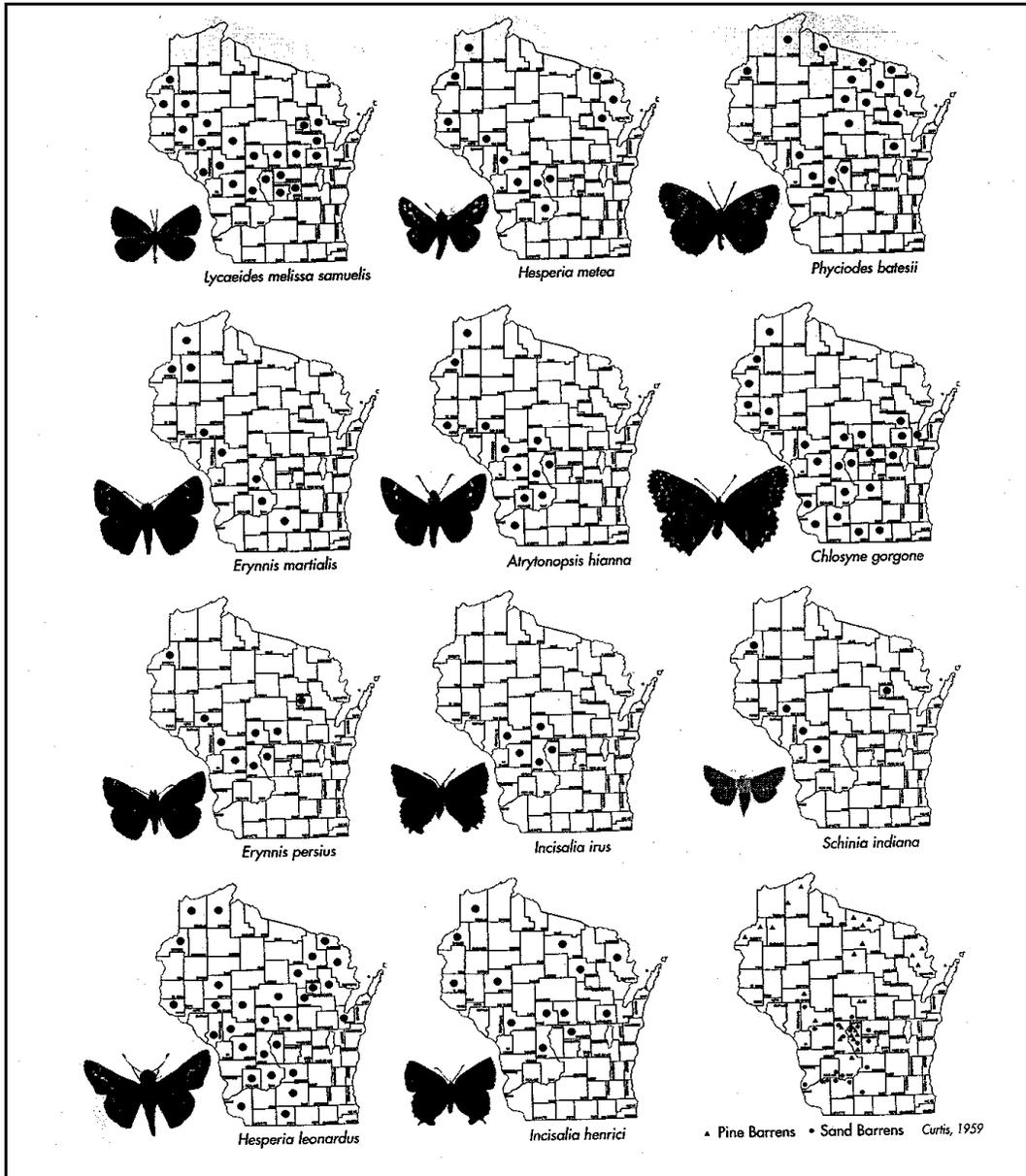
Knowing these habitat preferences might help predict the possible occurrence of these species in a given site (which should be established by actual survey) and may be useful in designing an appropriate management strategy.

Behavior: This section covers observed behavior, limited to that of adults, with emphasis on Wisconsin.

Dispersal: Dispersal may be motivated by individuals seeking food, mates, or egg laying sites or in some cases it may be migratory (Lane, 1997). For the dynamic landscape model (Givnish et al, 1988) (local extinctions and recolonizations as areas open due to disturbance) to apply, species must display sufficient dispersal ability. This section summarizes dispersal ability inferred by indirect evidence such as records far from known locations of larval hosts or records in areas where a species is not found persistently despite intensive survey. Studies dedicated to dispersal such as King's (1996) Karner blue study have not been done on these species.

Management: This section summarizes the limited information available on management, using Wisconsin data when possible. Caution must be applied when using information from another region. Ideally management should strive to maintain the habitat required for each life stage without causing adverse impacts to populations of other barrens associated species.

Range Maps



Relationships and Strategies

	Rough Estimate of Co-occurrence with Karner blue (1)	Preferred Habitat within Barrens Community	Management Strategies (2) (Vary depending on Site)	
			Recommended	Discouraged
Mottled dusky wing <i>Erynnis martialis</i>		Ceanothus area: patches of bare ground narrow oak branches for perching	Mowing sections of habitat during dormant season if Ceanothus is present	Spring, summer burns Extensive burns
Persius dusky wing <i>Erynnis persius</i>		Lupine area: patches of bare ground narrow oak branches for perching	Late season mowing or moderate methods to maintain openings	Intensive clearing of woody species
Leonard's skipper <i>Hesperia leonardus</i>		Open to scrub forest: purple flowers for nectar esp. liatris	Maintenance of openings	Burning more than a small part of breeding habitat
Cobweb skipper <i>Hesperia metea</i>		Grassy opening: bluestem grasses for perching birdfoot violet available for nectar	Cool, fast moving, patchy fires	Intensive fire rotation Burning more than a small part of breeding habitat
Dusted skipper <i>Atrytonopsis hianna</i>		Sandy grassland: bluestem grass present puccoon available for nectar	To date no active management strategy has been found to be of benefit	Mowing and intense fire
Frosted elfin <i>Incisalia irus</i>		Dense lupine area: some shading from canopy (savannah aspect)	Unintensive late season mowing and timber cutting	Virtually any fire management regime
Henry's Elfin <i>Incisalia henrici</i>		Scrub pine/oak barrens mosaic: some ground cover of heaths Woodland edges	Unintensive cutting	Over-clearing or thinning of woody species Frequent burning
Tawny crescent <i>Phyciodes batesii</i>		Various dry forest edges or barrens /scrub forest	Unknown	Unknown
Gorgone checkerspot <i>Chlosyne gorgone</i>		Dry open areas: Yellow flowers for nectar Prairie/barrens composites for larval hosts	Unknown	Extensive burning, mowing and cutting
Phlox moth <i>Schinia indiana</i>		Dense downy phlox area	Maintenance of openings and edges	Intensive burning

(1) Degree of overlap provides information on how highly the species on the left (indicated by first initial of common name) is associated with the Karner blue (K). For example, *E. persius* and *I. irus* are highly associated with Karner habitat while *P. batesii*, *C. gorgone*, *I. henrici*, and *H. leonardus* are significantly less associated with the Karner blue. See species accounts.

(2) Recommendations are in need of further research. If no management strategy is clearly beneficial it may be prudent to leave significant portions of occupied habitat unmanaged until more is known.

Life History

Species	Immatures:					Egg	Larva	Pupa	Reference
	Adults	Egg	Larva	Pupa	Reference				
	April	May	June	July	Aug	Sept	Oct-March		
Kanner blue (<i>Lycaeas melissa sarouelsi</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Ding, 1994)
Mottled dusky wing (<i>Erynnis marialis</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Scott, 1988)
Persius dusky wing (<i>Erynnis persius</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Opler & Krizek, 1984) (Karpulson, pers. comm.)
Leonard's skipper (<i>Hesperia leonardus</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Opler & Krizek, 1984) (Nielsen, 1997)
Cobweb skipper (<i>Hesperia metis</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Heizman, 1974)
Dusted skipper (<i>Atrypanopsis hianna</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Heizman, 1974)
Frosted skipper (<i>Trasalia flou</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Svenngel, 1996)
Henry's elfin (<i>Trasalia henrici</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Nielsen, 1995)
Tawny Crescent (<i>Phycodes boreas</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Opler & Krizek, 1984)
Gorgone checker-spot (<i>Chlosyne gorgone</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Williams, 1995)
Phlox moth (<i>Sobria indiana</i>)	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	(Hardwick, 1958) (Schweitzer 94)

Some overlap between stages occurs

Suspected Larval and Known Adult Resources in Wisconsin

Suspected Larval & Known Adult Resources in Wisconsin											
Larval Host	L. melissa	E. * martialis	E. persius	H. * leonardus	H. * metea	A. * hianna	I. irus	I. * henrici	P. * batesii	C. gorgone	S. * indiana
Asters - <i>Aster sp.</i>									X		
Coneflower - <i>Ratibida pinnata</i>										X	
Big bluestem <i>Andropogon gerardi</i>				X	X	X					
Black-eyed susan - <i>Rudbeckia hirta</i>										X	
Blueberry- <i>Vaccinium sp.</i>								X			
Downy phlox- <i>Phlox pilosa</i>											X
Jersey tea- <i>Ceanothus americanus/C. ovatus</i>		X									
Little bluestem - <i>Schizachyrium scoparium</i>				X	X	X					
Maple-leaf viburnum - <i>Viburnum acerifolium</i>								X			
Sunflower- <i>Helianthus</i>										X	
Wild lupine - <i>Lupinus perennis</i>	X		X				X				
Adult Nectar Source											
Asters - <i>Aster sp.</i>	X	X		X							
Birdsfoot violet - <i>Viola pedata</i>					X						
Black-eyed susan - <i>Rudbeckia hirta</i>	X									X	
Blazing star - <i>Liatris sp.</i>	X	X		X							
Bush houstonia - <i>Houstonia sp.</i>		X									
Butterfly milkweed - <i>Asclepias tuberosa</i>	X									X	
Choke cherry - <i>Prunus virginiana</i>								X			
Cinquefoil - <i>Potentilla sp.</i>	X									X	
Dewberry- <i>Rubus flagellans</i>	X					X					
Downy phlox- <i>Phlox pilosa</i>		X				X					X
Flowering spurge- <i>Euphorbia corollata</i>	X										
Goldenrod - <i>Solidago sp.</i>	X										
Heaths - Fam. ericaceae		X						X			
Hoary alysum - <i>Berteroa incana</i>	X										
Horsemint- <i>Monarda punctata</i>	X										
Knapweed - <i>Centaurea biebersteinii</i>	X										
Leadplant - <i>Amorpha canescens</i>	X										
Orange hawkweed- <i>Hieracium aurantiacum</i>	X		X						X	X	
Puccoon - <i>Lithospermum sp.</i>						X				X	
Rock cress - <i>Arabis lyrata</i>	X	X	X		X			X		X	
Sunflower- <i>Helianthus</i>	X			X						X	
White sweet clover - <i>Melilotus alba</i>	X										
Wild bergomont - <i>Monarda fistulosa</i>	X			X							
Wild lupine - <i>Lupinus perennis</i>	X		X			X	X				
Wild strawberry - <i>Fragaria virginiana</i>					X	X					
Other											
mudpuddles	X		X	X			X		X	X	
Urine, salts		X						X	X	X	
Dung	X								X		

* Larval host data from out-of-state records

Mottled Dusky Wing *Erynnis martialis* Scudder

Hesperiidae Pyrginae

Status - This species is local and dependent on extensive barrens habitats in central Wisconsin as well as in the northwestern counties where it may be numerous.

Similar Species - Several other *Erynnis* species can be heavily mottled, making *E. martialis* especially prone to misidentification. Summer brood individuals are easier to identify, as not all *Erynnis* species have second broods.

Habitat - Many adults were seen in a scrub forest/barrens mosaic and adjacent open sandy fire lane by Kons and Borth in the vicinity of the Namekagon barrens, Burnett County, but observations decreased markedly out into the contiguous open, frequently burned (every 4-6 years), treeless barrens (1997). Ferge (1989) reported the species as absent in these burn units.

Behavior - These behavioral observations were made by Kons and Borth in the vicinity of the Namekagon barrens (1997). In both the scrub forest/barrens mosaic and in the open, adults usually fly close to the ground and bask in sunlight with wings outstretched and forewing tips curved slightly inward. Numbers found peaked during intense sunny conditions when individuals were observed patrolling or visiting moist sand to imbibe fluids, rich in salts. Under cloudier conditions, *E. martialis* was generally not found on the open sandy fire lane but would be in the scrub forest barrens mosaic habitat perching up to several feet above the ground on burr oaks and small shrubs. During sunny intervals, some individuals would pursue approaching *Erynnis* or *Incisalia*.

Dispersal - Although dispersal is unknown, this species is a strong flier typical of *Erynnis*.

Management - While a suspected host plant redroot is able to withstand fire (due to the huge underground burl-like root stock) (Curtis, 1959), the larval leaf nest and pupae are above ground rendering the species vulnerable to spring burns. In the East, Schweitzer suggests mowing sections of habitat during the dormant season if *Ceanothus* is present (1994) to protect second brood larvae. Kons and Borth (1997) recommend that in the vicinity of Namekagon barrens maintenance of preferred habitat includes both the scrub forest/barrens mosaic with small oaks and open sandy areas in addition to *Ceanothus americanus*.

Persius Dusky Wing *Erynnis persius* Scudder

Hesperiidae Pyrginae

Status - This species is found in some numbers in a subset of Karner blue sites but it is not as numerous as the Karner blue. Many Karner blue sites have not yet been surveyed for *E. persius*.

Similar Species - *Erynnis persius* is very difficult to distinguish from *E. lucilius* (whose foodplant, Columbine, is found in dry sites throughout central Wisconsin) and *E. baptisiae* (which can also use lupine as a larval host (Schweitzer, 1994)). It may also be mistaken on the wing for the more abundant dusky wings with which it flies. Because this species cannot be reliably separated in the field or by photograph (Schweitzer, 1994a, Nielsen, 1997) it should be documented with voucher specimens.

Habitat - This species is found primarily in openings or perching on sparsely vegetated sandy ground. At the Emmons Creek Public Hunting Area in Portage County (Kons, 1997) *E. persius* adults were found principally in areas with sparser vegetation where open sandy and dormant grass covered ground was interspersed with immature scrub oaks while Karner blue adults were numerous wherever lupine was present at the site (including densely grassy areas). *E. persius* was absent at two sites in Portage County where Karner blues were numerous and these sites lacked the combination of open sparsely vegetated ground and small oaks (Kons, 1997). Maxwell and Ferge report the species in both open and shady oak woodland habitat at Fort McCoy in Monroe County (1994).

Behavior - *E. persius* may pause from its generally quick and erratic flight to bask in sandy sparsely vegetated areas or to nectar on low growing blueberry (pers. obsv., 1997). At Emmons Creek under cloudy conditions Kons observed *E. persius* and *E. brizo* landing on small diameter scrub oak branches and exhibiting "cryptic perching behavior" where they would wrap their wings around a branch covering from half to the entire circumference of the branch with their wings and become very difficult to detect except at very short range. "Cryptic sleeping posture" of *E. brizo* was previously reported by Burns (1969). Kons has found that this species, like the Karner blue, flies through areas of closed forest (1997). In Ohio, *E. persius* will not oviposit on shaded plants (Iftner et al., 1992).

Dispersal - Dispersal is apparently high as two specimens were found by Borth and Kons in Burnett county at least five miles from known lupine plants (Kons and Borth, 1997). At Emmons Creek, Kons inferred that this species dispersed through closed forest based on finding small numbers of *E. persius* in a barrens opening surrounded by forest which contained only 1 lupine plant (1994 and 1995). Kons also found one individual along a road about one mile from the lupine area.

Management - Management that may be beneficial for Karner blues, which may be numerous in sites where this species is absent, may not benefit *E. persius* unless the above habitat requirements are maintained. Shrubs causing excessive shade should be removed and Schweitzer recommends mowing during the fall - no earlier than mid-July (1986). While it was found in recently burned areas at Fort McCoy (Maxwell and Ferge, 1994), until more is known fire should be used sparingly in sites occupied by *E. persius*. Apparently no prior burning or active management was being conducted at Emmons Creek barrens where Kons found many *E. persius* during 1993 and 1994.

Leonard's Skipper *Hesperia leonardus* Harris

Hesperiidae Hesperinae

Status - Of the three bluestem-feeding skippers covered in this report *H. leonardus* is the most widespread and abundant (Parkinson, 1997). It can be locally common in prairie and barrens habitats and can also be found in more degraded sites.

Similar Species - *H. leonardus* also closely resembles *H. comma laurentina* which also flies in barrens, generally north of Karner blue range. *H. leonardus* is also somewhat similar in size and coloration to some other skippers.

Habitat - Although it is frequently found in barrens, associated with stands of bluestem grasses, *H. leonardus* appears to be more tolerant of habitat degradation than *H. metea* (Swengel, 1994b). Males may be found at roadside puddles and patrolling near concentrations of *Liatris aspera* (Maxwell and Ferge, 1994, Parkinson, 1997). This species comes to moisture in numbers along dirt roads through moist forest habitat in northeastern Wisconsin (Kons, 1997, Parkinson, 1997). Nielsen has found *H. leonardus* nectaring in moist meadows and old fields in Michigan (1997).

Behavior - Kons has observed this species primarily on purple flowers, including liatris and asters (Kons, 1996). Nielsen recorded a Michigan observation of a *H. leonardus* being seized by a robber fly (Asilidae) species, *Proctacanthus milberti*, as it flew from feeding on a liatrus flower (1977). This skipper is a strong flier and is often quite wary (pers. obsv.). Nielsen has observed it ovipositing on *Danthonia spicata* in pine barrens in Otsego County, Michigan (1997).

Dispersal - *H. leonardus*' dispersal ability may be substantial. Its appearance in numbers on a dirt road through a moist forest in Marinette County and along the grassy shoreline of a manmade lake at Lake DuBay Park in Portage County may provide evidence either that this species may be dispersing from its breeding habitat or that some populations are not dependent on barrens or prairie habitat (Kons, 1997).

Management - *H. leonardus* showed a very negative effect from fire which may persist for 3-5+ years (Swengel, 1995). Schweitzer also feels it is quite vulnerable to fire, though cool, fast moving fires are likely less lethal (1985).

Comments - Individuals found in the Wisconsin Karner blue range belong to the subspecies of *Hesperia leonardus leonardus*.

Cobweb Skipper *Hesperia metea* Scudder

Hesperiidae Hesperinae

Status - While this species is of localized occurrence it can be found in considerable numbers over extensive barrens in northern Wisconsin.

Similar Species - Its early flight distinguishes it from many other skippers, but the flight overlaps with *Amblyscirtes vialis* and *A. hegon*, the latter of which is similar in size and coloration to female *H. metea*.

Habitat - *H. metea* occurs only where bluestem grasses (*Andropogon* spp.), the larval food plants, are a consistently dominant element of the herbaceous vegetation. Possible sites may be recognized in the fall by the red-brown cast of bluegrass stems forming a dense cover (Shapiro, 1965). It generally flies in dry, open, sterile bleached out grassy areas, but may also be found in areas with some scattered trees (Borth, Kons, Barina pers. obsv.). Within the barrens habitat in Wisconsin, locations with abundant Karner blue butterflies were not found favorable for *H. metea* by Swengel (1994b). Ferge has found the species at Namekagon Barrens in openings of jack pine-oak scrub, and along the fire breaks at the edges of areas managed with fire where nectar sources were most abundant (1989).

Behavior - As described in (Kons, 1995), Borth and Kons observed males frequently perching near the tips of dead grass blades in grassy open areas. The skippers were very wary and difficult to approach and would frequently fly up in pursuit of other males patrolling over the grass level. These chases would occur at an accelerated rapid flight, rising up high over the barrens. Because *H. metea* is small and often flies low to the ground in the grass litter, it is difficult to follow in flight. Females flew slower and low to the ground where they would occasionally nectar on birdfoot violet. In Jackson County in shorter grass habitat both males and females flew low to the ground and nectared on birdfoot violet (pers. obsv.).

Shapiro feels that a definite transient territoriality exists where males feed in early morning and then extend their range in late morning, each occupying a specific site and normally returning to it when disturbed (1965). Shapiro observed both sexes flying into the shade for

short periods only (1965). Kons found only females on dates ranging from 3 to 10 June during 1993 and 1995 in Marinette County, but earlier in the season on 21 May, 1994 males outnumbered females there (1997).

Dispersal - Dispersal is unknown but this species is a strong and rapid flier.

Management - *H. metea* requires enough management so that little bluestem, which is an early successional species, is not shaded out by woody growth. Although it is not known how deep larvae tunnel underground, in the East Schweitzer has found survival of *H. metea* to be good after cool, fast-moving fires (1985). Shapiro found the skippers in burned-over sites the second year following wildfire which had allowed the bluestem grasses to become dominant (1965) but notes its disappearance once the grass is shaded out by trees or is replaced by other grasses. Swengel found wildfires more favorable than prescribed burning (1997a).

Dusted Skipper *Atrytonopsis hianna* Scudder

Hesperiidae Hesperiinae

Status - This species can be found in numbers, locally, in sandy barrens areas in western Wisconsin. The species appears to be absent from the eastern portion of the Karner blue range in Wisconsin.

Similar Species - Its early flight is helpful for identification but it may be mistaken for other larger dark skippers such as *Thorybes* species.

Habitat - *A. hianna* has been found on dry open sand barrens with sand blowouts as well as open savanna areas and edges (pers. obsv.). Parkinson has seen this species in Wisconsin only where puccoon and phlox are found (1997). The Swengels found no abundance correlation with the Karner blue (Swengel and Swengel, 1997).

Behavior - In sunny weather Shapiro found it to be a much more active and aggressive species than *H. metea* (1965). He found that feeding occurs in early morning and late afternoon and that females fly low, generally 6-8 inches above the ground. Balogh has observed it in Eau Claire County nectaring on the same roadside patch of phlox where a pair of *S. indiana* was found (1987).

Dispersal - Dispersal is unknown in Wisconsin but Shapiro observed in the East that *A. hianna* “wanders a good deal more than *H. metea*” (1965).

Management - Pupation is up to three inches above the ground and larvae are found up to several feet above the ground (Heitzman, 1974) which probably explains its aversion to mowing and un-intensive cutting (Swengel, 1997). Because succession is slower on hot sandy soils it may be that infrequent limited management is best here.

Comment - Females emerge six days after the males and Shapiro believes the following ten days to be the optimum survey period in Pennsylvania (1965).

Frosted Elfin *Incisalia irus* (Godart)

Lycaenidae Theclinae

Status - Swengel has published a detailed account of *I. irus* (1996), which is the basis of much of this discussion and confirms its relatively low numbers (less than a 1:20 ratio compared to Karner Blues) even in its specialized habitats (Swengel and Swengel, 1997). It is clearly the least numerous of Wisconsin’s lupine feeding butterflies where it inhabits a small subset of Karner blue sites. While all of Swengel’s *I. irus* sites also supported Karner blues, her findings also suggest a fair degree of niche segregation, as discussed in Shapiro (1974).

Similar Species - It is one of 5 elfins recorded from Wisconsin all of which fly in the spring and may occur in barrens. It is most likely to be confused with *I. henrici* or *I. polios*.

Habitat - Frosted elfins are rarely found in expanses of lupines blooming profusely in wide open, sunny places, but instead are found in somewhat shadier places with enough sun for lupines to flower and enough shade to prolong flowering. Swengel hypothesizes that greater local canopy diversity and higher canopy density (until lupine flowering drops markedly) would be favorable to prolong the flowering season, all the better to ensure adequate food throughout larval development (1996b). Some canopy may also be beneficial during drought periods. Typically a large patch or series of smaller patches of high-density lupine was required. Swengel (1994b)

and Parkinson (1997), respectively, have found the species in patches of high-density lupine in woods openings and within 10 feet of canopy cover in a more open landscape.

Behavior - The primary flight is just prior to peak lupine bloom (Swengel, 1996b). Adults exhibit a characteristic low flight with frequent perching on or near clumps of lupine in scattered oak openings (Balogh, pers. comm. 1996). Swengel found that individuals sometimes perched and flew in the shade, but they usually occurred in sunny patches (if the sun was shining) even in areas of high-density canopy (1996). Paired spiral intraspecific flights emanated vertically, sometimes well out of sight (Swengel, 1996b). Some exhibited heat minimizing perching behaviors (angling to reduce its shadow, perching within shaded vegetation) at temperatures over 27 degrees C. (Swengel, 1996b). Balogh observed perching to maximize sun exposure (angled wings sideways) on cool sunny days in Michigan (1997).

Dispersal - Swengel found most on lupine with nearly all within .5 m of lupine. Schweitzer (1994a) has found adults in the East on new lupine growth within 2 weeks of a burn.

Management - Management that is beneficial to Karner blues may be unsuitable for *I. irus*. For *I. irus* it is critically important to maintain not only abundant lupine but also dappled or partial sun (Swengel, 1996c). Unintensive late season mowing and timber-cutting are potentially valuable strategies. Areas managed with late-season mowing and with only part of the habitat cut each year appear to benefit the species according to Swengel's observations at several rights-of-way sites in Wisconsin (1994). Her best and most consistent *I. irus* site was managed with late-season mowing no more frequent than one cut/year, with only a partial cutting of the habitat in many years (1996b).

Fire management of entire sites is extraordinarily averse for *I. irus*, is at least as harmful as no management at all, and should be distinguished from wildfire effects on *I. irus* populations (Swengel, 1996b). Significantly more butterflies have been found in areas burned by wildfire over five years previously (Swengel, 1996b). Wildfire areas are surrounded by habitat that have been left unburned for much longer than are fire-managed areas where the entire habitat is burned by units on a rotational basis. May fires could be particularly detrimental by altering lupine phenology and flower abundance as well as direct egg mortality (Swengel, 1994). Numbers significantly increased with less frequent fire and with non-fire managements, especially mowing (Swengel and Swengel, 1997).

Henry's Elfin *Incisalia henrici* (Grote and Robinson)

Lycaenidae Theclinae

Status - This species has generally been found locally in northwestern Wisconsin north of Karner blue habitat, where it may be numerous in oak-pine scrub forest/barrens mosaic. It has been found infrequently in the central or northeastern parts of the state.

Similar Species - It can be confused with more numerous *Incisalia polios*, *I. niphon* and *I. augustinus* with which it often flies. It is similar to *I. irus* (above), especially if worn, and to a lesser extent *I. augustinus*.

Habitat - *I. henrici* has been found in considerable numbers in the extensive heath-covered oak and jack pine forest/barrens mosaic habitat that occurs to the north of the Namekagon barrens in Burnett County (Kons and Borth, 1997). Two concentrations were noted here within the scrub forest/barrens mosaic (Kons and Borth, 1997), however some individuals were found throughout the mosaic. Individuals were rarely found on an adjacent open fire lane, and never on the open frequently burned barrens. Only one individual was found by Borth and Kons over 2 years at the Dunbar barrens, which lack scrub forest /barrens mosaic and contain primarily open barrens and closed forest (Kons, 1997). In addition to openings in oak-heath scrub barrens, individuals have been recorded in bogs in northern Wisconsin (Ferge, 1997) and moist forest in Outagamie and Portage Counties (Kons, 1997).

Dispersal - Some evidence of its potential dispersal ability is suggested by only single individuals being found by Kons in an Outagamie County swamp forest and by James Kruse in swamp forest at Schmeekle Reserve in Portage County despite intensive searching during subsequent seasons (Kons, 1997).

Behavior - Its spiraling flight can be rapid and erratic, but it may be approachable when flying slow and close to the ground (Kons and Borth, 1997). Repeated perching behavior towards the ends of bur oak or shrub branches occurs generally below six feet in height (Kons and Borth, 1997). Nielsen has observed *I. henrici* (before full leaf development along Michigan's sandy trails and narrow wooded sunny openings) as they perched on small shrubs, on dried leaves and twigs or on bare sand (1985). Pairs may spiral together at some height and one individual was even seen to land roughly 15 feet up in a jack pine (Kons and Borth, 1997). *I. henrici* may rub its hindwings together (Iftner, 1992), which is characteristically done by members of the hairstreak group (Scott, 1986) to simulate the head and antennae, to draw the attention of predators to the wings instead of the head (false head hypothesis).

Management - The association of the adults with small trees or shrubs as observed in the vicinity of the Namekagon barrens argues against excessive clearing of woody species or frequent burning in occupied habitat (Kons and Borth, 1997). Some thinning may be necessary as no individuals were found in nearby areas allowed to succeed to dense canopy (Kons and Borth, 1997). *Viburnum*, which has been identified as a larval host shrub in Michigan, is found in wooded edges (Balogh, 1997).

Tawny Crescent *Phyciodes batesii* Reakirt

Nymphalidae Nymphalinae

Status - Many contributors questioned this species' inclusion in the report due to its very minimal association with the Karner blue and secure and widespread status especially in the northern part of the state beyond lupine's range. It may be numerous in extensive areas of similar habitat.

Similar Species - This species is very similar in appearance to *P. pascoensis* and *P. tharos* (the latter is infrequent to absent in northern Wisconsin) so voucher specimens are needed. Males are more readily identified than females.

Habitat - In the vicinity of the Namekagon barrens, it was numerous in more open barrens/scrub forest habitat and along an open sandy fire lane at the edge of this habitat (Kons and Borth, 1997). In some barrens areas, including extensive sites in northeast Wisconsin, it is numerous at the edge of dry forests which may maintain some degree of barrens character (Kons and Borth, 1997). In Marinette County the species is much more common in the dry forest edges than on nearby open barrens (Kons, 1997).

Behavior - Its flight is generally low to the ground, and not rapid unless disturbed (Kons and Borth, 1997). Males in particular congregate over sandy roads where they feed on dung and urine (Kons, pers. comm.).

Dispersal - It is difficult to determine the degree of dispersal as the species is often widespread and difficult to distinguish from other species. Adults may disperse out of their breeding habitat for moisture and nectar (Ferge, 1997).

Management - Although no information on management was found it would be useful to maintain areas of asters, potential larval hosts, along forest edges and in the barrens.

Comments - The author feels it would be unwise to list this species as federally threatened or endangered due to its widespread occurrence in Wisconsin and great similarity to other species.

Gorgone Checkerspot *Chlosyne gorgone* Hubner

Nymphalidae Nymphalinae

Status - This species is apparently more associated with barrens and prairies in Wisconsin than throughout the Great Plains where it is found in a variety of habitats. It can be found in numbers, locally.

Similar Species - The underside hindwing pattern is distinctive.

Habitat - In Wisconsin, lepidopterists noted that the species inhabits both barrens and dry prairies (Ferge, 1990). It may be numerous along roadsides or agricultural areas in southwestern Wisconsin in certain years (pers. obsv.) or colonize prairie plantings (Kons, 1997). The Swengels found no correlation between Karner blue and *C. gorgone* abundance (Swengel and Swengel, 1997).

Behavior - Swengel (1995) has found this species nectaring primarily on orange-yellow flowers (31 out of 40 nectar records). This species usually flies low to the ground and in taller prairies flies just over the vegetation (Kons, pers. comm.).

Dispersal - Kons has inferred evidence of substantial dispersal ability due to *C. gorgones*' appearance at two sites in Outagamie County where intensive survey failed to uncover it during prior seasons. One of these sites was a butterfly garden owned by Richard Merkhofer who reared *C. gorgone* larvae found there on Gloriosa Daisies (1997). In addition this species apparently colonized a prairie planting (planted from seed) at Mosquito Hill Nature Center in Outagamie County (Kons, 1997).

Management - Kons (1997) observed that a *C. gorgone* colony in Outagamie County was apparently eradicated after an entire prairie planting was burned during Spring, 1991, providing circumstantial evidence that it is highly sensitive to burns. It had been numerous there the previous 2 years and recolonization had not taken place as of 1995. This species is also averse to mowing and un-intensive cutting (Swengel, 1997).

Comments - Kons (1997) and Swengel (1994) have detected a third or partial third brood in Wisconsin during some years.

Phlox Moth *Schinia indiana* Smith

Noctuidae Heliethinae

Status - This species is listed by the Wisconsin Department of Natural Resources as “endangered” in Wisconsin. This species was first discovered in Wisconsin in an Eau Claire County power line cut in June 1973 by Fay Karpuleon. A total of 49 individuals were uncovered in Menominee county at 11 sites in the vicinity of Legend Lake over three days of intensive searching by Kons and Borth (1992). *S. indiana* was associated with *P. pilosa* occurring in extensive sandy oak/pines habitat along roadsides and trails. It was then found at 34 sites in oak savannah at Fort McCoy from 1993-1996 (Maxwell and Ferge, 1994; Kirk, 1994; Kirk, 1995). Two Burnett County sites and over 5 Jackson County sites have been found by Swengel (1994). Sparse county records may be indicative of the fact that this species cannot be found by customary collecting techniques.

Similar Species - In contrast to many Noctuidae this is a colorful, diurnal species readily identifiable in Wisconsin.

Habitat - The habitat is pine-oak barrens on sandy soils where *P. pilosa* is found (Balogh, 1987) (Kons and Borth, 1992). In Menomonee County it was found in both sparsely and thickly vegetated phlox areas (Kons and Borth, 1992). It is also found on open prairies in western Minnesota (Balogh, 1997).

Behavior - This species is well camouflaged on Downy phlox blossoms on which it rests, making it difficult to spot. Searches for the moth were not as productive under hot sunny conditions during which some individuals were seen to exhibit a rapid, darting flight (Kons and Borth, 1992). Kons and Borth found moths in both sunny and shaded areas (1992).

Dispersal - It has short range dispersal into and out of patches of phlox (Kons and Borth, 1992), however longer range dispersal is unknown.

Management - Review of the species' life cycle indicates that removal of above-ground phlox growth from May to July would be harmful. Several *S. indiana* locations in Wisconsin are rights-of-way where roadside mowing may be safely undertaken in August when presumably the species is underground (Maxwell and Ferge, 1994). Depth of hibernation is unknown for this species, so effects of soil disturbance or fire management during the period from August through April cannot be predicted. Tree planting has been implicated as a factor in habitat loss for *S. indiana* (Schweitzer, 1989).

Management

Management methods that promote lupine growth and enhance Karner blue habitat may, depending on their timing or intensity, have either positive or negative impacts on other species. It should be recognized that nonmanagement is also a management decision. Since research on management of barrens associated species is incomplete, definitive recommendations cannot be made upon current knowledge. However, it is hoped that this information can help lead to an informed land management process based on the best available data.

Under an adaptive management approach (Baskerville, 1985) clear goals are set, pre- and post-treatment observations made, and management practices modified based upon documented results. Best management practices would suggest first surveying recovery sites for these lepidoptera. Barrens dependent lepidoptera present a broad range of response to management so that their particular needs should be incorporated into the goals of site specific recovery plans. While there is no legal requirement to manage for these associated species, understanding something about their biology may allow the land manager to avoid any incremental costs, and preserve needed habitat for more species.

Because no one management type is favorable to all species, when managing for multiple species it is even more important to divide the site into multiple management plots so as to not include a large portion of a required plant resource in any one plot. Leaving portions undisturbed provides refugia for recolonization for species that may initially suffer high mortality due to management strategies being employed.

It's better for each site to adapt its management to its own particular species and history, rather than blindly follow how other sites are managed. Using different management techniques for similar sites is beneficial because various species differ as to favorable and adverse management types, even among specialists of the same habitat (Swengel and Swengel, 1997). For example, at Swengel's Frosted elfin highway site the ditch may be mowed more than once per year while the power line may not get mowed for several years, providing a gradient of management intensity and shrub transition to the adjoining property (Swengel, 1996c).

Management consistency within a particular site is equally important because the sequential use of different management types may successively eliminate species sensitive to each type (Swengel and Swengel, 1997). In the current fragmented landscape subsets or species assemblages can still be identified and conserved efficiently within the same set of sites.

Barrens management includes strategies ranging from intensive such as prescribed fire, to more moderate such as mowing, haying, thinning, grazing and applying herbicides to doing nothing. Most barrens dependent lepidoptera showed significantly increased numbers associated with less frequent and/or less intrusive managements; however, leaving habitat entirely unmanaged was rarely optimal (Swengel, 1997a). A general discussion of these techniques as they may apply to associated species follows.

Intensive Management

Fire: Fires which open new sites and set back succession have been proposed to have been an integral part of the barrens community. High intensity burns are expected to be needed in areas with closed tree canopies. The thick bark of bur oak makes it more tolerant to fire, while black oak may be top killed with high intensity fire but persists by resprouting and jack pines with thinner bark are less likely to survive fire (Curtis, 1959, Benzie 1977). Examples given by New (1993) of fires benefiting a butterfly were typically infrequent burns that create new habitat patches to be occupied by the butterflies afterward during long fire-free intervals, rather than repeated fires that maintain existing habitat already occupied by the butterfly. Swengel distinguishes between fire management and wildfire effects because significantly more wildfire areas are surrounded by habitat that has been left unburned for much longer than are fire-managed areas where the entire habitat is burned by units on a rotational basis.

Any application of fire is likely to result in mortality of some barrens associated species in the burned areas. Less frequent burning over 6-18 year intervals has been suggested in Karner blue populations to allow young oaks to establish and grow to a size and age resistant to fire (Grigore 1992, Givnish et al. 1988). Where prescribed fire is used it is advisable to avoid burning contiguous plots (the smaller the burn size the better), to avoid relighting skipped areas and to minimize backfires. Also, the use of fire alone may stimulate woody growth by selectively benefiting fire tolerant variations in woody growth (Schlict, 1993).

Seasonality of fire influences plant effects, with late spring burning tending to favor warm season grasses and fall burns favoring cool season grasses (Daubenire, 1968, Collins and Glenn 1988). May fires can be particularly detrimental to lupine feeders by altering lupine phenology and flower abundance as well as resulting in direct egg mortality (Swengel, 1994). Skipper larvae may or may not survive in a spring fire. In both cases the species will survive if enough surrounding refugia are left unburned (Nielsen, 1997). Because there is conflicting research about just how deep and how long lethal fire temperature penetrates the soil, refugia should always be preserved.

Swengel (1995) identifies four factors affecting response of prairie butterflies to fire including: (1) habitat niche breadth: species with broad habitat niches are more widespread and more likely to have source populations within dispersal distance for recolonization; (2) voltinism: multivoltine species have more generations in which to recover between fires; (3) location during

fire: resident species are vulnerable to fire unless their location (e.g. underground) protects them (cf. McClure, 1981) and (4) vagility: species with a greater dispersal tendency can reoccupy burned sites more quickly.

Karner blues, which have a larval host that benefits from fire (Grigore and Tramer, 1996) appear relatively tolerant of management and of burning, despite apparently high mortality of immatures during fire (Swengel 1995, Swengel and Swengel 1996). According to Swengel (1995), “skipper after skipper we’ve found experience BOTH short- and long-term declines at fire-managed sites.” Fewer, smaller and more restricted lepidoptera populations generally recover slower (if at all) from fire (Swengel, 1995). She found areas burned by a single wildfire 4-18 years ago produced results strongly contrasting with and much more favorable than prescribed burning for the Frosted elfin, Cobweb skipper, Gorgone checkerspot and Leonard’s skippers (1997a).

Moderate Management

Mowing/Haying: Areas managed with late-season mowing and with only part of the habitat cut each year appear to benefit a number of species according to Swengel’s observations (1994). Most of these barrens dependent species showed significant increases in numbers associated with less frequent and/or less intrusive management. In contrast to fire management, unintensified management supported relatively dense populations of specialist butterflies (Swengel and Swengel, 1997). Mowing and haying are superior for spring flowers to burning which favors native grasses that shade and choke out spring flowers.

Timing and application of mowing management should be considered. For Karner blues the optimal time to mow is mid to late October when overwintering eggs are present and are laid less than 4” from the soil. While it may be efficient to cut or mow before plants translocate winter stores to roots (mid-June through August), species affected should be considered to make sure they are not in a vulnerable life stage. For example, mowing is best done to benefit Frosted elfins long after lupines finished seeding and the larvae have pupated and are presumably lying well below the mowers blade. The maximum frequency should be once per year to avoid excessive plant damage. Its best that only a portion of the habitat be mowed at a time. Slash and clippings after mowing or cutting should be spread on non-habitat areas.

In some cases medium to more severe intensities of mechanical site preparation are needed to encourage Karner blue plant resources while controlling competing species such as Pennsylvania sedge (*Carex pennsylvanica*).

Grazing: Grazing is more gradual than mowing/haying. Some have proposed that the presence or absence of grazers has a lot to do with control of woody growth. Native grazers which have co-evolved with the plants in these habitats may be preferable to domestic grazers but their feeding preferences should be considered in relation to species present at that site. Experimentation with buffalo grazing is being contemplated in Wood County. Due to the size of most sites grazing should only be used occasionally and for brief periods.

Herbicides: Application of herbicides directly to competing woody vegetation through basal sprays, stump treatments, hack-n-squirt methods, etc. is expected to minimize contact of herbicide with Karner blue plant resources and is generally considered the safest method. Herbicides reducing competition to understory vegetation are expected to result in an increase in

the abundance of species present and in species diversity, although increases may only last a few years. Surveys are necessary prior to herbicide release studies. Herbicides may be required for aggressive species and species that create underground suckers from mechanical treatments and should be considered for difficult species such as sumac and black locust.

It should be noted that pesticides can be harmful to many species of lepidoptera. For example, Btk used in control of Gypsy moth is known to kill Karner larvae in laboratory settings and it is expected that applications in Karner blue occupied areas will result in significant Karner mortality and negatively impact non-target butterfly and moth species (Papp, 1996). The U.S. Fish and Wildlife Service recommends that use of Bt and Btk within one-half mile of Karner blue occupied habitat be prohibited (Lane, 1997). However, shade is also lost from gypsy moth defoliated trees (Papp, 1996; Lane 1997). Wisconsin's Department of Agriculture, Trade and Consumer Protection, which is an HCP partner, has drafted guidelines for pesticide use in Karner blue habitat.

Thinning/cutting: Tree cutting or girdling can be used to begin restoring a forested area to more open barrens to allow sufficient light for needed understory vegetation. Red pine stands may require a wider spacing than jack pine to permit sufficient light to reach the forest floor and allow lupine or other host plants to persist. Openings must be large enough to permit flowering of lupine and nectar plants. The size of the opening needed to permit lupine flowering will vary with the tree species, age of trees, and other factors, but is expected to occur at 1.5 to 2 times the average height of surrounding trees or with an average canopy cover of between 40% and 60% (Maxwell and Givnish, 1993). Removal of larger trees should be done in the winter with frozen ground and snow cover in order to protect the suppressed understory species. Setback of woody species can be maximized by cutting and recutting sprouts more than once per year as well as recutting in successive years.

Short-term Nonmanagement

While fire suppression and habitat fragmentation have increased the need for overt management, management may not always be appropriate. In the long-term, an early successional community requires disturbance, however some sites such as hot sandy sites may change very little from year to year and drier soils require less frequent fires. In light of limited information on these sites little or no management may be best in the short-term until more information is known. Some species such as Dusted skippers and Gorgone checkerspots have been found to be adversely affected by even non-intrusive managements. Swengel found the Cobweb skipper and Leonard's skipper rather intolerant of any active management type (1997a).

Additional Considerations

It would be beneficial to broaden research focused on Karner blues to include the species treated here as well as other barrens associated species. Basic life history questions integral to management (such as whether Frosted elfins pupate in leaf litter or underground in Wisconsin) need to be resolved. Observations and photographs of nectaring, mating, ovipositions etc. especially as part of planned studies are very useful. Collecting is an effective way to document/support distribution, life history, behavioral, ecological and evolutionary/taxonomic studies. To reliably evaluate if the lepidoptera component of an ecosystem is being preserved

requires a voucher material baseline on species that occur there. Extensive species inventory collections from specialized habitats are needed to improve our understanding of what species are dependent on these habitats. Numbers of specimens collected are generally negligible in terms of insect population levels but these vouchers contribute significantly to identification of quality habitat and our understanding of the barrens ecosystem. Emphasis and concern should not be misplaced on individual organisms with regard to reasonable collecting or experimentation when considering intensive management and conservation options that may significantly impact populations.

This report includes only one moth species as moth taxa are relatively poorly known compared to butterflies in terms of general biology, habitat association and response to management practices. In Ferge's (1997) opinion, "we hardly have enough data on common forest habitats and various disturbed areas to use as a baseline to evaluate the uniqueness of the barrens or prairie moth fauna." In order to provide HCP partners with some currently available information, Kons and Borth prepared a "Preliminary Wisconsin List of Barrens and Dry Prairie Associated Moths" (1996) based on consideration of well over 15,000 moth records from a diverse array of general and specialized habitats and published larval hosts. While additional information will likely warrant species' additions or deletions, this list is intended to lead to better informed decisions for evaluating habitat quality and site management than species' inventories alone. For example, it cites lead plant, which occurs in some Karner blue habitat, as a critical larval host for several moth species which are highly sensitive to fire (Borth and Barina, 1991).

Concluding Remarks

There is a need to preserve high quality barrens areas of sufficient size that they cannot be entirely consumed by a single fire. We should not try to create Karner blue zoos and wildflower gardens when dealing with large tracts of land, but rather something resembling natural habitat in which the Karner blues and associated species occur in their natural state with as little direct management as possible and on sufficient acreage (Schweitzer, 1994b). Small patches of habitat supporting specialized lepidoptera also have value.

The Karner blue's protective umbrella has many holes with regard to other barrens associated species. However, by taking an ecosystem approach, which also incorporates the biological requirements of other lepidoptera, a land manager can maintain healthy and diverse populations of other barrens associated species in addition to fulfilling legal obligations to protect the Karner blue.

Color Photos

The original report by R.J. Borth and others included one page with nine color photographs. These pictures are not reproduced here due to difficulties associated with printing and publishing.

Species depicted included *Erynnis martialis*, *Erynnis persius*, *Incisalia hanrici*, *Chlosyne gorgone*, *Atrytonopsis hianna*, *Schinia indiana*, *Hesperia leonardus*, *Hesperia metea*, and *Incisalia irus*.

List of References

- Bailowitz, R.A. and J.P. Brock. 1991. *Butterflies of Southeastern Arizona*. Sonoran Arthropod Studies, Inc. Tucson.
- Balogh, G.J. 1987. New localities for *Schinia indiana* (Smith)(Noctuidae). *Ohio Lepidop.* 9(2):15-16.
- Balogh, G. 1997. Comments on Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Rept. to USFWS and Wisconsin Dept. Natural Resources, Madison. Letter. April 21, 1997.
- Baskerville, G. 1985. Adaptive management: wood availability and habitat availability. *For. Chronicle* (April):171-5.
- Benzie, J.W. 1977. Jack pine in the north central states. *Gen. Tech. Rept.* NC-32. North Central Exper. Station, St. Paul.
- Bleser, C.A. 1994. Status, research and management in Wisconsin. Pp. 153-162 In D.A. Andow, R.J. Baker and C.P. Lane (eds.). Karner blue butterfly: A symbol of a vanishing landscape. *Misc. Publ.* 84-1994, Minnesota Ag. Exper. Station, Univ. Minnesota, St. Paul.
- Borth, R.J. and T.S. Barina. 1991. Observations of *Amorpha*-feeding *Catocala* (Noctuidae) in Wisconsin. *J. Lepidop. Soc.* 45:371-373.
- Borth, R.J. 1996. Comments on Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Rept. to USFWS and Wisconsin Dept. Natural Resources, Madison. Letter. August 24, 1996.
- Burns, J. M. 1969. Cryptic sleeping posture of a skipper butterfly, *Erynnis brizo*. *Psyche* 76(4):382-386.
- Collins, S.L., and S.M. Glenn. 1988. Disturbance and community structure in North American prairies. Pp. 131-43 In J.J. Dunning, J.A. Werger and J.H. Williams (eds.). *Diversity and Pattern In Plant Communities*. SPB Scientific Publications, The Hague, Netherlands.
- Curtis, J.T. 1959. *The Vegetation of Wisconsin*. Univ. Wisconsin Press, Madison.
- Daubenmire, R. 1968. Ecology of fire in grasslands. *Advan. Ecol. Res.* 5:209-66.
- Dirig, R. 1994. Historical notes on wild lupine and the Karner blue butterfly at the Albany Pine Bush, NY. Pp. 23-36 In D.A. Andow, R.J. Baker and C.P. Lane (eds.). Karner blue butterfly: A symbol of a vanishing landscape. *Misc. Publ.* 84-1994, Minnesota Ag. Exper. Station, Univ. Minnesota, St. Paul.
- Ebner, J.A. 1970. Butterflies of Wisconsin. *Pop. Sci. Handbook* (12). Milwaukee Publ. Mus. Milwaukee.
- Ferge, L.A. 1989. Lepidoptera observations at Namekagon Barrens, Burnett County, Wisconsin. (Unpub. Rept.).
- Ferge, L.A. 1990. Checklist of Wisconsin butterflies. *Wisconsin Entomol. Soc. Misc. Pub.* (1).
- Ferge, L. A. 1997. Comments on Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Rept. to USFWS and Wisconsin Dept. Natural Resources, Madison. Letter. April 21, 1997.
- Givnish, T.J., E.S. Menges, and D.F. Schweitzer. 1988. Minimum area requirements for long-term conservation of the Albany Pine Bush and the Karner blue butterfly: An assessment. Consultants' Rept. to City of Albany, NY. Malcolm Pirnie, Inc., Albany.
- Grigore, Michelle. 1992. The short-term effect of fire on wild lupine (*Lupinus perennis* L.). M.S. Thesis. Univ. Toledo, Toledo.
- Grigore, M.T. and E.J. Tramer. 1996. The short-term effect of fire on *Lupinus perennis* (L.). *Nat. Areas J.* 16:41-8.

- Hamilton, R. 1994. *Native Prairie Management Guide*. The Iowa Prairie Network. 12 pp.
- Hardwick, D.F. 1958. Taxonomy, life history, and habits of the elliptoid-eyed species of *Schinia* (Lepidoptera: Noctuidae), with notes on the *Heliiothidinae*. *Canadian Entomol.* 9(6).
- Heitzman, J.R. and R.L. Heitzman 1974. *Atrytonopsis hianna* biology and life history in the Ozarks. *J. Res. Lepidop.* 13(4):239-245.
- Holmes, A.M., Q.F. Hess, R.R. Tasker and A.J. Hanks. 1991. *The Ontario Butterfly Atlas*. Toronto Entomologists' Association, Toronto. 167 pp.
- Iftner, D., C., J.A. Shuey, and J.V. Calhoun. 1992. Butterflies and skippers of Ohio. *Bull. Ohio Biol. Surv.* (n.s.) 9(1), *Res. Rept.* (3):1-213.
- King, Richard. 1996. Spatial ecology, dispersal patterns and monitoring methods for the Karner blue butterfly, *Lycaeides melissa samuelis* on Necedah National Wildlife Refuge. Rept. to Natl. Fish Wildl. Foundation, USFWS, and Forest Industry.
- Kirk, K. 1994. Report on a survey of the distribution of downy phlox (*Phlox pilosa*) and the phlox moth (*Schinia indiana*) (Lepidoptera: Noctuidae) on Fort McCoy, Monroe County, Wisconsin. 1994 Progress Rept. The Nature Conservancy, Madison.
- Kirk, K. 1995. Report on a survey of the distribution of downy phlox (*Phlox pilosa*) and the phlox moth (*Schinia indiana*) (Lepidoptera: Noctuidae) on Fort McCoy, Monroe County, Wisconsin. 1995 Progress Rept. The Nature Conservancy, Madison.
- Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Unpub. Rept. to USFWS and Wisconsin Dept. Natural Resources, Madison.
- Kons, H.L., Jr. 1990. *The Outagamie Co. Area Entomol. Newsl.* 4.
- Kons, H.L., Jr. 1991. *The Outagamie Co. Area Entomol. Newsl.* 6.
- Kons, H.L., Jr. 1995. 1994 Lepidoptera surveys in Wisconsin. (Unpub. Rept.).
- Kons, H.L., Jr. 1997. Comments on Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Rept. to USFWS and Wisconsin Dept. Natural Resources, Madison. Letter. March, 1997.
- Kons, H.L., Jr. and R.J. Borth 1992. Observations of *Schinia indiana* in Menomonie County, Wisconsin. (Unpub. Rept.).
- Kons, H.L., Jr. and R.J. Borth 1996. Preliminary Wisconsin list of barrens and dry prairie associated moths. (Unpub. Rept.).
- Kons, H.L., Jr. and R.J. Borth 1997. Study and biodiversity inventory of the Lepidoptera of the Namekagon barrens. (In Progress).
- Kuehn, R.M. 1983. New Wisconsin butterfly records. *J. Lepidop. Soc.* 37(3):228-2325.
- Lane, C. 1997. Forest management guidelines: Developing management plans compatible with Karner blue butterfly persistence. Rept. to Wisconsin Dept. Natural Resources, Madison and USFWS, Fort Snelling.
- Maxwell, J.S. and L.A. Ferge. 1994. Report on a survey of Lepidoptera at Fort McCoy, 1992-1993. (Unpub. Rept.).
- Maxwell, J.S. and Tom Givnish. 1993. Research on the Karner blue butterfly at Fort McCoy, Wisconsin: Progress Rept. for 1993 Field Season (Unpub. Rept.).
- McClure, H.E. 1981. Some responses of resident animals to the effects of fire in a coastal chaparral environment in southern California. *California-Nevada Wildl. Trans.* 1981:86-89.
- Merkhofer, Richard. 1991. Personal Communication with H.L. Kons.
- Milwaukee Public Museum. Lepidoptera Collection, Milwaukee.
- New, T.R. (ed.). 1993. *Conservation Biology of Lycaenidae (Butterflies)*. IUCN, Gland.
- Nichols, T. 1996. Determining compatibility between herbicide release and habitat for Karner blue butterfly in red pine plantations. Unpub. Rept. to Georgia Pacific Corp.

- Nielsen, M. 1977. Invertebrate predators of Michigan Lepidoptera. *Great Lakes Entomol.* 10(3):113-118.
- Nielsen, M. 1985. Notes on the habitat and foodplant of *Incisalia henrici* (Lycaenidae) and *Pygrus centaureae* (Hesperiidae) in Michigan. *J. Lepidop. Soc.* 39(1):62-63.
- Nielsen, M. 1997. Comments on Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Rept. to USFWS and Wisconsin Dept. Natural Resources, Madison. Letter. March 29, 1997.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies East of the Great Plains*. Johns Hopkins Univ. Press, Baltimore.
- Panzer, R., J. Shuey and D. Stillwaugh. 1997. Characterizing insects within fragmented landscapes. *Nat. Areas J.* 17(1):53-55.
- Papp, C. 1996. The endangered Karner blue butterfly (Lepidoptera: Lycaenidae) in Michigan: Habitat suitability, potential impacts of gypsy moth (Lepidoptera; Lymantriidae) suppression, and laboratory rearing. M.S. Thesis, Michigan State Univ., East Lansing.
- Parkinson, James. 1997. Comments on Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Rept. to USFWS and Wisconsin Dept. Natural Resources, Madison. Letter. April 17, 1997.
- Schlicht, D. 1993. Prairie paradigms and the challenge of management for biodiversity. Letter to Iowa Butterfly Enthusiasts.
- Schweitzer, D.F. 1985. Effects of prescribed burning on rare lepidoptera. Memo to The Nature Conservancy, Eastern and Midwestern Regions. March 27, 1985.
- Schweitzer, D.F. 1986. *Erynnis persius persius*. Element occurrence report, The Nature Conservancy, New York.
- Schweitzer, D.F. 1989. A review of category 2 Insecta in USFWS Regions 3, 4 and 5. The Nature Conservancy, Boston.
- Schweitzer, D.F. 1994a. Swengel KB reports and other KB related matters. Memo to Karner blue recovery team and others.
- Schweitzer, D.F. 1994b. Recovery Goals and Methods. Pp. 185-193 In D.A. Andow, R.J. Baker, and C.P. Lane (eds.). Karner Blue Butterfly: A symbol of a vanishing landscape. *Misc. Publ.* 84-1994, Minnesota Ag. Exper. Station, Univ. Minnesota, St. Paul.
- Scott, J.A. 1986. *The Butterflies of North America*. Stanford Univ. Press, Stanford.
- Schultz, C. 1990. Season summary report. *Outagamie County Area Entomol. Newsl.*
- Schultz, C. 1991. Season summary report. *Outagamie County Area Entomol. Newsl.*
- Shapiro, A.M. 1965. Ecological and behavioral notes on *Hesperia metea* and *Atrytonopsis hianna* (Hesperiidae). *J. Lepidop. Soc.* 19(4):215-221.
- Shapiro, A.M. 1974. Partitioning of resources among lupine-feeding lepidoptera. *American Midland Nat.* 91:243-248.
- Swengel, A.B. 1994a. Observations on the effects of fire on Karner blue butterflies. Pp. 81-86 In D.A. Andow, R.J. Baker, and C.P. Lane (eds.). Karner Blue Butterfly: A symbol of a vanishing landscape. *Misc. Publ.* 84-1994, Minnesota Ag. Exper. Station, Univ. Minnesota, St. Paul.
- Swengel, A.B. 1994b. Conservation of the prairie-savanna butterfly community. Pp.133-138 In J.S. Fralish, R.C. Anderson, J.E. Ebinger and R. Szafoni (eds.). *Proc. N. American Conf. on Savannas and Barrens*. Illinois State Univ., Normal.
- Swengel, A.B. 1995. Comments on HCP Biological Subteam's list and text on associated species. Letter. April 15, 1995.

- Swengel, A.B. 1996a. Effects of fire and hay management on abundance of prairie butterflies. *Biol. Conserv.* 76:73-85.
- Swengel, A.B. 1996b. Observations of *Incilisalia irus* (Lepidoptera: Lycaeniidae) in central Wisconsin 1988-95. *Great Lakes Entomol.* 29(2):47-62.
- Swengel, A.B. 1996c. Open habitats for butterflies. *American Butterflies* 4(4):12-20.
- Swengel, A.B. 1997a. Effects of management on butterfly abundance in tallgrass prairie and pine barrens. *Biol. Conserv.* (In Press).
- Swengel, A.B. 1997b. Comments on Kirk, K. 1996. The Karner blue community: Understanding and protecting associated rare species of the barrens. Rept. to USFWS and Wisconsin Dept. Natural Resources, Madison. Letter. March 1997.
- Swengel, A.B. and S.R. Swengel. 1997. Co-occurrence of prairie and barrens butterflies: Applications to ecosystem conservation. *J. Insect Conserv.* (in press).
- Tietz, H. M. 1972. *An Index to the Described Life Histories, Early Stages and Hosts of the Macrolepidoptera of the Continental United States and Canada, Vol. 1.* Allyn Mus. Entomol., Sarasota. 536 pp.
- USFWS. 1992. Endangered and threatened wildlife and plants: Determination of endangered status for the Karner blue butterfly. *Federal Register* 57 (240); 59236-59244.
- Williams, A.H. 1995. New larval host plant and behavior of *Chlosyne Gorgone* (Lepidoptera: Nymphalidae). *Great Lakes Entomol.* 28(1):93-94.

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Wisconsin Karner Blue Butterfly
Habitat Conservation Plan and Environmental Impact Statement

**Appendix C. History of Wisconsin Karner Blue Butterfly
HCP Partnership, Articles of Partnership and
Partnership Anti-Trust Policy**

This appendix provides a brief historical overview of the Wisconsin Karner Blue Butterfly HCP partnership effort. It also provides information on the institutional framework on which the HCP partnership has been based since its inception (i.e. the Articles of Partnership) and compliance with anti-trust laws.

A. History of Wisconsin HCP Partnership

The USFWS listed the Karner blue butterfly as an endangered species in December 1992. This listing extended protection and recovery provisions of the ESA to the Karner blue butterfly and made it unlawful to conduct activities which would result in "take" of this butterfly. Several

current and planned land uses and management processes have the potential of resulting in take as defined in the ESA.

In February 1994, representatives of Georgia Pacific Corporation visited with key Wisconsin DNR administrators and staff members to discuss whether or not the DNR would help with the construction of a statewide HCP for the Karner blue butterfly. Georgia Pacific officials were planning to talk to USFWS staff and were interested in exploring the concept further with DNR. The company was interested in constructing an HCP as efficiently as possible and wanted to know what DNR's role could be in such a process.

A short time later, DNR staff met with USFWS Region 3 staff. USFWS staff challenged DNR personnel to "take the lead in the Wisconsin HCP process." DNR staff then met internally to determine which interested parties might be involved. A series of meetings to discuss what procedures and objectives could be outlined to complete the HCP followed. These meetings, involving forest products companies, several utilities, conservation organizations, and state and federal agencies led to the establishment of the HCP Articles of Partnership. These articles served as the process rules for the series of meetings at which the issues involving completion of the HCP were discussed and decided.

Beginning in the fall of 1994 and extending into 1998, HCP partnership meetings were held on a regular basis to provide direction for the development and drafting of the HCP, implementing agreement, individual partner species and habitat conservation agreements, appropriate guidelines and protocols, and other associated documents. On September 27, 1999 the HCP was approved and the DNR along with 25 other partners began to implement the HCP.

From 1999 through 2009 the HCP Partners, now numbering 40, successfully implemented the HCP under an aggressive adaptive management program.

The original Articles of Partnership were created to guide the development of the HCP and applications for an incidental take permit. The Articles of Partnership included here have since been updated to reflect the ongoing implementation of the approved HCP.

ARTICLES OF PARTNERSHIP

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan

Mission

1. Implement and maintain the Wisconsin Statewide Karner Blue Butterfly (KBB) Habitat Conservation Plan (HCP), which integrates conservation with economic and other land uses through a partnership among stakeholders sharing their collective knowledge and experience for as long as the species needs our conservation for its populations to be sustainable in the state.

Guiding Principles and Precepts

2. The strength and vision of our statewide partnership is founded in the basic principles of trust, commitment, and service toward a higher goal. Each acre of habitat enrolled in the partnership will contribute to the accomplishment of our overall goal, saving the Karner blue butterfly from extinction, by preserving and promoting a landscape of suitable habitat throughout the state, while continuing to reach our business goals.
3. We affirm that our partnership is formalized via Species and Habitat Conservation Agreements (SHCA) between each individual partner and the DNR;

Therefore, we set forth to achieve the following goals:

Goals

4. Focus primarily on the conservation of the Karner blue butterfly while fulfilling the commitments and responsibilities in respective conservation agreements and consistent with the Federal Endangered and Threatened Species permit number TE060014-x.
5. Provide sound barrens/savanna ecosystem management when performing management activities on the working landscape.
6. Encourage multiple species consideration in management planning for those ownerships where such measures are desirable and feasible and acceptable by the landowners.
7. There will be No Net Loss of Karner blue butterfly Habitat (NNLOH) as a result of HCP partner activities in the KBB High Potential Range (HPR).
8. To assist in Karner blue butterfly recovery in Wisconsin. The HCP partners' role in recovery can best be described as "voluntary" and a "support" role (*Also see article 12*).
9. Seek to reduce or eliminate regulatory compliance requirements associated with the Incidental Take Permit (ITP).
10. Set a good example for collaborative, grass roots conservation and responsible stewardship.

Strategic Intent

The Karner Blue butterfly Habitat Conservation Plan (HCP) intends to:

11. Apply a structured Adaptive Management strategy that incorporates sound science, societal needs and economics.
12. Implement the statewide HCP in ways that will not prevent the management or recovery of other species.

13. Implement the Wisconsin Statewide Karner Blue Butterfly HCP as a collaborative process designed, consistent with these Articles, to include all interested parties.

Description of Partnership

14. Partners are those persons, agencies or organizations:
 - a. Entering into and agreeing to these Articles of Partnership; and
 - b. Having an ownership interest i.e. fee title or easement in land with existing or potential Karner blue butterfly habitat; or
 - c. Having economic assets at risk as a result of the listing of the Karner blue butterfly as endangered; or
 - d. Having a role in implementing the HCP e.g. municipalities, utility providers, etc.

The status (inclusion or exclusion) as a "Partner" will be determined by the Implementation Oversight Committee (IOC). A recommendation of inclusion will be after consideration of an application for partnership, supporting the party's eligibility. A recommendation of exclusion will be determined following consideration of evidence of failure to act in good standing as a partner. A Partner may withdraw by letter of request consistent with their SHCA.

15. Decision making process of the HCP partnership:
 - a. Consensus in the partnership process, whether partners or not, will be the goal in making decisions or determining direction. Where consensus cannot be reached, the partners present shall determine. The vote of a minimum of three-fourths (3/4's) of the partners present plus one is necessary to support a decision. All partners are equal in this development process and have an equal vote. Partners may designate proxies.
 - b. Consensus will likewise be the goal of the IOC decision making process. Where consensus cannot be reached, the IOC representatives present shall determine. The vote of a minimum of three-fourths (3/4's) of the IOC members or alternates present is necessary to support a decision. All IOC members are equal in this process and have an equal vote. IOC members may designate proxies when their alternate cannot attend.
16. Persons or organizations other than partners are invited and encouraged to participate in the HCP process. Their opinions and advice will be considered.
17. Noncompliance with the Articles of Partnership shall result in the Partner(s) forfeiting partnership status and the right to vote under Articles 14 and 15.

18. The Administrator of the Partnership shall be the Wisconsin Department of Natural Resources. The Department's role shall include, coordination and facilitation of the process, provision of administrative support, oversight of the process, principle administrator of all applicable documents related to the permit, including National Environmental Policy Act (NEPA) documents, holder of the Incidental Take Permit and implementation and oversight of activity under the permit and in accordance with the Implementing Agreement (IA), all consistent with the direction of the Partnership, the IOC and approval of the Natural Resources Board and the Governor and State Legislature. The Department's role as partner will be consistent with this agreement and in furtherance of conservation of endangered species.
19. The U.S. Fish and Wildlife Service shall be invited and encouraged to serve in an advisory capacity to the process.

Rules of Procedure

20. All meetings of the Partnership shall be noticed and held as public meetings. Participants, as defined in Article 23.c, may provide advice and shall be involved in the business of the meetings consistent with Articles 15 and 16.
21. A minimum of two-thirds (2/3) of the Full partners shall be present at a meeting to constitute a quorum to vote on an issue under articles 14 and 15.
22. Meetings of the Partnership may be held at a variety of locations in the state. Dates and times of meetings shall be determined by the Partnership, Committees, Subcommittees or Teams. Arrangements for meetings shall be made by the HCP Coordinator, committee chairs, or team leaders as appropriate.
23. Meetings shall be subject to the following:
 - a. The HCP Coordinator is responsible for HCP Team and IOC meeting minutes. A note taker, or the method of recording the discussion and decisions made at a meeting, shall be the responsibility of the HCP Coordinator. Comment periods and requests for information in the minutes shall be consistent with direction of the Partnership, if given. Minutes shall be prepared and distributed to the Partnership, and others attending the meeting. The minutes shall be routinely distributed within twenty (20) working days from the meeting. They may be amended if necessary, and shall be approved at the following meeting.
 - b. Committees, Subcommittees or Teams may establish review or comment periods for their membership and the Partnership.
 - c. Participants in the process, other than the Partners, shall be provided meeting minutes. Participants include:
 - (1) Those who serve in an advisory capacity; or

(2) Those who have a scientific interest in protection and recovery of the Karner Blue butterfly; and

(3) Those that were fully involved in discussions during the plan development and are involved in the implementation. Participants who attend are expected to be prepared for meetings.

d. Other persons interested in this conservation effort, upon request, and consistent with the Communications Plan, shall be provided with regular mailings on the implementation of the HCP and issues related to the ITP.

24. The Articles of Partnership may be amended by a two-thirds vote of the Full Partners.
25. Amendments to the HCP may not be acted on by the Partnership prior to IOC or Partner approval. The IOC will act on behalf of the Partners. However, at the discretion of the IOC, should those amendments be seen as having or potentially having significant, adverse impacts to the partners they represent, those partners will be apprised of the proposed action and given the opportunity to register individual opinion. This review may occur by contacting each partner individually, at a meeting of partners from an entity group, or at an annual HCP Team meeting.
26. Communications and public information, including press releases, shall be consistent with a public information plan or release agreed upon by the Partnership. This provision does not restrict the release of information subject to and consistent with the Public Records Law, Ch. 19, Wis. Stats.
27. The Karner Blue Butterfly HCP shall include and incorporate a public information component designed to effectively inform and update all interested persons on the proceedings and progress of the HCP.
28. The Partnership in the implementation of the Conservation Plan has no direct responsibility to the Recovery Plan; however, an open and clear line of communication between the Karner Blue Recovery team and this Partnership will be maintained in a support role consistent with these Articles and for the exchange of technical information.
29. The Karner Blue Butterfly HCP shall be statewide in scope, with reasonable and prudent goals, incorporating an incentive based approach to assure its broad and effective application in Wisconsin.
30. Land management, monitoring, and reporting activities will be consistent with the ITP, HCP, IA and individual SHCAs.

Original December 13, 1994
1st Amendment January 23, 1995
2nd Amendment April 25, 2009

Antitrust Policy

The conduct of this assembly is in no way intended to present any federal or state antitrust problems. However, the operation of this assembly requires that representatives of member organizations meet together, and since these member organizations in the normal course of their business may be competitors, it is deemed advisable to set forth this policy with regard to Antitrust Compliance.

The uncompromising policy of this assembly is:

STRICT COMPLIANCE WITH THE SPIRIT AND THE LETTER OF THE ANTITRUST LAWS.

In furtherance of this policy, the following rules are adopted to provide those assembled today with precepts to guide them in their conduct.

NO ACTIVITY OR COMMUNICATION SHALL:

1. be used for the purpose of bringing about or attempting to bring about any understanding, arrangement or agreement, written or oral, formal or informal, express or implied, directly or indirectly, among competitors with regard to (a) prices, terms or conditions of sales, distribution, volume, production, territories or customers, or (b) prices or purchases of any materials, equipment, services of supplies, or suppliers.
2. include discussion, directly or indirectly, for any purpose or any fashion regarding (a) sales prices or pricing methods, production quotas or other limitations on either the timing or volume of production or sales or allocation of products, territories or customers, or (b) purchase prices or pricing methods, purchasing quotas or other limitations on either the timing or volume of purchases or allocation of purchases of materials, equipment, services or supplies or allocations of territories or suppliers.
3. include any discussion which might be construed as an attempt to prevent any person or business entity (a) from gaining access to any market or customer for goods or services, or (b) from obtaining a supply of goods or otherwise purchasing goods or services freely in the market.
4. make any effort to bring about the standardization of any product for the purpose of or have the effect of preventing the manufacture, sale or purchase of any product not conforming to a specified standard.

In all discussions, formal or informal, all assembled are expected to observe and conduct themselves in accordance with these rules and in compliance with all antitrust laws and regulations, both federal and state.

Persons invited to participate in or giving presentations shall be advised of the need to comply with these rules and applicable laws and regulations.

It is the responsibility of all assembled to comply with the letter and spirit of these rules, and with all applicable state and federal antitrust laws.

Karner Blue Butterfly HCP

December 22, 2005 DRAFT

D. Lentz and J. Christenson

“10-YEAR + RECOVERY” PERMIT RENEWAL ALTERNATIVE

Five tenets form the basis of this Five Point Plan:

1. Kbb habitat needs periodic disturbance.
2. There are many more Kbb in Wisconsin than originally imagined; the Kbb is not in jeopardy here.
3. Land management activities that provide beneficial disturbance should not be discouraged by the prohibitions and requirements of the conventional endangered species protection mindset and incidental take permit features.
4. The DNR and other Partners and Participants to Wisconsin's Karner blue butterfly KBB) conservation program have finite resources available to apply to the KBB. They have realized that in order to finish the conservation program successfully that they must assist in recovery efforts for the species.
5. In making commitments to recovery of the species in Wisconsin, the Partners and Participants recognize that under Section 4(f) of the Endangered Species Act of 1973 (ESA), the federal government is responsible to establish and implement recovery programs for listed species. Therefore, in volunteering to assist in recovery, the Partners and Participants will seek cooperation from the Fish and Wildlife Service to modify commitments to redirect available resources currently solely devoted to the HCP to recovery efforts. They will also seek reasonable modifications of the recovery provisions of the ESA to allow down listing or de listing invertebrates by distinct population segment or on a geographic or jurisdictional basis, e.g. by State or other considerations regarding management and regulatory treatment under the Act .

THE FIVE POINT PLAN FOR A STATEWIDE HCP BEGINNING TODAY AND BEYOND 2009

1. FOCUS HCP implementation on recovery areas.

- Focus efforts on recovery areas (SPAs and/or ACEs?)
- De-emphasize focus on non-recovery areas; to the extent possible reduce time and resources for activities that serve to comply with regulations but do not add conservation benefits for the species
- Eliminate or reduce non-value added, non-ESA required activities that do not add conservation value.
- Redirect available resources toward the goals and objectives of this plan.

2. STREAMLINE PROCESSES

- Reduce costs to the extent possible to DNR to administer statewide program and to DNR properties and partners to implement the HCP so they may be redirected towards recovery efforts and this Plan.
- Redirect available resources toward the goals and objectives of this Five Point plan.
- Develop a repeatable, consistent training and orientation program to assure appropriate and necessary conservation and permit compliance, which provides beneficial disturbance and successional management and reduces mistakes and rework so as to redirect resources to this Plan.

3. IMPROVE PROTOCOLS AND GUIDELINES, i.e. monitoring and management protocols and guidelines.

- Accomplish desired results with only those resource expenditures likely and necessary to accomplish the goals of this Plan.
- Redirect available resources toward the goals and objectives of this Five Point Plan.
- Eliminate activities or methods unlikely to provide beneficial conservation or are inconsistent with this Plan.
- Correct inaccurate or conflicting information.
- Re-organize protocols & guidelines, and their delivery systems to be user-friendly, easily accessible and clearly understood to assure efficient use of available resources.

4. RECOVER the KBB in WI

- Demonstrate KBB is in reality recovered in WI due to its persistence in the State based on historic and traditional on-going management of the land.
- Develop recovery implementation plans that describe the long-term management plan being committed to by the DNR which describes how the DNR will maintain sustainable KBB populations.
- Seek reasonable modification to the ESA to allow Distinct Population & Geographic Segment treatment in the ESA for invertebrates which will recognize efforts of public and private entities, reward those entities for sound conservation efforts and programs for rare species, and make available resources to then be applied to other rare species in the jurisdiction.
- Document, or continue to develop data supporting KBB down listing for the WI KBB population segment.
- Redirect available resources to other conservation and partnering opportunities that result from reduction of management and regulatory constraints or result from down listing or de listing the KBB in WI.

5. Extend the TERM of the permit: **Develop 10-Year ITP RENEWAL proposal**

- Include a provision in the HCP/ITP, that after an additional 10 years of implementation of conservation programs under the HCP/ITP, with an additional focus on recovery that non-recovery area lands are given incidental take authority through the “voluntary” category inclusion.
- Redraft Articles of Partnership to emphasize (include) and define partners’ recovery goals.
- Amend HCP and Implementing Agreement, where necessary, to capture recovery direction commitments.
- Redirect available resources toward the goals and objectives of this plan.

\\ITP Renewal\...\ KBB 5-point plan outline 12-22-05 updated 2009.doc

Wisconsin Karner Blue Butterfly
Habitat Conservation Plan and Environmental Impact Statement

**Appendix D. Participation Plan and Landowner Inclusion
Strategy Supporting Information**

This appendix includes supporting information for the participation plan and landowner inclusion strategy described in Chapter 5 of the HCP. The Appendix is organized as follows:

- A. Communication Plan
- B. Participation Decision flow chart
- C. Application for Inclusion (template)
- D. Inclusion Fees
- E. Species and Habitat Conservation Agreements (Templates)
 - for Full Partners
 - for Limited Partners

A. Communication Plan

Karner Blue Butterfly HCP Strategic Communication Plan Draft 9/12/2007

Introduction

Executive Summary

The Karner Blue Butterfly Habitat Conservation Plan (HCP) has been focused heavily on two valuable processes; Outreach and Education and Adaptive Management. This strategic communication plan is designed to take advantage of these key processes and move the HCP forward by focusing on the following objectives:

- Meet the outreach and education requirements of the HCP, Incidental Take Permit, Implementing Agreement, and support partner Species and Habitat Conservation Agreement commitments
- Provide informational resources to interested landowners and other voluntary, non-partner entities within Wisconsin and to the public at large
- Focus priority outreach and education efforts on those areas that are strategically important to the recovery goals of the Karner blue in Wisconsin
- Provide program and technical information to all HCP partners and interested parties
- Receive and retrieve data and other information regarding the Karner blue program in an efficient manner
- Educate state and federal policy makers and regulators about the Karner blue program needs and experience in WI and the status and activities of the HCP partnership
- Spread awareness about the success of the HCP and the lessons learned throughout the development and implementation of this program to academics, policy makers, conservationists, resource professionals, and others
- Continue to provide expert advice, assistance, and information to the general public, students and other resource professionals interested in the Karner blue butterfly, barrens ecosystems and the voluntary conservation approach of the HCP partnership

Background

The Wisconsin Department of Natural Resources coordinated an effort on behalf of many public and private landowners to develop a landscape scale, multi-partner Habitat Conservation Plan for the Karner blue butterfly. This was an innovative approach in more than one way, but especially in the inclusion of a “Voluntary Category” of property owners that would receive permit coverage for incidental take of the Karner blue, with no additional regulatory requirements.

This innovative approach was predicated on the massive conservation work that the HCP partners agreed to and also a proactive outreach and education program. As quoted from the HCP “a non-regulatory approach, substantial public outreach, education and assistance programs will be included to **foster partnerships and encourage conservation efforts on a voluntary basis**” (emphasis added)

This approach was anticipated to remove the fear of regulation by property owners and encourage proactive conservation and stewardship on these lands. This assumption was accurate and has proved to be immensely successful. In the first 8 years of the HCP, many thousands of landowners, citizens and students have learned about the Karner blue, its habitat and ways to conserve and restore the imperiled habitat that the Karner blue needs.

The HCP also made the realization that the partners would learn much through implementing the permit and encouraged adaptive management. This adaptive management has fostered efficiency and focus on behalf of the partners, and as detailed in the Situational Analysis, this Strategic Communication Plan helps to support that focus to the larger goals of Karner blue conservation and ultimately recovery.

Situational Analysis

Issue: Outreach and Education should be focused on those areas that provide the greatest conservation benefit

Focus of O&E was recognized in the HCP when the ACEs and SPAs were created. The focus on these areas will transition to be defined by the Biological Recovery Zones. The Communication Strategy should be adjusted as well.

Issue: Resources are scarce

A broad brush approach to O&E around the state has been effective at fostering an understanding of the Karner and its habitat. However, this general approach to O&E has not satisfied some specific HCP goals. This general approach to O&E can become an extra workload for partners with little added conservation value. Systems and processes used to collect, distribute and store information can be made more efficient.

Issue: Efficiencies should be identified, duplication of effort minimized and collaborative efforts sought.

As resources are scarce it is imperative to utilize the available resources to the greatest extent possible. This requires coordination and creativity on behalf of the partners to leverage the existing O&E infrastructure and identify new individuals, organizations and outlets to help support and communicate the message.

Issue: Clear direction and support should be provided to partners.

Commitments vary with partners. O&E has been broadly implemented, often on demand and when opportunities became available rather than by design.

Issue: New tools are available

Web based O&E has reduced workload and improved access to information. The use of web based communication can continue to improve quality and efficiency

of the O&E and other information provided to partners, landowners, regulators, and the public at large. These tools can also help to make the administration of the program by DNR and compliance with the ITP by all partners more efficient.

Issue: Adaptive Management

The HCP partners have taken the time to assess and adjust many aspects of the program. In addition, the DNR is taking steps to make the administration of the permit as efficient as possible.

Communication Plan Components

HCP Partner Component

Goal: Provide HCP Partners relevant and timely information about the HCP, ITP and related issues.

Objectives:

- Inform HCP partners about relevant HCP information
- Provide relevant technical information and resources
- Provide efficient method for partner communication to WDNR
- Promote information sharing between partners
- Provide training, outreach and education support and other items as needed.

Communication Targets:

- Implementation Oversight Committee
- HCP Partners
- Potential Partners

Tools:

- Website
- E-mail
- Newsletter
- IOC and partnership meetings

Process:

- Assess all HCP partner information needs
- Develop website to provide access to all necessary information
- Develop training and orientation modules for partner staff to access
- Encourage partner collaboration through meetings and networking
- Evaluate database and reporting improvement options and make recommendations to HCP Coordinator and IOC

Voluntary Landowner Component

Goal: Encourage conservation by private landowners in the voluntary category through assistance, education and targeted outreach.

Objectives:

- Focus outreach to private landowners in those areas that are strategically important to the recovery goals of the Karner blue. i.e. Biological Recovery Zones
- Provide access to technical information and assistance regarding Karner blue habitat conservation and restoration
- Respond quickly to inquiries
- Offer the opportunity to become involved in conservation efforts for the Karner blue

Communication Targets:

- Landowners and land users located within Biologic Recovery Zones
- Landowners and land users within the High Potential Range
- Other landowners and land users within Wisconsin
- General Public

Tools:

- Website
- Personal contact by partners
- Partner O&E materials
- DNR O&E materials

Process:

- Develop web site to enhance outreach and education to land owners
- Gain feedback, improvement, information and suggestions by land owners and others experienced in working with land owners on Karner blue issues
- Provide assistance to the Wisconsin Karner Blue Recovery program as needed to develop communication and outreach and education strategies

Policy Makers

Goal: Educate policy makers at the state and federal level about the WI Karner blue program to influence future policy decisions with regards to endangered species conservation.

Objectives:

- Inform state legislators about the program, landowner responsibilities, Partner accomplishments and program needs
- Inform federal legislators about the success and lessons learned from implementing this unique approach to endangered species conservation

Targets:

- Local elected officials
- State elected officials
- Federal elected officials
- Appointed agency staff

- Regional agency staff

Tools:

- Partners through trade organizations
- Direct mailings, issue briefs and papers
- One-on-one meetings
- Invitations to HCP celebration events

Process:

- Actively monitor state (not only WI) and federal initiatives, discussions and debates regarding endangered species conservation and especially Endangered Species Act.
- Actively monitor any court proceedings or judgments with regards to the Endangered Species Act
- Develop and provide policy briefs to policy makers

Regulator

Goal: Inform state and federal regulators about the Karner blue program, the reality of partnering success, regulatory process within the Karner blue program to ensure efficiencies with overlap between the HCP and other programs, and to provide a template for innovative, incentive based conservation approach.

Objectives:

- Provide clear descriptions of relevant HCP processes that involve administration of the ITP and relationship of Partner responsibilities under the ITP with other regulatory process (e.g. USACOE, DNR permits etc.)
- Provide assistance to other regulatory departments and agencies on collaboration, cooperation and meaningful regulatory process
- Communicate a new regulatory paradigm that involves partnering and trust

Targets:

- FWS
- USACOE
- DNR
- Other states
- PSC

Tools:

- Presentations at conferences, meetings, and other venues
- Working sessions
- Papers
- One-on-one conversations

Process:

- Assess regulatory agency education needs for Karner blue
- Develop briefings and other tools as needed
- Provide opportunities to inform regulatory agencies about the Karner blue approach through lessons learned presentations, participation in various department and agency meetings

Media

Goal: Inform local and national media of the success of the Kbb program in WI

Objectives:

- Increase national awareness of Kbb HCP (especially the voluntary strategy) and its implications for endangered species management
- Sustain support for the Kbb program within the State of Wisconsin
- Promote the conservation done by all partners
- Promote the conservation approach taken under this HCP
- Provide an additional vehicle to get “good news” about the HCP get to landowners
- Promote public support for conservation and especially recovery efforts for this endangered species

Targets:

- CBS Sunday Morning
- USA Today
- E Magazine
- Gannet Outdoors Report
- Local Newspapers
- Local TV News
- Conservation Magazines

Tools:

- Web
- Press Release

Process:

- Working with DNR media staff, develop a list of media contacts/outlets, state and nationally
- Determine best time and strategy for issuing a press release to various media outlets

General

Goal: Provide access to information about the WI KBB HCP program and encourage Kbb conservation through a variety of means.

Objectives:

- Provide information about the history, innovations and development process of the HCP to academic researchers.
- Encourage understanding of the lessons learned to date by the partnership to NGOs and other states involved with rare species and ecosystem conservation.

Targets:

- NGOs
- General public
- Other states
- Academics

Tools:

- Web site

Process:

- Develop materials that help to tell the story of the Karner blue program in Wisconsin
- Publish educational material regarding the program on the web site including reports completed by academics or conservation organizations
- Provide an on-line resource to access FWS, DNR and other publications regarding the Karner blue and the HCP

Tools, Reference

Tools

Communication Tools Matrix

Component	Communication Tool								
	Web	e-mail	Newsletter	Direct Mail	One-on-One	Press Release	Organizations	Specific O&E materials	Presentations
HCP Partners	X	X	X	X	X			X	X
Landowners	X					X		X	
Legislators	X			X	X	X	X		X
Regulators	X				X				X
Media	X					X			
General	X					X			

Web: This tool is the DNR Karner website, <http://dnr.wi.gov/forestry/karner/>.

This is a great venue for mass communications and can provide the broadest audience with the information that they need, whenever they access. This tool can also be used to communicate relevant information to the HCP Partners and provide access to the necessary forms, documents, templates and other materials they need to comply with the HCP requirements. The web can be the primary mechanism used to meet HCP O&E requirements.

E-mail: E-mail is used to make announcements to a broad audience, and transfer information to a selected group. E-mail distribution lists have been created and used for a variety of purposes.

Newsletter: Newsletters are published and sent or e-mailed to those on the distribution lists at regular intervals throughout the year. The information is diverse as is the audience.

Direct mail: Direct mail is sent postage paid, to the individuals mailing address. Direct mail can include a variety of information or be used to transfer specific printed materials, O&E resources or other items.

One-on-One: One-on-one meetings are especially effective at fostering understanding and building trust about an issue. These meetings are useful in exchanging ideas and brainstorming.

Press Release: Press Releases are issued directly to the media with contact information for a follow-up. This communication tool usually needs to go through various process steps to be released, as it is 'official'.

Organizations: Trade organizations or those representing various entities are useful in providing a national or regional viewpoint, and can also be a good path for getting information to a larger audience, especially policy makers.

Specific O&E Materials: These are designed specifically for an audience or a purpose, e.g. DNR Wildcards

Presentations: Presentations are usually given at trade shows or conferences and can reach a good size audience.

Key Constituents

The primary constituents for this strategic communication plan are the HCP Partners and land owners located within or around biological recovery zones.

The HCP partners need to have a clear understanding of the program, their responsibilities, and access to relevant information, training, O&E materials, and the forms, documents, and other materials that are necessary for compliance.

O&E directed to private landowners is now focused on those areas that are strategically important for recovery of the Kbb in WI. Specific needs will be drawn from the Recovery O&E strategy and utilized by HCP Partners to focus O&E activities. Focusing O&E resources on these areas is the most efficient use of HCP Partner efforts. O&E to other private landowners and interested parties will be primarily through the Kbb website.

Communications to other key constituents is specifically addressed in the implementation plan below.

Key Messages

- Private landowner requirements
- HCP Partners success
- Lessons learned
- Conservation not regulation
- Partnership and collaboration, not command and control
- HCP partner responsibilities

Implementation

The implementation plan is comprised of a section describing the actions needed for each of the plan components detailed in Section II above. These actions are then put into an overall schedule for implementation

HCP Partners

- Develop Orientation training package for new partners or new partner employees
- Develop HCP Users Guide training
- Consult with IOC or Communication Team and receive guidance on Strategic Communications Plan
- Consult with IOC or Communication Team on updates to Kbb website and information needs
- Provide access to all O&E materials via Kbb website
- Provide access to Guidelines and Protocols via Kbb website
- Provide access to training materials via Kbb website
- Provide access to necessary HCP forms via Kbb website
- Assist HCP Partners as needed with targeted Kbb information (e.g. trade orgs, landowners, lobbyists, management)
- Update HCP distribution lists and mechanisms
- Clarify O&E requirements under HCP and SHCAs as necessary, e.g. SPA and ACE requirements change to BRZ

Landowners

- Assist WI Kbb Recovery Program with development and implementation of O&E strategy
- Provide O&E materials to public via Kbb website
- Update website to provide easy access to Kbb and Habitat identification and management information
- Update website to provide access to other relevant Kbb information
- Update website to include clear communication of landowner responsibilities (e.g. gypsy moth, construction, etc.)

Policy Makers

- Monitor relevant legislative and judicial proceedings
- Provide Briefings
- Develop white papers

Regulators

- Assess education needs

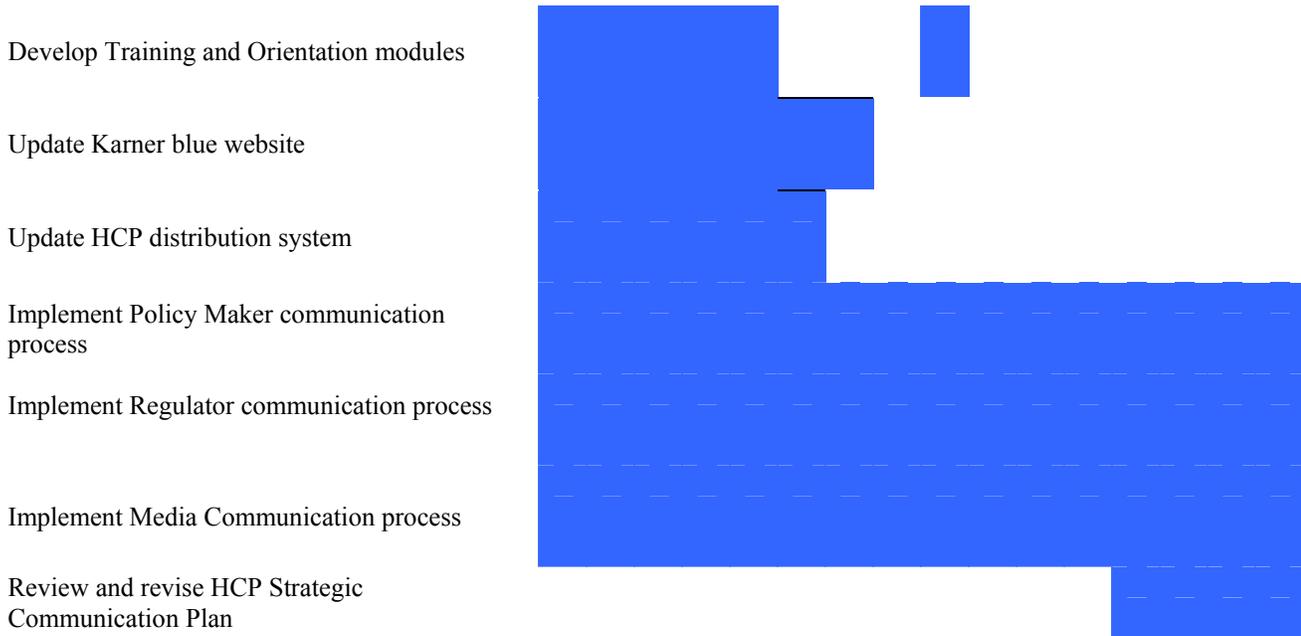
Media

- Develop Media list
- Develop press release strategy and needs

General

Schedule

General task description	S 07	O 07	N 07	D 07	J 08	F 08	M 08	A 08	M 08	J 08	J 08	A 08	S 08	O 08	N 08	D 08
Finalize Communication Plan and any necessary HCP updates																



Resource Needs

- 10-20 hrs/week of DNR LTE
- Assistance from DNR Forestry for Website design and maintenance
- Assistance from DNR forestry for training and orientation module development
- Assistance from DNR Forestry attorney for legislative and judicial monitoring
- Assistance from DNR BER and FWS Partners for Wildlife program in reviewing and providing expertise in land owner outreach actions
- IOC time for review and guidance

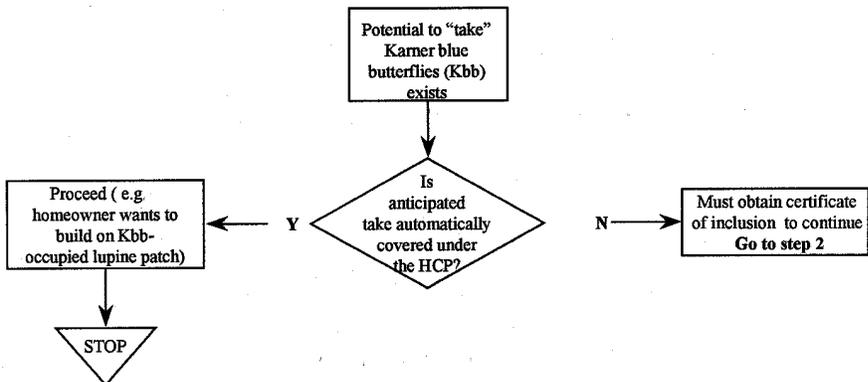
Appendices

- Appendix A: O&E Resource List

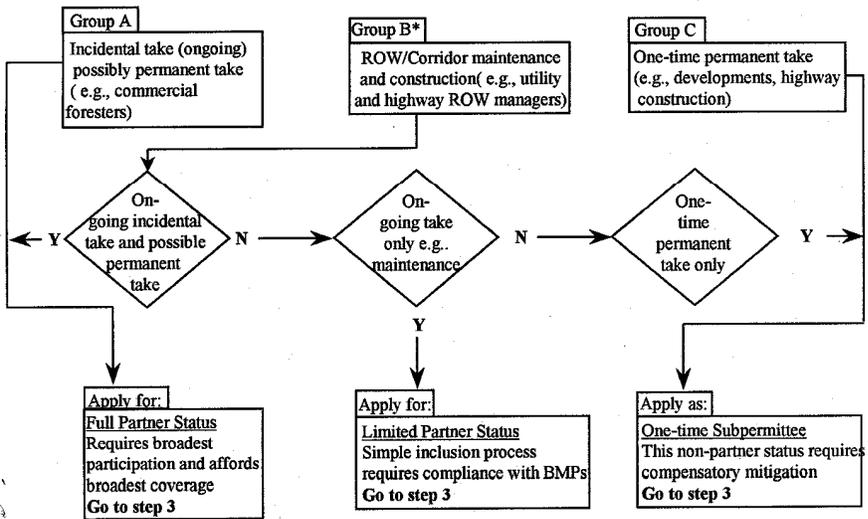
B. Participation Decision flow chart

Figure x.x Flow Chart for Determining Options for ITP Coverage

Step 1 - Determine Need: Do I need to apply for coverage (to "take")?

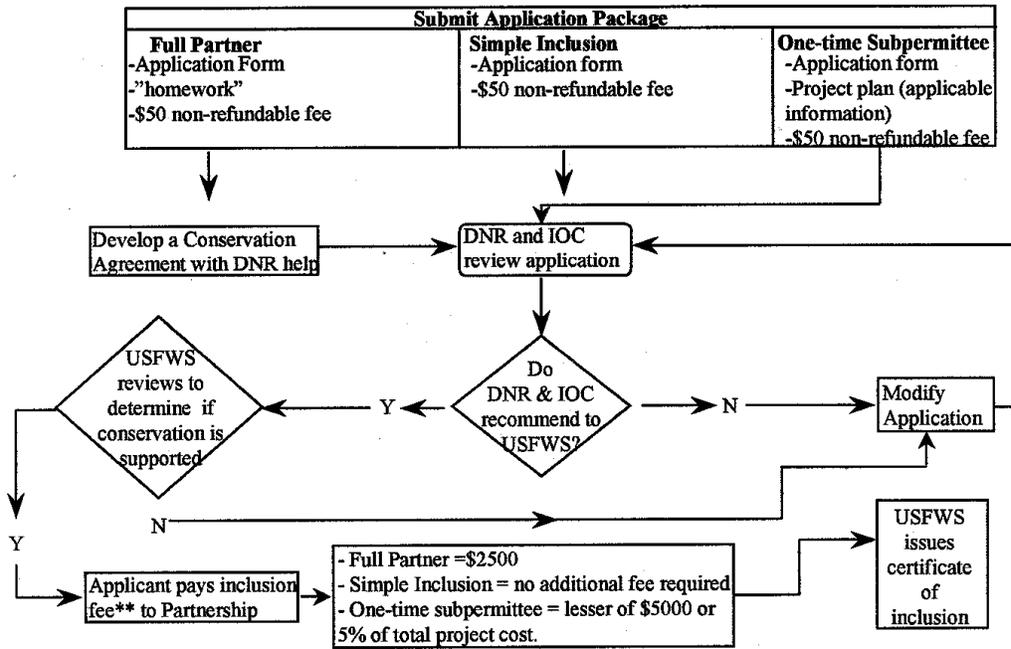


**Step 2 - Participation Status:
- Which participation group best describes my situation?
- Which application process best fits my needs?**



* Option: Applicant may select combination of simple inclusion and mitigate one-time permanent take. Consult with DNR.

Step 3 - The Application Process:



C. Application for Inclusion (template)

This section includes an example of an application for inclusion in the HCP. Such an application will be used by non-partners wishing to be covered by the incidental take permit. The application acts as a screening tool to better assess the needs of the applicant. The application would be made to the Wisconsin DNR.

APPLICATION for CONSIDERATION for INCLUSION in the WISCONSIN STATEWIDE KARNER BLUE BUTTERFLY HCP

When complete, submit this application to Attn: Karner Blue HCP Coordinator, FR/4, Wisconsin DNR, 101 S. Webster St., Box 7921, Madison, WI 53707-7921

(This is an informational questionnaire, and will be used by WDNR to assess applicant's intentions and assist in processing a conservation agreement and request for inclusion under USFWS Permit TE010064)

Applicant Information:
 Organization Name
 Mailing Address

1 st Contact Person _____	Title _____
Phone Number () -	Fax Number () -
2 nd Contact Person _____	Title _____
Phone Number () -	Fax Number () -

Check all that apply:		
<input type="checkbox"/> Full partner status	<input type="checkbox"/> Limited partner status	<input type="checkbox"/> One-time project.
<input type="checkbox"/> Governmental unit	<input type="checkbox"/> Non-governmental organization	
Complete fully and to the best of your ability.		

THIS APPLICATION SHALL NOT BE CONSIDERED COMPLETE AND ACTED UPON UNTIL ALL INFORMATION IN IT, AND AS OTHERWISE REQUESTED BY THE DEPARTMENT OF NATURAL RESOURCES IS PROVIDED.
--

Non-refundable Application fee (\$50): (This fee does not apply to governmental units or transfers from existing partners.)

1. Land ownership by acreage and description (the more specific the better e.g. quarter-quarter section, town, range.)

Note: For road ROWs enter number of miles of ROW and the total average width of vegetation on both sides of road.

2. Land use activities or land management practices you engage in or desire to engage in:
3. If the land involved is forest land, please describe type of vegetation and age class.
4. Describe the extent of land occupied by the Karner Blue butterfly and, to the best of your ability, the number of butterflies (if known).
 - a. What is the occupied site or sites used for currently?
 - b. Are there any natural or managed corridors adjacent to the occupied site that are or might be used for dispersal purposes?
 - c. What is the history of Karner Blue butterflies on the property, to the best of your knowledge? acreage, numbers.
5. What conservation measures are you willing to apply to your land to receive authorization to incidentally take Karner blue butterflies?
For how long?

6. What monitoring capability do you currently have to monitor the species and habitat on your property?
 - a. What monitoring are you willing to conduct?
7. Are you willing to allow the Department of Natural Resources, or its designees, access to your land to assure compliance with any authorization to incidentally take Karner blue butterflies?
8. Are you willing to submit periodic reports to the Department of Natural Resources regarding the status of Karner blue butterflies and habitat on your property?
9. What type of records do you currently keep respecting your land use and management activities? Are you willing to keep records in the form and of the type described in the information attached?
10. Other information you would like considered along with this application:

As and in the capacity of the applicant, I hereby commit to and agree to comply with the plans and conservation efforts contained in this application and submitted for the purpose of obtaining coverage under the Permit issued to the Department of Natural Resources for the incidental take of the Karner blue butterfly in the State of Wisconsin. I also agree to comply fully with any restrictions or conditions included in any Certificate of Inclusion issued to me by the Wisconsin DNR under Permit No. TE010064 as a result of this application for consideration as a partner in this HCP where applicable.

The information above is accurately and correctly stated to the best of my knowledge.

 Print or type name of person filling out application

 APPLICANT'S SIGNATURE

 DATE

D. Inclusion Fees

This section outlines fees which will be required to obtain incidental take permit coverage through participation in the Wisconsin Karner Blue Butterfly HCP.

Partner

An applicant may join this HCP and ITP in the status of a partner. As such, the applicant must comply with the Articles of Partnership, the "homework" requirements, and any other obligations established by the Partnership, the HCP or the Incidental Take Permit (e.g., reporting, monitoring, etc.)

Application Fee. A non-refundable application fee, except for governmental units, is **\$50** per partner application.

Additional Fees to Obtain Coverage

Partner. An applicant seeking the status of a Partner, unless the applicant is a governmental unit, must pay, upon a determination of acceptance as a Partner, an **inclusion fee of \$2,500**.

One-time. An applicant seeking to obtain coverage under the Incidental Take Permit for the purpose of incidentally taking a Karner blue butterfly, must comply with the application and Certificate of Inclusion requirements, and if determined to be acceptable as a participant in the conservation effort, pay the fee of:

A flat fee of \$5000, or 5% of the value of the project to be developed on the land, or the value of the activity e.g. value of timber to be removed, **whichever is less, with a credit to be given** for conservation efforts to be engaged in and continued by the applicant.

The credit to be given the applicant under this option may not exceed 50% of the fee (except for governmental lands or activities - see below) and will be determined by an oversight committee of the Partnership. Criteria to be used in determining the credit will be developed by the oversight committee and made available to applicants.

Governmental Unit. Governmental units, including state, county, town, etc., are not required to pay fees to obtain coverage under the Incidental Take Permit, but are required to comply with application, partnership or certificate of inclusion requirements.

E. Templates for Species and Habitat Conservation Agreement

This section provides a template for species and habitat conservation agreements (conservation agreements) for future HCP partners. There are separate agreements for Full HCP Partners and Limited (Local) HCP Partners. These templates were adapted for use by some HCP partners when renewing their individual conservation agreements prior to the 2009 application to renew the incidental take permit. Conservation agreements are legally-binding agreements between individual partners and the Wisconsin DNR.

Full Partner Conservation Agreement Template

**WISCONSIN KARNER BLUE BUTTERFLY
HABITAT CONSERVATION PLAN**

SPECIES AND HABITAT CONSERVATION AGREEMENT

FULL PARTNER

THIS SPECIES AND HABITAT CONSERVATION AGREEMENT (Agreement) is entered into by and between the State of Wisconsin Department of Natural Resources (DNR) and _____ (___) for the purpose of implementing the Habitat Conservation Plan (HCP) and authorizing the incidental take of the Karner blue butterfly (KBB) in the State of Wisconsin consistent with and during the period of an Incidental Take Permit (Permit) issued by the U.S. Fish and Wildlife Service (FWS).

WHEREAS, the DNR holds a Permit issued by the United States Department of the Interior, Fish and Wildlife Service (FWS) based upon the Habitat Conservation Plan, Species and Habitat Conservation Agreements (SHCA) with the Partners and Implementing Agreement submitted to the FWS with the application for a Permit;

WHEREAS, the statewide KBB conservation program relies on the inter-relationship of SHCAs, a HCP and an Incidental Take Permit (Permit) to form and direct the KBB conservation plan, as well as clarify commitments and obligations of landowners and land users in this effort;

WHEREAS, the Permit from the FWS authorizes the incidental take of the KBB subject to implementation of conservation measures and compliance with procedures, terms and conditions of this Agreement, the HCP and the Permit, by Partners entering into SHCAs with the DNR; and

WHEREAS, the Partner plans to engage in activities that may result in the incidental take of the KBB and is willing to implement conservation measures consistent with the HCP and the Permit on lands under and to the extent of the Partner's control to avoid, minimize or mitigate the take of such species as further provided herein.

IT IS HEREBY AGREED by the parties, based upon the mutual terms and conditions herein, that this Agreement shall constitute the Partner's commitment and agreement to undertake conservation measures for the KBB upon issuance of a Certificate of Inclusion (Certificate). The parties further agree this Certificate is conditioned on the premise that the Agreement shall be consistent with the HCP and conditions of the Permit.

1. DEFINITIONS.

For purposes of this Agreement, the following definitions apply:

- A.** "Certificate of Inclusion" (Certificate) is a document issued by the DNR as authorized by the FWS, which, thereby, includes the person or entity it is issued to under the provisions of the Permit and authorizes incidental take consistent with the HCP, the Permit and this Conservation Agreement.
- B.** "Implementing Agreement" is a legal contract entered into between the DNR and the FWS that: (1) identifies the responsibilities of all participants to the HCP; (2) legally binds the DNR to their obligations; and (3) is signed by the DNR.
- C.** "Incidental take" is the take of a species incidental to, and not for the purpose of, the carrying out of an otherwise lawful activity.
- D.** "Incidental take permit" (Permit) is a permit issued by the FWS under the authority of Section 10(a)(1)(B) of the Endangered Species Act to authorize the incidental take of a species listed as endangered or threatened under that Act.

- E. "Intentional take" means the purposeful take of a species not incidental to an otherwise lawful activity e.g. collecting.
- F. "Partner", consistent with the HCP Articles of Partnership (AOP) and determined as a Partner by HCP Implementation Oversight Committee (IOC) assigned this task, is a person, agency or organization that:
 1. Enters into and agrees to the HCP and AOP; and
 2. Has an ownership interest i.e. fee title or easement in land with existing or potential KBB habitat; or
 3. Has economic assets at risk as a result of the listing of the KBB as endangered; or
 4. Has a role in implementing the HCP e.g. ASCS, municipalities.

2. PERIOD OF AGREEMENT.

The period of this Agreement shall be from its execution and the issuance of a Certificate authorizing incidental take consistent with this Agreement, during the period of the Permit, unless terminated in accordance with paragraph 11 or amended in accordance with paragraph 12.

3. LANDS SUBJECT TO AGREEMENT.

The lands subject to this Agreement include approximately [REDACTED] acres and are more particularly described in Appendix A (Lands Included) which is attached to and made part of this Agreement, and all future ownership (including, but not limited to, easements and temporary work spaces) within the high potential range of the KBB, subject to the notification and reporting processes, and implementation of conservation practices consistent with this Agreement, the HCP and the Permit.

4. ACTIVITIES/INCIDENTAL TAKE AUTHORIZED/PUBLIC OUTREACH AND EDUCATION/CONSERVATION EFFORTS.

- A. **ACTIVITIES.** The following specified land management or land use activities, in addition to any other activity covered by an HCP guideline, protocol or management direction, may be engaged in on the Lands Included in accordance with this Agreement, and the incidental take of KBB is authorized, if the activities are conducted consistent with the HCP, HCP standard guidelines and protocols, the Permit, this Agreement and any changes and improvements made with HCP participation processes and consistent with the AOP, which amend these documents; and other protocols or management directions attached to, and made part of this Agreement as Appendix B. Standard HCP guidelines and protocols are published and made available on the HCP webpage; any other protocols and management directions defined by the partner will be listed and attached to Appendix B:

[LIST MANAGEMENT ACTIVITIES PARTNER WISHES TO ENGAGE IN HERE.]

- B. **INTENTIONAL TAKE.** The Partner agrees not to engage in the intentional take of the KBB and agree that the entering into of this Agreement does not authorize the intentional take of such species.

C. PUBLIC OUTREACH AND EDUCATION. The Partner agrees to engage in the following public outreach and education activities for the purpose of conserving the KBB consistent with the HCP and Permit:

[LIST O&E ACTIVITIES PARTNER COMMITS TO ENGAGE IN HERE.]

D. CONSERVATION EFFORTS FOR THE KBB. Other than as described elsewhere in this clause, the Partner intends to engage in the following conservation efforts and practices:

[LIST OTHER CONSERVATION ACTIVITIES PARTNER IS WILLING TO COMMIT TO HERE.]

5. OTHER SPECIES.

In addition to those efforts identified in this Agreement for the KBB, the Partner intends to implement the following conservation measures or programs related to the following species:

[LIST OTHER SPECIES OR INSERT "N/A" (Not Applicable) OR "NONE" HERE.]

6. SURVEYS.

The Partner agrees to conduct surveys for the KBB and other species identified in paragraph 5 and their habitat consistent with the HCP, on Lands Included, prior to engaging in or conducting a management or land use activity or practice. Written records of all surveys, including identification and qualifications of the person conducting the survey, the results of the survey as to habitat and occurrences observed, and the conservation strategy to be applied to respond to the findings of the survey, shall be maintained by the Partner during the period of and retained for five years following termination of the Agreement, at the following facility (*Include organization name, contact person's name and title, full mailing address including street, road or RFD number, telephone and facsimile numbers and email address*):

[INSERT NAME and TITLE OF CONTACT PERSON, COMPLETE MAILING AND STREET ADDRESS, TELEPHONE AND FACSIMILE NUMBERS AND EMAIL ADDRESS HERE.]

7. MONITORING.

The Partner agrees to monitor and maintain written records regarding the effects of land management and use practices and activities on KBB and KBB habitat, consistent with the HCP, on Lands Included, during the period of this Agreement and retain them for five years following termination of the Agreement, at the following facility (*Include organization name, contact person's name and title, full mailing address including street, road or RFD number, telephone and facsimile numbers and email address*):

[INSERT NAME and TITLE OF CONTACT PERSON, COMPLETE MAILING AND STREET ADDRESS, TELEPHONE AND FACSIMILE NUMBERS AND EMAIL ADDRESS HERE.]

8. DNR AND FWS INGRESS AND EGRESS.

A. COMPLIANCE MONITORING.

- (1) During the period of this Agreement, the DNR may conduct compliance monitoring of the activities and records of the Partner. Except as provided in Subparagraph A.(2), compliance monitoring shall be preceded by reasonable notice, not to be less than 24 hours, and shall be conducted in the presence of a representative of the Partner, if the representative is available at the noticed time and date, or other time agreed upon by the Partner and auditing personnel. Access to the property involved, to the extent of the Partner's authority, is authorized. Access to Lands Included and records required by this Agreement, or the HCP, shall be for the purpose of assuring compliance with this Agreement and the HCP, and be unlimited. If the Partner does not have authority to authorize access to the land identified in the notice to be monitored during the compliance monitoring the Partner shall immediately notify the DNR of such lack of authority and the limited use it has in the land identified. Documents of title or interest in the land identified shall be provided to the DNR upon its request. A copy of any final report, map or other record prepared by the DNR on the results of its going upon the land identified or reviewing the records shall be provided to the Partner within thirty (30) days of the DNR access and review.

Notification under this Paragraph shall be in writing, facsimile, or telephone to (*Include organization name, contact person's name and title, full mailing address including street, road or RFD number, telephone and facsimile numbers and email address*):

[INSERT NAME and TITLE OF CONTACT PERSON, COMPLETE MAILING AND STREET ADDRESS, TELEPHONE AND FACSIMILE NUMBERS AND EMAIL ADDRESS HERE.]

-
- (2) The notice provision in Subparagraph A.(1), shall not apply when the DNR or representatives of the FWS considers that pending or ongoing activities of the Partner, or person authorized by the Partner, based on concerns or complaints made known to them, may adversely affect KBB occupied sites in a manner inconsistent with the Agreement, or result in damage to or destruction of KBB occupied habitat or that may jeopardize the Permit.
- B.** Any refusal of access authorized in Subparagraphs (1) or (2) shall be considered a breach of this Agreement and subject the Partner to all remedies available to the DNR under this Agreement or at law,
- C.** The FWS may accompany the auditor when auditing or monitoring under this Agreement or the HCP.
- D.** In addition to authority granted elsewhere in this Agreement, the FWS may enter the Lands Included or where permission by others with an ownership interest has been granted and access the records of the Partner required for the purpose of overseeing the Permit and activities under it or required by this Agreement.
- E.** Nothing in this Agreement, including this section, shall abrogate the authority of the Secretary of the Interior, through the FWS, to fulfill his or her responsibility in the

administration and enforcement of the Endangered Species Act (ESA), 16 USC 1531 et seq. and all implementing regulations including but not limited to 50 CFR Parts 13 and 17.

9. ANNUAL REPORT.

- A.** The Partner shall submit an annual report no later than March 1 following the calendar year which is the subject of the report. Each report shall be consistent with the required conditions of the Permit, the HCP and its guidelines and processes in effect for the reporting period, and this Agreement.

10. REMEDIES.

- A.** The Partner agrees that this Agreement and authorization under the Permit does not apply to conduct resulting in the take of a KBB that does not strictly conform to the requirements of this Agreement or the HCP, and in such a situation the landowner will be acting without a Permit or authority to take a KBB and shall be subject to all provisions, remedies and penalties of the ESA, 16 USC 1531 et seq. and all implementing regulations including but not limited to 50 CFR Parts 13 and 17, 29.415, Wis. Stats., the Wisconsin Endangered Species ACT (WESA) and ch. NR 27, Wis. Adm.Code.
- B. (1)** Upon a breach or violation of this Agreement, as determined by the DNR, and in addition to any remedies provided or pursued under paragraphs 10.a., the DNR may revoke this Agreement and the authorization under it after considering recommendations of the HCP IOC. The Landowner and the FWS shall be notified of an alleged breach or violation by the Partner.

The DNR will notify the FWS of any violation of the Permit, HCP, or Agreement. Such notification shall be made in writing within five (5) calendar days of discovery of the violation, to the address listed below. Notification will include the name of the Party(ies) and individual(s) involved, the nature of the suspected violation, time period when the suspected violation occurred and the specific location(s) of the suspected violation.

**2661 Scott Tower Drive
New Franken, WI 54229
Telephone: (920) 866-1717
Fax: (920) 866-1710
Field Supervisor
U.S. Fish and Wildlife Service**

- B. (2)** The Partner shall be provided an opportunity to present information to the DNR and the IOC on an alleged violation and what an appropriate remedy should be prior to the DNR's determination on whether a breach or violation occurred and the appropriate remedy. Information shall be presented to the DNR and the IOC by the Partner within thirty (30) days of notice of an alleged violation of this Agreement to the Partner.
- B. (3)** If the DNR, after consideration of recommendations of the IOC, determines that action by the Partner may be taken that is reasonable and consistent with ensuring the conservation of the species and its habitat without the application of other remedies in this paragraph, it shall

not seek additional remedies on the condition that the Partner completes the remedial action within a time considered reasonable by the DNR.

- C. The DNR retains all further remedies in law or equity, which it may apply to a breach or violation of this Agreement. Enforcement or other remedies available to the FWS under the ESA shall not be abridged or affected by any decision of the DNR under this paragraph.
- D. It is understood that unintentional violations of this Agreement may occur, and that the Partners may be required to act in emergency situations that do not allow them to follow all commitments in this Agreement. Should such a situation arise, it is expected that a Partner will report such an activity consistent with the HCP and the HCP Emergency Guideline, detailing the damage, if any, to KBB habitat and such action the Partner intends to take to cure or mitigate any damage to KBB or its habitat. The DNR agrees to consider the circumstances and the Partner's offer to cure or mitigate in any decision it may make regarding appropriate remedial or enforcement action necessary under this Agreement.

11. TERMINATION.

This Agreement or its applicability to any land under it may be terminated by the Partner upon sixty (60) days written notice to the DNR and upon the occurrence of one of the following:

- A. The Lands Included or management rights are transferred to another by land contract, fee title, easement, or otherwise;
- B. The KBB is no longer protected by the ESA, (i.e. is delisted) or the KBB is downlisted to threatened and take activities of the Partner is allowed per a 4.d. rule.
- C. The Partner ceases to exist, in fact or by law.
- D. Other reasons for termination mutually agreed upon as reasonable by the Partner and the DNR, with advice of the IOC, provided that appropriate conservation and/or compensation has occurred for the take of occupied KBB habitat. It is the responsibility of the Partners to demonstrate to DNR that conservation has occurred prior to termination.

12. AMENDMENT.

This Agreement shall constitute the entire agreement of the parties and any previous communications or agreements are hereby superseded and no modifications of this Agreement or waiver of its terms and conditions shall be effective unless made specifically in writing and mutually agreed upon and signed by both parties.

13. CONTRACTING PARTIES.

In this Agreement, the DNR and the Partner include their respective officers, employees, agents, directors, partners, representatives, successors, heirs, members and servants.

14. STATUS OF PARTIES.

The Partner shall not be considered as an agent, contractor or an employee of the DNR for any purpose, including workers compensation. The DNR agrees that the Partner has sole control of the activities and work conducted on the lands of or under the control of the Partner. The DNR only reserves the right of ingress and egress to the lands and facilities, consistent with paragraph 8, to inspect the lands and records of the Partner, as provided herein, to assure compliance with this Agreement.

15. ASSIGNMENT

In the event the Partner sells, transfers or otherwise divests itself of all Lands Included or management rights to a subsequent owner and no longer has assets at risk due to the listing of the KBB, the Partner may relinquish and assign this Agreement or performance under it that subsequent owner (Assignee) with the consent of the DNR. Consent to assign shall be conditioned upon the Assignee's agreement in writing to comply with all the terms of this Agreement following discussion with the DNR to assure a full understanding of the requirements of the Agreement. The FWS shall be notified of any assignment and shall issue a Certificate of Inclusion covering the Assignee.

16. TRANSFER

In the event that the Partner sells, transfers or otherwise divests itself of some portion of the Lands Included or management rights, but still has a portion of the Lands Included, management rights or assets at risk due to the listing of the KBB, and the Partner chooses to remain a signatory Partner, assignment of any incidental take authorization under this Agreement and the Permit may be transferred to a subsequent owner of the Lands Included or management rights (Transferee) if the Transferee enters into, agrees to and files with the DNR a SHCA, which is acceptable to the DNR. Following review and recommendation by the IOC, the SHCA may be signed. The FWS will be notified of the transfer and approved SHCA and shall issue a Certificate covering the Transferee. Unlike the complete transfer and assignment of an SHCA to an Assignee, incidental take authorization is not afforded to the Transferee until a SHCA unique to the Transferee is approved by the IOC and DNR and a Certificate is issued by the FWS.

The Partner agrees to notify the DNR of any transaction involving Lands Included, management rights, or assets relating to land within the High Potential Range, which may pertain to this Agreement, and coverage under the Permit. Notification of transfers can be made at any time, but must be included prior to any activity which would result in incidental take of KBB in order for incidental take authority to be valid. Incidental take is not authorized on newly acquired land until the transfer is reported to the DNR and added to the Partner's Lands Included.

17. MODIFICATION/ADAPTIVE MANAGEMENT.

The Partner agrees to modify responsibilities and duties under this Agreement consistent with the review and adaptive management process established in the HCP unless otherwise stated in this Agreement.

18. FUNDING COMMITMENTS.

The Partner commits to completing its conservation strategies and other obligations as provided in this Agreement, whether accomplished by employees, agents, contractors or cooperators.

[LIST OTHER FUNDING COMMITMENTS HERE.]

19. LIABILITY FOR AGENTS, ETC.

It is recognized that the Partner often conducts its land management or use activities through an agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser. The Partner has and accepts the obligation to require, normally through written agreement or communication, that activities be conducted in a manner consistent with this Agreement, the HCP and the Permit. Take incidental to otherwise lawful activities by these persons or entities is authorized by the Permit so long as such activity and incidental take resulting from it is authorized by the Partner consistent with this Agreement, the HCP and the Permit. A violation of any authorization which includes procedures and activities for KBB conservation the Partner is required to follow or conduct, consistent with this Agreement, the HCP, and the Permit, by an agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser, shall not result in the suspension, revocation, or termination of the Permit or the authorization to the Partner under this Agreement, the HCP and the Permit; nor shall it affect other benefits, rights, or privileges under this Agreement, the HCP or the Permit, except as to that agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser, who is and will be subject to the provisions of the ESA, including remedies for its violation when acting inconsistent with the authorization from this Partner, this Agreement, the HCP and the Permit. The obligation to demonstrate that the Partner adequately communicated procedures and requirements of this Agreement, the HCP and the Permit to the agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser is on the Partner, and cannot be waived by the DNR.

20. DATA SHARING

- A. Data provided by the DNR and which constitutes Natural Heritage Inventory data (NHI) may not be used for any purpose other than development of the SHCA or conducting of activities under the Permit. It may not be released or made available to any other person, agency or organization for any purpose unless agreed to in writing by the DNR. Documents or data containing NHI information is included in this restriction.
- B. Data provided to the DNR is subject to Wisconsin's Public Records Law, Ch. 19, Wis. Stats., and subject to that law regarding requests for it. Under s.23.27 (3), Wis. Stats., NHI information is considered confidential and release or use of it is controlled by the Department and administrative rules adopted to administer the NHI program.

21. ARTICLES OF PARTNERSHIP

The partner agrees to enter into and comply with the AOP, which are attached to and made part of this Agreement.

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

DATE _____

BY _____

Paul DeLong
Division Administrator of
Forestry, Wisconsin DNR

AND

DATE _____

BY _____

Laurie Osterndorf
Division Administrator of
Land, Wisconsin DNR

[INSERT PARTNER'S ENTITY NAME]

DATE _____ BY _____

(Partner signatory's name/title)

DATE _____ BY _____

(Partner signatory's name/title)

APPENDIX A
LANDS INCLUDED

[LIST LANDS FOR WHICH PARTNER WISHES INCIDENTAL TAKE COVERAGE. INCLUDE MAP(S) INDICATING LOCATION OF THESE LANDS, WHICH ARE SUFFICIENTLY SPECIFIC TO PROVIDE USFWS OR DNR ENOUGH INFORMATION]

FOR AUDITING AND ENFORCEMENT PURPOSES. NECESSARY MAP CHARACTERISTICS INCLUDE, PARTNER NAME, TOWN, RANGE, SECTION, AND COUNTY INFORMATION AND CARDINAL MARKER.]

APPENDIX B

PARTNER SPECIFIC MANAGEMENT GUIDELINES AND PROTOCOLS

[LIST AND ATTACH HERE ALL MANAGEMENT PROCEDURES, CONSERVATION MEASURES, AND MONITORING PROCEDURES NOT COVERED BY STANDARD HCP MANAGEMENT GUIDELINES AND PROTOCOLS THAT PARTNER WISHES TO APPLY WHEN PERFORMING ACTIVITIES LISTED IN 4.A. ON LANDS LISTED IN APPENDIX A.]

Limited Partner Conservation Agreement Template

WISCONSIN KARNER BLUE BUTTERFLY

HABITAT CONSERVATION PLAN

SPECIES AND HABITAT CONSERVATION AGREEMENT

LIMITED PARTNER

THIS SPECIES AND HABITAT CONSERVATION AGREEMENT (Agreement) is entered into by and between the State of Wisconsin Department of Natural Resources (DNR) and _____, (Partner) for the purpose of implementing the Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan (HCP) and authorizing the incidental take of the Karner blue butterfly (Kbb) in the State of Wisconsin consistent with and during the period of the Incidental Take Permit (Permit) issued by the U.S. Fish and Wildlife Service (FWS).

WHEREAS, the DNR holds a Permit issued by the United States Department of the Interior, Fish and Wildlife Service (FWS) based upon the Habitat Conservation Plan, Species and Habitat Conservation Agreements (SHCA) with the Partners and Implementing Agreement submitted to the FWS with the application for a Permit;

WHEREAS, the statewide KBB conservation program relies on the inter-relationship of SHCAs, a HCP and an Incidental Take Permit (Permit) to form and direct the KBB conservation plan, as well as clarify commitments and obligations of landowners and land users in this effort;

WHEREAS, the Permit from the FWS authorizes the incidental take of the KBB subject to implementation of conservation measures and compliance with procedures, terms and conditions of this Agreement, the HCP and the Permit, by Partners entering into SHCAs with the DNR; and

WHEREAS, the Partner plans to engage in activities that may result in the incidental take of the KBB and agrees to implement conservation measures consistent with the HCP and the Permit on lands under its control and to the extent of the Partner's control to avoid, minimize or mitigate the take of such species as further provided herein.

IT IS HEREBY AGREED by the DNR and the Partner (Parties), based upon the mutual terms and conditions herein, that this Agreement shall constitute the Partner's commitment and agreement to undertake conservation measures for the KBB upon issuance of a Certificate of Inclusion (Certificate). The parties further agree this Certificate is conditioned on the premise that the Agreement shall be consistent with the HCP and conditions of the Permit.

1. DEFINITIONS.

For purposes of this Agreement, the following definitions apply:

- A. "Certificate of Inclusion" (Certificate) is a document issued by the DNR as authorized by the FWS, which, thereby, includes the person or entity it is issued to under the provisions of the Permit and authorizes incidental take consistent with the HCP, the Permit and this Conservation Agreement.
- B. "Implementing Agreement" is a legal contract entered into between the DNR and the FWS that: (1) identifies the responsibilities of all participants to the HCP; (2) legally binds the DNR to their obligations; and (3) is signed by the DNR.
- C. "Incidental take" is the take of a species incidental to, and not for the purpose of, the carrying out of an otherwise lawful activity.
- D. "Incidental Take Permit" (Permit) is a permit issued by the FWS under the authority of Section 10(a)(1)(B) of the Endangered Species Act to authorize the incidental take of a species listed as endangered or threatened under that Act.
- E. "Intentional Take" means the purposeful take of a species not incidental to an otherwise lawful activity e.g. collecting.
- F. "Partner", defined as "Limited Partners" within the HCP, means a person, agency or organization that is engaged in a limited suite of management activities, such as predefined best management practices, on a local level, typically resulting in short term take and subsequently, favorable habitat conditions. Examples include, but are not limited to, county highway departments, townships and municipalities,

2. PERIOD OF AGREEMENT.

The period of this Agreement shall be from its execution and the issuance of a Certificate authorizing incidental take consistent with this Agreement, during the period of the Permit, unless terminated in accordance with paragraph 11 or amended in accordance with paragraph 12.

3. LANDS SUBJECT TO AGREEMENT.

The lands subject to this Agreement include approximately acres and are more particularly described in Appendix A (Lands Included), which is attached to and made part of this Agreement, and all future ownership (including, but not limited to, easements and temporary work spaces) within the high potential range of the KBB, subject to the notification and reporting processes, and implementation of conservation practices consistent with this Agreement, the HCP and the Permit

4. ACTIVITIES/INCIDENTAL TAKE AUTHORIZED/PUBLIC OUTREACH AND EDUCATION/ INFORMATION

- A. **ACTIVITIES.** The following specified land management or land use activities, in addition to any other activity covered by an HCP guideline, protocol or management direction, may be engaged in on the Lands Included in accordance with this Agreement, and the incidental

take of KBB is authorized, if the activities are conducted consistent with the HCP, HCP standard guidelines and protocols, the Permit, this Agreement and any changes and improvements made with HCP participation processes which amend these documents; and other protocols or management directions attached to, and made part of this Agreement as Appendix B. Standard HCP guidelines and protocols are published and made available on the HCP webpage; any other protocols and management directions defined by the Partner will be listed and attached to Appendix B:

[LIST MANAGEMENT ACTIVITIES PARTNER WISHES TO ENGAGE IN HERE. Select from examples listed below.]

Highway or road right of way maintenance, including:

- (1) Mowing,
- (2) Brushing (including tree pruning and hazard tree removal),
- (3) Use of pesticides to control vegetation,
- (4) Shoulder maintenance and grooming,
- (5) Snowplowing.

Certain highway or road and road right of way construction, (may be subject to project plan or activity review and approval by WDNR and USFWS), including:

- (1) Ditch maintenance and construction,
- (2) Shoulder construction,
- (3) Road and road right of way construction,
- (4) Other construction, which may impact occupied Karner blue butterfly habitat.

B. INTENTIONAL TAKE. The Partner agrees not to engage in the intentional take of the KBB, as defined in Paragraph 1.E., and agrees that the entering into of this Agreement does not authorize the intentional take of such species.

C. PUBLIC OUTREACH AND EDUCATION. The Partner agrees to respond to questions by the public regarding their activities relating to KBB conservation and provide information on the KBB program when opportunities arise, e.g. budget deliberations, planning or information meetings, etc.

D. INFORMATION. Partner agrees to provide updated guidelines and protocols to those officers, employees, agents or contractors responsible for implementing this agreement.

5. SURVEYS.

The Partner agrees to conduct surveys for wild lupine (*Lupinus perennis*) consistent with the HCP and the survey protocols described in the HCP User's Guide (accessed on the DNR's KBB HCP website or otherwise provided by the DNR), on lands identified in Appendix A or lands the DNR is notified of through the process provided in this Agreement and approves as being subject to it, and maintain written records of all surveys, including:

- a. identification and qualifications of the person conducting the survey,
- b. the results of the survey as to habitat and occurrences observed, and

c. the written records shall be maintained by the Partner during the period of and retained for five years following termination of the Agreement, at the following facility:

(Include Organization Name, contact person, full mailing address, including street, road or RFD number, telephone number and email address):

6. MONITORING.

The Partner agrees to monitor and maintain written records regarding the effects of land management and use practices and activities, consistent with the Plan, on the lands subject to this Agreement, as identified in Appendix A during the period of this Agreement. Written records will be maintained, including, but not limited to:

- a. the location and dates of management activities on Kbb occupied (if known) lupine habitat,
- b. the conservation strategy/protocol applied, and
- c. written records will be retained for five years following termination of the Agreement, at the following facility:

(Include Organization Name, contact person, full mailing address, including street, road or RFD number, telephone number and email address):

7. DNR AND FWS INGRESS AND EGRESS.

A. COMPLIANCE MONITORING.

(1) During the period of this Agreement, the DNR may audit and monitor the activities and records of the Partner. Except as provided in A.(2), auditing and monitoring shall be preceded by reasonable notice, not to be less than 24 hours, and shall be conducted in the presence of a representative of the Partner, if the representative is available at the noticed time and date, or other time agreed upon by the Partner and auditing personnel. Access to the property involved, to the extent of the Partner's authority, is authorized. Access to the lands subject to this Agreement and records required by it, or the HCP, shall be for the purpose of assuring compliance with this Agreement and the HCP, and be unlimited. If the Partner does not have authority to authorize access to the land identified in the notice to be monitored or audited, or during the audit, the Partner shall immediately notify the DNR of such lack of authority and the limited use it has in the property. Documents of title or interest in the property shall be provided to the DNR upon its request.

A copy of any final report, map or other record prepared by the DNR on the results of its going upon the land or reviewing the records shall be provided to the Partner within thirty (30) days of the DNR access and review.

Notification under this Paragraph shall be in writing, facsimile, or telephone to:

(Include Organization Name, contact person, full mailing address, including street, road or RFD number, telephone number and email address):

(2) The notice provision in Subparagraph A.(1), shall not apply when the DNR or representatives of the FWS considers that pending or ongoing activities of the Partner, or person authorized by the Partner, based on concerns or complaints made known to them, may adversely affect Kbb occupied sites in a manner inconsistent with this Agreement, or result in damage to or destruction of Kbb occupied habitat or that may jeopardize the Permit.

- B.** Any refusal of access authorized in Subparagraphs (1) or (2) shall be considered a breach of this Agreement and subject the Partner to all remedies available to the DNR under this Agreement or at law, as well as loss of KBB incidental take authorization provided by the FWS through use of this Agreement.
- C.** The FWS may accompany the DNR when auditing or monitoring under this Agreement or the HCP.
- D.** In addition to authority granted elsewhere in this Agreement, the FWS may enter the lands subject to this Agreement, which are owned by the Partner or where permission by others with an ownership interest has been granted and access the records of the Partner required for the purpose of overseeing the Permit and activities under it or required by this Agreement.
- E.** Nothing in this Agreement, including this section, shall abrogate the authority of the Secretary of the Interior, through the FWS, to fulfill his (her) responsibility in the administration and enforcement of the Endangered Species Act (ESA), 16 USC 1531 et seq. and all implementing regulations including but not limited to 50 CFR Parts 13 and 17.

8. ANNUAL REPORT.

The Partner shall submit an annual report no later than March 1 following the calendar year, which is the subject of the report which shall be on a form provided by the DNR and fully and accurately completed by the Partner with all attachments requested by the DNR, which may include maps, surveys, records, or other information.

9. ASSIGNMENT.

The Partner may not assign this Agreement or performance under it to another without the consent of the DNR. Consent to assign shall be conditioned upon the assignee's Agreement in writing to comply with all the terms of this Agreement following discussion with the DNR to assure a full understanding of the requirements of the Agreement. The FWS shall be notified of any assignment.

10. REMEDIES.

- A.** The Partner agrees that this Agreement and authorization under the Permit does not apply to conduct resulting in the take of a Kbb that does not strictly conform to the requirements of this Agreement or the HCP, and in such a situation the Partner shall be acting without a Permit or authority to take a Kbb and shall be subject to all provisions, remedies and penalties of the Endangered Species Act (ESA), 16 USC 1531 et seq. and all implementing regulations including but not limited to 50 CFR Parts 13 and 17, 29.415, Wis. Stats., the

Wisconsin Endangered Species Act (WESA) and ch. NR 27, Wis. Adm.Code.

- B.** (1) Upon a breach or violation of this Agreement, as determined by the DNR, and in addition to any remedies provided or pursued under paragraph 10.A., the DNR may revoke this Agreement and the authorization under it after considering recommendations of the HCP Partners' Implementation and Oversight Committee. The DNR shall notify the Partner and the FWS of an alleged breach or violation.

The DNR shall notify the FWS of any violation of the Permit, HCP or this Agreement. Such notification shall be in writing within five (5) calendar days of discovery of the violation and to the address listed below. Notification shall include the name of the Party(ies) and individual(s) involved, the nature of the suspected violation, time period when the suspected violation occurred and the specific location(s) of the suspected violation.

**Field Supervisor
U.S. Fish and Wildlife Service
2661 Scott Tower Drive
New Franken, WI 54229
Telephone: (920) 866-1717**

Fax: (920) 866-1710

- (2) The Partner shall be provided an opportunity to present information to the DNR and the HCP Partners' Implementation Oversight Committee on an alleged violation and what an appropriate remedy should be prior to the DNR's determination on whether a breach or violation occurred and the appropriate remedy. Information shall be presented to the DNR and the HCP Partners' Implementation Oversight Committee by the Partner within thirty (30) days of notice of an alleged violation of this Agreement to the Partner.
- (3) If the DNR, after consideration of recommendations of the HCP Partners' Implementation Oversight Committee, determines that action by the Partner may be taken that is reasonable and consistent with ensuring the conservation of the species and its habitat without the application of other remedies in this paragraph, it shall not seek additional remedies on the condition that the Partner completes the remedial action within a time considered reasonable by the DNR.
- C.** The DNR retains all further remedies in law or equity, which it may apply to a breach or violation of this Agreement. Enforcement or other remedies available to the FWS under the ESA shall not be abridged or affected by any decision of the DNR under this paragraph.
- D.** It is understood that unintentional violations of this Agreement may occur, and that the Partner may be required to act in emergency situations that do not allow them to follow all commitments in this Agreement. Should such a situation arise, it is expected that a Partner shall report such an activity consistent with the HCP and the HCP Emergency Guideline, detailing the damage, if any, to Kbb habitat and such action the Partner intends to take to cure or mitigate any damage to KBB or its habitat. The Department agrees to consider the circumstances and the Partner's offer to cure or mitigate in any decision it may make regarding appropriate remedial or enforcement action necessary under this Agreement.

11. TERMINATION.

This agreement or its applicability to any land under it may be terminated by the Partner upon sixty (60) days written notice to the DNR and upon the occurrence of one of the following:

- A.** The land or management right over it is transferred to another by land contract, fee title, easement, or otherwise;
- B.** The KBB is no longer protected by the ESA, (i.e. is delisted) or the KBB is down listed to threatened and take activities of the Partner is allowed per a 4.d. rule.
- C.** The Partner ceases to exist, in fact or by law.
- D.** Other reasons for termination mutually agreed upon as reasonable by the Partner and the DNR, with advice of the HCP Partners' Implementation Oversight Committee, provided that appropriate conservation and/or compensation has occurred for the take of occupied Kbb habitat. It is the responsibility of the Partner to demonstrate to DNR that conservation has occurred prior to termination.

12. AMENDMENT.

This Agreement shall constitute the entire agreement of the Parties and any previous communications or agreements are hereby superseded and no modifications of this Agreement or waiver of its terms and conditions shall be effective unless made specifically in writing and mutually agreed upon and signed by both Parties.

13. CONTRACTING PARTIES.

In this Agreement, the DNR and the Partner include their respective officers, employees, agents, directors, partners, representatives, successors, heirs, members and servants.

14. STATUS OF PARTIES.

The Partner shall not be considered as an agent, contractor or an employee of the DNR for any purpose, including workers compensation. The DNR agrees that the Partner has sole control of the activities and work conducted on the lands of or under the control of the Partner. The DNR only reserves the right of ingress and egress to the lands and facilities, consistent with paragraph 7, to inspect the lands and records of the Partner, as provided herein, to assure compliance with this Agreement.

15. TRANSFER.

The Partner agrees to notify the DNR of any transaction involving Lands Included, management rights, or assets relating to land, which may pertain to this Agreement, and coverage under the Permit. Notification of transfers can be made at any time, but must be

included prior to any activity, which would result in incidental take of Kbb in order for incidental take authority to be valid. Incidental take is not authorized on newly acquired land until the transfer is reported to the DNR and added to the Partner's SHCA Appendix A (lands included).

16. MODIFICATION/ADAPTIVE MANAGEMENT.

The Partner agrees to modify responsibilities and duties under this Agreement consistent with the review and adaptive management process established in the HCP.

17. FUNDING COMMITMENTS.

The Partner commits to completing its conservation strategies and other obligations as provided in this Agreement, whether accomplished by employees, agents, contractors or cooperators.

18. LIABILITY FOR AGENTS, ETC.

It is recognized that the Partner often conducts its land management or use activities through an agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser. The Partner has and accepts the obligation to require, normally through written agreement or communication, that activities be conducted in a manner consistent with this Agreement, the HCP and the Permit. Take incidental to otherwise lawful activities by these persons or entities is authorized by the Permit so long as such activity and incidental take resulting from it is authorized by the Partner consistent with this Agreement, the HCP and the Permit. A violation of any authorization, which includes procedures and activities for KBB conservation the Partner is required to follow or conduct, consistent with this Agreement, the HCP and the Permit, by an agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser, shall not result in the suspension, revocation, or termination of the Permit or the authorization to the Partner under this Agreement, the HCP and the Permit; nor shall it affect other benefits, rights, or privileges under this Agreement, the HCP or the Permit, except as to that agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser, who is and shall be subject to the provisions of the ESA, including remedies for its violation when acting inconsistent with the authorization from this Partner, this Agreement, the HCP and the Permit. The obligation to demonstrate that the Partner adequately communicated procedures and requirements of this Agreement, the HCP and the Permit to the agent, lessee, licensee, contractor, permittee, right-of way grantee, or purchaser is on the Partner, and cannot be waived by the DNR.

19. DATA SHARING

- A. Data provided by the DNR and which constitutes Natural Heritage Inventory data (NHI) may not be used for any purpose other than development of the SHCA or conducting of activities under the Permit. It may not be released or made available to any other person, agency or organization for any purpose unless agreed to in writing by the DNR. Documents or data containing NHI information is included in this restriction.

- B. Data provided to the DNR is subject to Wisconsin's Public Records Law, Ch. 19, Wis. Stats., and subject to that law regarding requests for it. Under s.23.27 (3), Wis. Stats., NHI information is considered confidential and release or use of it is controlled by the Department and administrative rules adopted to administer the NHI program.

20. NOTIFICATION

Partner agrees to notify the Department of any change in the responsible agent, employee, officer or representative responsible for implementing this agreement.

**STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES**

DATE _____

BY _____

Paul DeLong
Division Administrator of
Forestry, Wisconsin DNR

AND

DATE _____

BY _____

Laurie Osterndorf
Division Administrator of
Land, Wisconsin DNR

[PARTNER NAME below line]

DATE _____

BY _____

(Print name/title below line)

DATE _____

BY _____

(Print name/title below line)

APPENDIX A

PARTNER LANDS INCLUDED

Partner lands included are those road ROWs that the partner has management responsibility for, and which are highlighted on the attached map.

The lands subject to this agreement include roads and highways, and the rights-of- ways (ROW) of which the ROWs are approximately:

_____ feet, meters (*circle one or delete other*) wide on each of two sides, and

_____ feet, meters, miles (*circle one or delete other*) in length.

Total Acres Included for Incidental Take Coverage
= _____ ACRES

Acreage Calculator:

1 meter = 3.2808 feet _____ meters x 3.2808 = _____ feet
1 mile = 5,280 feet _____ miles x 5,280 feet = _____ feet
1 acre = 43,560 square feet _____ ft. wide x _____ ft. long = _____ sq. ft.

_____ sq. ft. divided by 43,560 sq. ft. = _____ acres (include in block above)

Attach county or township map with roads partner manages marked with a highlighter. Map will contain:

- County name
- Township name(s)
- Town & Range
- Cardinal marker
- Distance scale (and/or section lines)

APPENDIX B

PARTNER SPECIFIC MANAGEMENT GUIDELINES AND PROTOCOLS

[LIST AND ATTACH HERE ALL MANAGEMENT PROCEDURES, CONSERVATION MEASURES, AND MONITORING PROCEDURES NOT COVERED BY STANDARD HCP]

MANAGEMENT GUIDELINES AND PROTOCOLS THAT PARTNER WISHES TO APPLY WHEN PERFORMING ACTIVITIES LISTED IN 4.A. ON LANDS LISTED IN APPENDIX A.]

SHCA Amendment Template & Example

**AMENDMENT
TO
SPECIES AND HABITAT CONSERVATION AGREEMENT (SHCA)**

THIS AMENDMENT is entered into by and between the Wisconsin Department of Natural Resources (DNR) and [REDACTED] (Partner) for the purpose of amending, where applicable, the SHCA, entered into by the parties on or about [REDACTED], 19 [REDACTED] for the purpose of implementation of the statewide Karner blue butterfly (KBB) conservation strategy as further described in the applicable agreements, the Habitat Conservation Plan (HCP) and the Incidental Take Permit (ITP), and all previous modifications and amendments to them. That SHCA is attached to and made part of this agreement.

WHEREAS, an ITP, with associated HCP, AOPs and SHCAs, were issued or agreed upon to direct implementation of a statewide KBB conservation plan consistent with the federal Endangered Species Act (ESA). The Term of the Permit was 10 years, with an option to extend, from the date of its issuance, which was September 27, 1999;

WHEREAS, the Partners, with the DNR and technical assistance of the U.S. Fish and Wildlife Service (FWS), has been successfully implemented to the benefit of the Kbb and its habitat, the Partners, and the State of Wisconsin;

WHEREAS, the Partners and DNR, consistent with the HCP and ITP, have committed to implement the KBB conservation plan under an adaptive management approach,

WHEREAS, the Partners, with the DNR, have requested to extend the Permit consistent with the HCP, ITP and Agreements, as modified subsequent to the issuance of the original ITP, and consistent with further modifications as described herein and consistent with an adaptive management approach;

THIS AMENDMENT modifies all previous agreements between the Partners and the DNR for the purpose of implementing the statewide KBB conservation program into the future consistent with changes to all agreements and documents deemed necessary for the purposes of adaptive management and conservation of the species. This amendment provides that the Partner and DNR agree:

1. *As to the "Period of Agreement", This SHCA shall be effective until and unless terminated consistent with its provisions. (Amends Paragraph I.)*

2. *The “lands included” Appendix A. are modified or adjusted as follows: [REDACTED] x acres as represented on the attached map.*
3. *The “Activities” are modified or adjusted as follows:*
The following specified land management or land use activities may be engaged in on the Lands Included in accordance with this Agreement, and the incidental take of KBB is authorized, if the activities are conducted consistent with the HCP, HCP standard guidelines and protocols, the Permit, this Agreement and any changes and improvements made with HCP participation processes and consistent with the AOP, which amend these documents; and other protocols or management directions attached to, and made part of this Agreement as Appendix B. (Standard HCP guidelines and protocols are published and made available on the HCP webpage; any other protocols and management directions defined by the partner will be listed and attached to Appendix B). Appendix B is adjusted or modified as follows: [REDACTED].
(Amends Paragraph 3.A)
4. *As to “outreach and education”, We will seek out opportunities to provide outreach and education with a priority emphasis on helping to support conservation and recovery of the Karner blue butterfly in the Biological Recovery Zones (BRZ). (Amends Paragraph 3.C)*
5. *As to “Surveying” and “Monitoring”, Surveying and Monitoring shall be conducted consistent with protocols authorized or required as provided in the HCP and user guides in effect at the time of the surveying or monitoring activity unless otherwise stated. Surveying and Monitoring are modified or adjusted as follows: [REDACTED] (Amends Paragraphs [REDACTED] and [REDACTED] respectively)*
6. *“Annual reports” shall be submitted as required by the conditions of the ITP and consistent with the HCP and its guidelines and processes in effect for the reporting period. (Amends Paragraph 8)*
7. *“Assignments” pertain to rights and privileges of the Partner. “Transfers” pertain to the transfer of ownership of the land, be it in fee-title or easement. (Clarifies Paragraphs [REDACTED] and [REDACTED])*
8. *As to “Funding”, The Partner commits to completing its conservation strategies and other obligations as provided in this Agreement, whether accomplished by employees, agents, contractors or cooperators.*
9. *Data provided by the DNR under this KBB Habitat Conservation Plan program and which constitutes “Natural Heritage Inventory” (NHI) data, normally addressing the Kbb or other species addressed in the information which may share Kbb habitat, may not be used for any purpose other than development of the SHCA or conducting of activities under the ITP. It may not be released or made available to any other person, agency or organization for any purpose unless agreed to in writing by the DNR. Documents or data containing NHI information is included in this restriction.*

Data provided to the DNR is subject to Wisconsin's Public Records Law, Ch. 19, Wis. Stats., and subject to that law regarding requests or its disclosure.

10. The Partner agrees to enter into and comply with the Articles of Partnership, which are attached to and made part of this agreement.

**STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES**

DATE _____

BY _____

Paul DeLong
Division Administrator of
Forestry, Wisconsin DNR

AND

DATE _____

BY _____

Laurie Osterdorf
Division Administrator of
Land, Wisconsin DNR

[PARTNER NAME below line]

DATE _____

BY _____

(Print name/title below line)

DATE _____

BY _____

(Print name/title below line)

**Karner Blue Butterfly HCP
Strategic Communication Plan**

Introduction

Executive Summary

The Karner Blue Butterfly Habitat Conservation Plan (HCP) has been focused heavily on two valuable processes; Outreach and Education and Adaptive Management. This strategic communication plan is designed to take advantage of these key processes and move the HCP forward by focusing on the following objectives:

- Meet the outreach and education requirements of the HCP, Incidental Take Permit, Implementing Agreement, and support partner Species and Habitat Conservation Agreement commitments
- Provide informational resources to interested landowners and other voluntary, non-partner entities within Wisconsin and to the public at large
- Focus priority outreach and education efforts on those areas that are strategically important to the recovery goals of the Karner blue in Wisconsin
- Provide program and technical information to all HCP partners and interested parties
- Receive and retrieve data and other information regarding the Karner blue program in an efficient manner
- Educate state and federal policy makers and regulators about the Karner blue program needs and experience in WI and the status and activities of the HCP partnership
- Spread awareness about the success of the HCP and the lessons learned throughout the development and implementation of this program to academics, policy makers, conservationists, resource professionals, and others
- Continue to provide expert advice, assistance, and information to the general public, students and other resource professionals interested in the Karner blue butterfly, barrens ecosystems and the voluntary conservation approach of the HCP partnership

Background

The Wisconsin Department of Natural Resources coordinated an effort on behalf of many public and private landowners to develop a landscape scale, multi-partner Habitat Conservation Plan for the Karner blue butterfly. This was an innovative approach in more than one way, but especially in the inclusion of a “Voluntary Category” of property owners that would receive permit coverage for incidental takes of the Karner blue, with no additional regulatory requirements.

This innovative approach was predicated on the massive conservation work that the HCP partners agreed to and also a proactive outreach and education program. As quoted from the HCP “a nonregulatory approach, substantial public outreach, education and assistance programs will be included to **foster partnerships** and **encourage conservation efforts** on a **voluntary basis**” (emphasis added)

This approach was anticipated to remove the fear of regulation by property owners and encourage proactive conservation and stewardship on these lands. This assumption was accurate and has proved to be immensely successful. In the first 8 years of the HCP, many thousands of landowners, citizens and students have learned about the Karner blue, its habitat and ways to conserve and restore the imperiled habitat that the Karner blue needs.

The HCP also made the realization that the partners would learn much through implementing the permit and encouraged adaptive management. This adaptive management has fostered efficiency and focus on behalf of the partners, and as detailed in the Situational Analysis, this Strategic Communication Plan helps to support that focus to the larger goals of Karner blue conservation and ultimately recovery.

Situational Analysis

Issue: Outreach and Education should be focused on those areas that provide the greatest conservation benefit

Focus of O&E was recognized in the HCP when the ACEs and SPAs were created. The focus on these areas will transition to be defined by the Biological Recovery Zones. The Communication Strategy should be adjusted as well.

Issue: Resources are scarce

A broad brush approach to O&E around the state has been effective at fostering an understanding of the Karner and its habitat. However, this general approach to O&E has not satisfied some specific HCP goals. This general approach to O&E can become an extra workload for partners with little added conservation value. Systems and processes used to collect, distribute and store information can be made more efficient.

Issue: Efficiencies should be identified, duplication of effort minimized and collaborative efforts sought.

As resources are scarce it is imperative to utilize the available resources to the greatest extent possible. This requires coordination and creativity on behalf of the partners to leverage the existing O&E infrastructure and identify new individuals, organizations and outlets to help support and communicate the message.

Issue: Clear direction and support should be provided to partners

Commitments vary with partners. O&E has been broadly implemented, often on demand and when opportunities became available rather than by design.

Issue: New tools are available

Web based O&E has reduced workload and improved access to information. The use of web based communication can continue to improve quality and efficiency of the O&E and other information provided to partners, landowners, regulators, and the public at large. These tools can also help to make the administration of the program by DNR and compliance with the ITP by all partners more efficient.

Issue: Adaptive Management

The HCP partners have taken the time to assess and adjust many aspects of the program. In addition, the DNR is taking steps to make the administration of the permit as efficient as possible.

Communication Plan Components

HCP Partner Component

Goal: Provide HCP partner's relevant and timely information about the HCP, ITP and related issues.

Objectives:

- Inform HCP partners about relevant HCP information
- Provide relevant technical information and resources
- Provide efficient method for partner communication to WDNR
- Promote information sharing between partners
- Provide training, outreach and education support and other items as needed.

Communication Targets:

- Implementation Oversight Committee
- HCP Partners
- Potential Partners

Tools:

- Website
- E-mail
- Newsletter
- IOC and partnership meetings

Process:

- Assess all HCP partner information needs
- Develop website to provide access to all necessary information
- Develop training and orientation modules for partner staff to access
- Encourage partner collaboration through meetings and networking
- Evaluate database and reporting improvement options and make recommendations to HCP Coordinator and IOC

Voluntary Landowner Component

Goal: Encourage conservation by private landowners in the voluntary category through assistance, education and targeted outreach.

Objectives:

- Focus outreach to private landowners in those areas that are strategically important to the recovery goals of the Karner blue. i.e. Biological Recovery Zones
- Provide access to technical information and assistance regarding Karner blue habitat conservation and restoration
- Respond quickly to inquiries
- Offer the opportunity to become involve in conservation efforts for the Karner blue

Communication Targets:

- Landowners and land users located within Biologic Recovery Zones
- Landowners and land users within the High Potential Range
- Other landowners and land users within Wisconsin
- General Public

Tools:

- Website
- Personal contact by partners
- Partner O&E materials
- DNR O&E materials

Process:

- Develop web site to enhance outreach and education to land owners
- Gain feedback, improvement, information and suggestions by land owners and others experienced in working with land owners on Karner blue issues
- Provide assistance to the Wisconsin Karner Blue Recovery program as needed to develop communication and outreach and education strategies

Policy Makers

Goal: Educate policy makers at the state and federal level about the WI Karner blue program to influence future policy decisions with regards to endangered species conservation.

Objectives:

- Inform state legislators about the program, landowner responsibilities, Partner accomplishments and program needs
- Inform federal legislators about the success and lessons learned from implementing this unique approach to endangered species conservation

Targets:

- Local elected officials
- State elected officials
- Federal elected officials
- Appointed agency staff
- Regional agency staff

Tools:

- Partners through trade organizations
- Direct mailings, issue briefs and papers
- One-on-one meetings
- Invitations to HCP celebration events

Process:

- Actively monitor state (not only WI) and federal initiatives, discussions and debates regarding endangered species conservation and especially Endangered Species Act.
- Actively monitor any court proceedings or judgments with regards to the Endangered Species Act
- Develop and provide policy briefs to policy makers

Regulator

Goal: Inform state and federal regulators about the Karner blue program, the reality of partnering success, regulatory process within the Karner blue program to ensure efficiencies with overlap between the HCP and other programs, and to provide a template for innovative, incentive based conservation approach.

Objectives:

- Provide clear descriptions of relevant HCP processes that involve administration of the ITP and relationship of Partner responsibilities under the ITP with other regulatory process (e.g. USACOE, DNR permits etc.)
- Provide assistance to other regulatory departments and agencies on collaboration, cooperation and meaningful regulatory process
- Communicate a new regulatory paradigm that involves partnering and trust

Targets:

- FWS
- USACOE
- DNR
- Other states
- PSC

Tools:

- Presentations at conferences, meetings, and other venues
- Working sessions
- Papers
- One-on-one conversations

Process:

- Assess regulatory agency education needs for Karner blue
- Develop briefings and other tools as needed
- Provide opportunities to inform regulatory agencies about the Karner blue approach through lessons learned presentations, participation in various department and agency meetings

Media

Goal: Inform local and national media of the success of the Kbb program in WI

Objectives:

- Increase national awareness of Kbb HCP (especially the voluntary strategy) and its implications for endangered species management
- Sustain support for the Kbb program within the State of Wisconsin
- Promote the conservation done by all partners
- Promote the conservation approach taken under this HCP
- Provide an additional vehicle to get “good news” about the HCP get to landowners
- Promote public support for conservation and especially recovery efforts for this endangered species

Targets:

- CBS Sunday Morning
- USA Today
- E Magazine
- Gannet Outdoors Report
- Local Newspapers
- Local TV News
- Conservation Magazines

Tools:

- Web
- Press Release

Process:

- Working with DNR media staff, develop a list of media contacts/outlets, state and nationally
- Determine best time and strategy for issuing a press release to various media outlets

General

Goal: Provide access to information about the WI KBB HCP program and encourage _____

Objectives:

- Provide information about the history, innovations and development process of the HCP to academic researchers.
- Encourage understanding of the lessons learned to date by the partnership to NGOs and other states involved with rare species and ecosystem conservation.

Targets:

- NGOs
- General public
- Other states
- Academics

Tools:

- Web site

Process:

- Develop materials that help to tell the story of the Karner blue program in Wisconsin
- Publish educational material regarding the program on the web site including reports completed by academics or conservation organizations
- Provide an on-line resource to access FWS, DNR and other publications regarding the Karner blue and the HCP

Tools

Communication Tools Matrix

Component	Communication Tool								
	Web	e-mail	Newslett er	Direct Mail	One-on- One	Press Release	Organiza tions	Specific O&E materials	Presentat ions
HCP Partners	●	●	●	●	●			●	●
Landowners	●					●		●	
Legislators	●			●	●	●	●		●
Regulators	●				●				●
Media	●					●			
General	●					●			

Web: This tool is the DNR Karner website, <http://dnr.wi.gov/forestry/karner/>. This is a great venue for mass communications and can provide the broadest audience with the information that they need, whenever they access. This tool can also be used to communicate relevant information to the HCP Partners and provide access to the necessary forms, documents, templates and other materials they need to comply with the HCP requirements. The web can be the primary mechanism used to meet HCP O&E requirements.

E-mail: E-mail is used to make announcements to a broad audience, and transfer information to a selected group. E-mail distribution lists have been created and used for a variety of purposes.

Newsletter: Newsletters are published and sent or e-mailed to those on the distribution lists at regular intervals throughout the year. The information is diverse as is the audience.

Direct mail: Direct mail is sent postage paid, to the individuals mailing address. Direct mail can include a variety of information or be used to transfer specific printed materials, O&E resources or other items.

One-on-One: One-on-one meetings are especially effective at fostering understanding and building trust about an issue. These meetings are useful in exchanging ideas and brainstorming.

Press Release: Press Releases are issued directly to the media with contact information for a follow-up. This communication tool usually needs to go through various process steps to be released, as it is 'official'.

Organizations: Trade organizations or those representing various entities are useful in providing a national or regional viewpoint, and can also be a good path for getting information to a larger audience, especially policy makers.

Specific O&E Materials: These are designed specifically for an audience or a purpose, e.g. DNR Wildcards

Presentations: Presentations are usually given at trade shows or conferences and can reach a good size audience.

Key Constituents

The primary constituents for this strategic communication plan are the HCP Partners and land owners located within or around biological recovery zones.

The HCP partners need to have a clear understanding of the program, their responsibilities, and access to relevant information, training, O&E materials, and the forms, documents, and other materials that are necessary for compliance.

O&E directed to private landowners is now focused on those areas that are strategically important for recovery of the Kbb in WI. Specific needs will be drawn from the Recovery O&E strategy and utilized by HCP Partners to focus O&E activities. Focusing O&E resources on these areas is the most efficient use of HCP Partner efforts. O&E to other private landowners and interested parties will be primarily through the Kbb website.

Communications to other key constituents is specifically addressed in the implementation plan below.

Key Messages

- Private landowner requirements
- HCP Partners success
- Lessons learned
- Conservation not regulation
- Partnership and collaboration, not command and control
- HCP partner responsibilities

Implementation

The implementation plan is comprised of a section describing the actions needed for each of the plan components detailed in Section II above. These actions are then put into an overall schedule for implementation

HCP Partners

- Develop Orientation training package for new partners or new partner employees
- Develop HCP Users Guide training
- Consult with IOC or Communication Team and receive guidance on Strategic Communications Plan
- Consult with IOC or Communication Team on updates to Kbb website and information needs
- Provide access to all O&E materials via Kbb website
- Provide access to Guidelines and Protocols via Kbb website
- Provide access to training materials via Kbb website
- Provide access to necessary HCP forms via Kbb website
- Assist HCP Partners as needed with targeted Kbb information (e.g. trade orgs, landowners, lobbyists, management)
- Update HCP distribution lists and mechanisms
- Clarify O&E requirements under HCP and SHCAs as necessary, e.g. SPA and ACE requirements change to BRZ

Landowners

- Assist WI Kbb Recovery Program with development and implementation of O&E strategy
- Provide O&E materials to public via Kbb website
- Update website to provide easy access to Kbb and Habitat identification and management information
- Update website to provide access to other relevant Kbb information
- Update website to include clear communication of landowner responsibilities (e.g. gypsy moth, construction, etc.)

Policy Makers

- Monitor relevant legislative and judicial proceedings
- Provide Briefings
- Develop white papers

Regulators

- Assess education needs

Media

- Develop Media list

- Develop press release strategy and needs

General

Schedule

General task description	S 07	O 07	N 07	D 07	J 08	F 08	M 08	A 08	M 08	J 08	J 08	A 08	S 08	O 08	N 08	D 08
Finalize Communication Plan and any necessary HCP updates	█	█														
Develop Training and Orientation modules	█	█	█	█	█				█							
Update Karner blue website	█	█	█	█	█	█	█									
Update HCP distribution system	█	█	█	█	█	█										
Implement Policy Maker communication process	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Implement Regulator communication process	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Implement Media Communication process	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Review and revise HCP Strategic Communication Plan													█	█	█	█

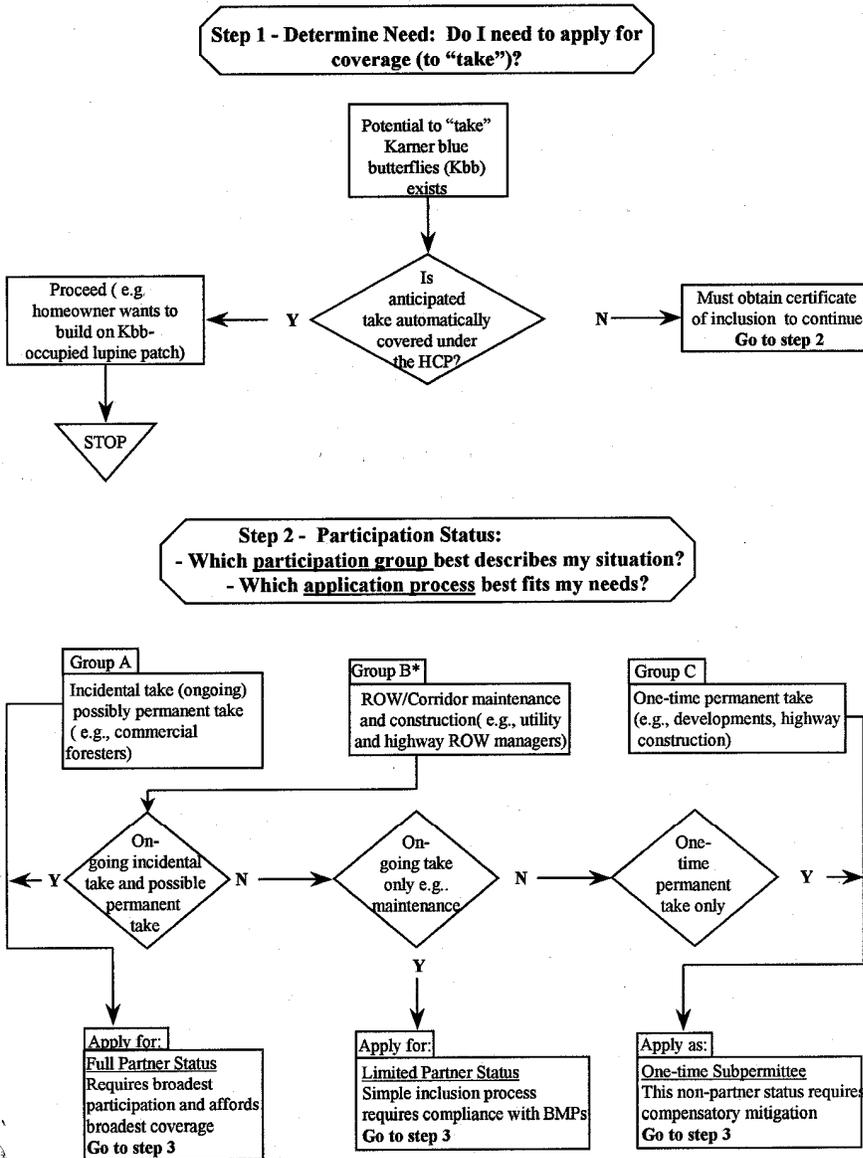
Resource Needs

- 10-20 hrs/week of DNR LTE
- Assistance from DNR Forestry for Website design and maintenance
- Assistance from DNR forestry for training and orientation module development
- Assistance from DNR Forestry attorney for legislative and judicial monitoring
- Assistance from DNR BER and FWS Partners for Wildlife program in reviewing and providing expertise in land owner outreach actions
- IOC time for review and guidance

Appendices

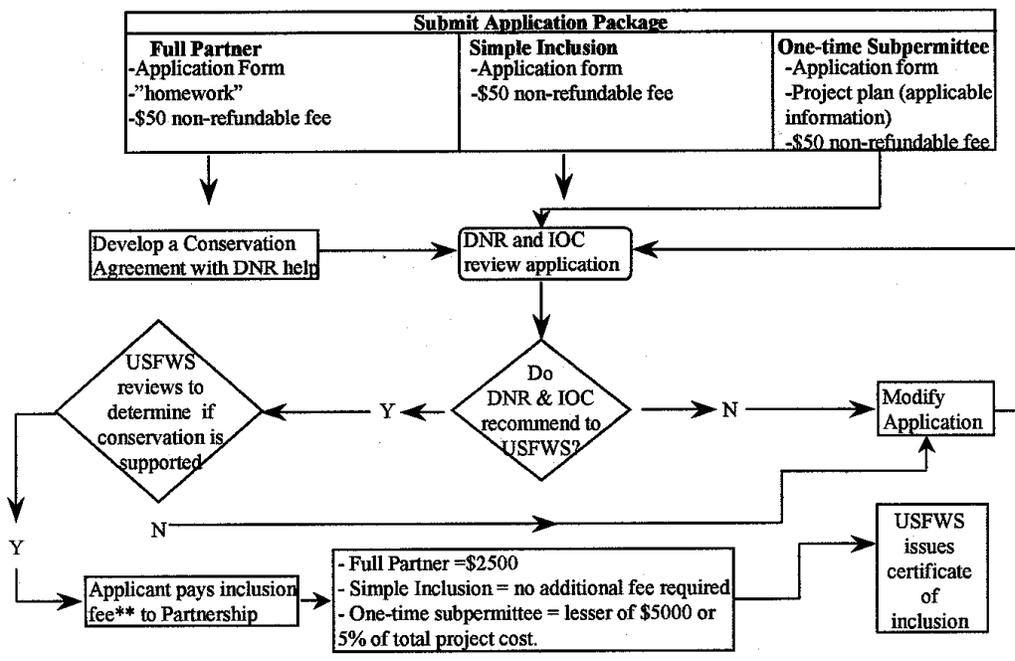
- Appendix A: O&E Resource List

Figure x.x Flow Chart for Determining Options for ITP Coverage



* Option: Applicant may select combination of simple inclusion and mitigate one-time permanent take. Consult with DNR.

Step 3 - The Application Process:



**APPLICATION for CONSIDERATION for INCLUSION in the
WISCONSIN STATEWIDE KARNER BLUE BUTTERFLY HCP**

When complete, submit this application to Attn: Karner Blue HCP Coordinator, FR/4,
Wisconsin DNR, 101 S. Webster St., Box 7921, Madison, WI 53707-7921

(This is an informational questionnaire, and will be used by WDNR to assess applicant's intentions and assist in processing a conservation agreement and request for inclusion under USFWS Permit TE010064)

Applicant Information:

Organization Name _____

Mailing Address _____

1st Contact Person _____ Title _____

Phone Number () - _____ Fax Number () - _____

2nd Contact Person _____ Title _____

Phone Number () - _____ Fax Number () - _____

Check all that apply:

- Full partner status Limited partner status One-time project.
 Governmental unit Non-governmental organization

Complete fully and to the best of your ability.

THIS APPLICATION SHALL NOT BE CONSIDERED COMPLETE AND ACTED
UPON UNTIL ALL INFORMATION IN IT, AND AS OTHERWISE REQUESTED BY
THE DEPARTMENT OF NATURAL RESOURCES IS PROVIDED.

Non-refundable Application fee (\$50): (This fee does not apply to governmental units or transfers from existing partners.)

2. Land ownership by acreage and description (the more specific the better e.g. quarter-quarter section, town, range.)

Note: For road ROWs enter number of miles of ROW and the total average width of vegetation on both sides of road.

2. Land use activities or land management practices you engage in or desire to engage in:
3. If the land involved is forest land, please describe type of vegetation and age class.

4. Describe the extent of land occupied by the Karner Blue butterfly and, to the best of your ability, the number of butterflies (if known).
 - a. What is the occupied site or sites used for currently?
 - b. Are there any natural or managed corridors adjacent to the occupied site that are or might be used for dispersal purposes?
 - c. What is the history of Karner Blue butterflies on the property, to the best of your knowledge? acreage, numbers.
5. What conservation measures are you willing to apply to your land to receive authorization to incidentally take Karner blue butterflies?
For how long?
6. What monitoring capability do you currently have to monitor the species and habitat on your property?
 - a. What monitoring are you willing to conduct?
7. Are you willing to allow the Department of Natural Resources, or its designees, access to your land to assure compliance with any authorization to incidentally take Karner blue butterflies?
8. Are you willing to submit periodic reports to the Department of Natural Resources regarding the status of Karner blue butterflies and habitat on your property?
9. What type of records do you currently keep respecting your land use and management activities? Are you willing to keep records in the form and of the type described in the information attached?
10. Other information you would like considered along with this application:

As and in the capacity of the applicant, I hereby commit to and agree to comply with the plans and conservation efforts contained in this application and submitted for the purpose of obtaining coverage under the Permit issued to the Department of Natural Resources for the incidental take of the Karner blue butterfly in the State of Wisconsin. I also agree to comply fully with any restrictions or conditions included in any Certificate of Inclusion issued to me by the Wisconsin DNR under Permit No. TE010064 as a result of this application for consideration as a partner in this HCP where applicable.

The information above is accurately and correctly stated to the best of my knowledge.

Print or type name of person filling out application

APPENDIX A

Partner Lands Included

Partner lands included are those road ROWs that the partner has management responsibility for, and which are highlighted on the attached map.

The lands subject to this agreement include roads and highways, and the rights-of- ways (ROW) of which the ROWs are approximately:

_____ feet, meters (*circle one or delete other*) wide on each of two sides, and

_____ feet, meters, miles (*circle one or delete other*) in length.

Total Acres Included for Incidental Take Coverage = _____ ACRES

<u>Acreage Calculator:</u> 1 meter = 3.2808 feet _____ meters x 3.2808 = _____ feet 1 mile = 5,280 feet _____ miles x 5,280 feet = _____ feet 1 acre = 43,560 square feet _____ ft. wide x _____ ft. long = _____ sq. ft. _____ sq. ft. divided by 43,560 sq. ft. = _____ acres (include in block above)
--

Attach county or township map with roads partner manages marked with a highlighter. Map will contain:

- County name
- Township name(s)
- Town & Range
- Cardinal marker
- Distance scale (and/or section lines)

**AMENDMENT
TO
SPECIES AND HABITAT CONSERVATION AGREEMENT (SHCA)**

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WHEREAS, the Partners, with the DNR and technical assistance of the U.S. Fish and Wildlife Service (FWS), has been successfully implemented to the benefit of the Kbb and its habitat, the Partners, and the State of Wisconsin;

WHEREAS, the Partners and DNR, consistent with the HCP and ITP, have committed to implement the KBB conservation plan under an adaptive management approach,

WHEREAS, the Partners, with the DNR, have requested to extend the Permit consistent with the HCP, ITP and Agreements, as modified subsequent to the issuance of the original ITP, and consistent with further modifications as described herein and consistent with an adaptive management approach;

THIS AMENDMENT modifies all previous agreements between the Partners and the DNR for the purpose of implementing the statewide KBB conservation program into the future consistent with changes to all agreements and documents deemed necessary for the purposes of adaptive management and conservation of the species. This amendment provides that the Partner and DNR agree:

11. *As to the “Period of Agreement”, This SHCA shall be effective until and unless terminated consistent with its provisions. (Amends Paragraph 1.)*
12. *The “lands included” Appendix A. are modified or adjusted as follows: _____ x acres as represented on the attached map.*
13. *The “Activities” are modified or adjusted as follows:
The following specified land management or land use activities may be engaged in on the Lands Included in accordance with this Agreement, and the incidental take of KBB is authorized, if the activities are conducted consistent with the HCP, HCP standard guidelines and protocols, the Permit, this Agreement and any changes and improvements made with HCP participation processes and consistent with the AOP, which amend these documents; and other protocols or management directions attached to, and made part of this Agreement as Appendix B. (Standard HCP guidelines and protocols are published and made available on the HCP webpage; any other protocols and management directions defined by the partner will be listed and attached to Appendix B). Appendix B is adjusted or modified as follows: _____.
(Amends Paragraph 3.A)*
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(Amends Paragraph 3.C)*

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19. Data provided by the DNR under this KBB Habitat Conservation Plan program and which constitutes “Natural Heritage Inventory” (NHI) data, normally addressing the Kbb or other species addressed in the information which may share Kbb habitat, may not be used for any purpose other than development of the SHCA or conducting of activities under the ITP. It may not be released or made available to any other person, agency or organization for any purpose unless agreed to in writing by the DNR. Documents or data containing NHI information is included in this restriction.

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**STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES**

DATE _____

BY _____

Paul DeLong
Division Administrator of
Forestry, Wisconsin DNR

AND

DATE _____

BY _____

Laurie Osterndorf
Division Administrator of
Land, Wisconsin DNR

[PARTNER NAME below line]

DATE _____

BY _____

(Print name/title below line)

DATE _____

BY _____

(Print name/title below line)

**WISCONSIN KARNER BLUE BUTTERFLY
HABITAT CONSERVATION PLAN**

SPECIES AND HABITAT CONSERVATION AGREEMENT

FULL PARTNER

THIS SPECIES AND HABITAT CONSERVATION AGREEMENT (Agreement) is entered into by and between the State of Wisconsin Department of Natural Resources (DNR) and _____ () for the purpose of implementing the Habitat Conservation Plan (HCP) and authorizing the incidental take of the Karner blue butterfly (KBB) in the State of Wisconsin consistent with and during the period of an Incidental Take Permit (Permit) issued by the U.S. Fish and Wildlife Service (FWS).

WHEREAS, the DNR holds a Permit issued by the United States Department of the Interior, Fish and Wildlife Service (FWS) based upon the Habitat Conservation Plan, Species and Habitat Conservation Agreements (SHCA) with the Partners and Implementing Agreement submitted to the FWS with the application for a Permit;

WHEREAS, the statewide KBB conservation program relies on the inter-relationship of SHCAs, a HCP and an Incidental Take Permit (Permit) to form and direct the KBB conservation plan, as well as clarify commitments and obligations of landowners and land users in this effort;

WHEREAS, the Permit from the FWS authorizes the incidental take of the KBB subject to implementation of conservation measures and compliance with procedures, terms and conditions of this Agreement, the HCP and the Permit, by Partners entering into SHCAs with the DNR; and

WHEREAS, the Partner plans to engage in activities that may result in the incidental take of the KBB and is willing to implement conservation measures consistent with the HCP and the Permit on lands under and to the extent of the Partner's control to avoid, minimize or mitigate the take of such species as further provided herein.

IT IS HEREBY AGREED by the parties, based upon the mutual terms and conditions herein, that this Agreement shall constitute the Partner's commitment and agreement to undertake conservation measures for the KBB upon issuance of a Certificate of Inclusion (Certificate). The parties further agree this Certificate is conditioned on the premise that the Agreement shall be consistent with the HCP and conditions of the Permit.

1. DEFINITIONS.

For purposes of this Agreement, the following definitions apply:

- A. "Certificate of Inclusion" (Certificate) is a document issued by the DNR as authorized by the FWS, which, thereby, includes the person or entity it is issued to under the provisions of the Permit and authorizes incidental take consistent with the HCP, the Permit and this Conservation Agreement.
- B. "Implementing Agreement" is a legal contract entered into between the DNR and the FWS that: (1) identifies the responsibilities of all participants to the HCP; (2) legally binds the DNR to their obligations; and (3) is signed by the DNR.
- C. "Incidental take" is the take of a species incidental to, and not for the purpose of, the carrying out of an otherwise lawful activity.
- D. "Incidental take permit" (Permit) is a permit issued by the FWS under the authority of Section 10(a)(1)(B) of the Endangered Species Act to authorize the incidental take of a species listed as endangered or threatened under that Act.
- E. "Intentional take" means the purposeful take of a species not incidental to an otherwise lawful activity e.g. collecting.
- F. "Partner", consistent with the HCP Articles of Partnership (AOP) and determined as a Partner by HCP Implementation Oversight Committee (IOC) assigned this task, is a person, agency or organization that:
 - 1. Enters into and agrees to the HCP and AOP; and
 - 2. Has an ownership interest i.e. fee title or easement in land with existing or potential KBB habitat; or
 - 3. Has economic assets at risk as a result of the listing of the KBB as endangered; or
 - 4. Has a role in implementing the HCP e.g. ASCS, municipalities.

2. PERIOD OF AGREEMENT.

The period of this Agreement shall be from its execution and the issuance of a Certificate authorizing incidental take consistent with this Agreement, during the period of the Permit, unless terminated in accordance with paragraph 11 or amended in accordance with paragraph 12.

3. LANDS SUBJECT TO AGREEMENT.

The lands subject to this Agreement include approximately [REDACTED] acres and are more particularly described in Appendix A (Lands Included) which is attached to and made part of this Agreement, and all future ownership (including, but not limited to, easements and temporary work spaces) within the high potential range of the KBB, subject to the notification and reporting processes, and implementation of conservation practices consistent with this Agreement, the HCP and the Permit.

4. ACTIVITIES/INCIDENTAL TAKE AUTHORIZED/PUBLIC OUTREACH AND EDUCATION/CONSERVATION EFFORTS.

A. ACTIVITIES. The following specified land management or land use activities, in addition to any other activity covered by an HCP guideline, protocol or management direction, may be engaged in on the Lands Included in accordance with this Agreement, and the incidental take of KBB is authorized, if the activities are conducted consistent with the HCP, HCP standard guidelines and protocols, the Permit, this Agreement and any changes and improvements made with HCP participation processes and consistent with the AOP, which amend these documents; and other protocols or management directions attached to, and made part of this Agreement as Appendix B. Standard HCP guidelines and protocols are published and made available on the HCP webpage; any other protocols and management directions defined by the partner will be listed and attached to Appendix B:

[LIST MANAGEMENT ACTIVITIES PARTNER WISHES TO ENGAGE IN HERE.]

B. INTENTIONAL TAKE. The Partner agrees not to engage in the intentional take of the KBB and agree that the entering into of this Agreement does not authorize the intentional take of such species.

C. PUBLIC OUTREACH AND EDUCATION. The Partner agrees to engage in the following public outreach and education activities for the purpose of conserving the KBB consistent with the HCP and Permit:

[LIST O&E ACTIVITIES PARTNER COMMITS TO ENGAGE IN HERE.]

D. CONSERVATION EFFORTS FOR THE KBB. Other than as described elsewhere in this clause, the Partner intends to engage in the following conservation efforts and practices:

[LIST OTHER CONSERVATION ACTIVITIES PARTNER IS WILLING TO COMMIT TO HERE.]

5. OTHER SPECIES.

In addition to those efforts identified in this Agreement for the KBB, the Partner intends to implement the following conservation measures or programs related to the following species:

[LIST OTHER SPECIES OR INSERT "N/A" (Not Applicable) OR "NONE" HERE.]

6. SURVEYS.

The Partner agrees to conduct surveys for the KBB and other species identified in paragraph 5 and their habitat consistent with the HCP, on Lands Included, prior to engaging in or conducting a management or land use activity or practice. Written records of all surveys, including identification and qualifications of the person conducting the survey, the results of the survey as to habitat and occurrences observed, and the conservation strategy to be applied to respond to the findings of the survey, shall be maintained by the Partner during the period of and retained for five years following termination of the Agreement, at the following facility (*Include organization name, contact person's name and title, full mailing address including street, road or RFD number, telephone and facsimile numbers and email address*):

[INSERT NAME and TITLE OF CONTACT PERSON, COMPLETE MAILING AND STREET ADDRESS, TELEPHONE AND FACSIMILE NUMBERS AND EMAIL ADDRESS HERE.]

7. MONITORING.

The Partner agrees to monitor and maintain written records regarding the effects of land management and use practices and activities on KBB and KBB habitat, consistent with the HCP, on Lands Included, during the period of this Agreement and retain them for five years following termination of the Agreement, at the following facility (*Include organization name, contact person's name and title, full mailing address including street, road or RFD number, telephone and facsimile numbers and email address*):

[INSERT NAME and TITLE OF CONTACT PERSON, COMPLETE MAILING AND STREET ADDRESS, TELEPHONE AND FACSIMILE NUMBERS AND EMAIL ADDRESS HERE.]

8. DNR AND FWS INGRESS AND EGRESS.

A. COMPLIANCE MONITORING.

- (1) During the period of this Agreement, the DNR may conduct compliance monitoring of the activities and records of the Partner. Except as provided in Subparagraph A.(2), compliance monitoring shall be preceded by reasonable notice, not to be less than 24 hours, and shall be conducted in the presence of a representative of the Partner, if the representative is available at the noticed time and date, or other time agreed upon by the Partner and auditing personnel. Access to the property involved, to the extent of the Partner's authority, is authorized. Access to Lands Included and records required by this Agreement, or the HCP, shall be for the purpose of assuring compliance with this Agreement and the HCP, and be unlimited. If the Partner does not have authority to authorize access to the land identified in the notice to be monitored during the compliance monitoring the Partner shall immediately notify the

DNR of such lack of authority and the limited use it has in the land identified. Documents of title or interest in the land identified shall be provided to the DNR upon its request. A copy of any final report, map or other record prepared by the DNR on the results of its going upon the land identified or reviewing the records shall be provided to the Partner within thirty (30) days of the DNR access and review.

Notification under this Paragraph shall be in writing, facsimile, or telephone to (*Include organization name, contact person's name and title, full mailing address including street, road or RFD number, telephone and facsimile numbers and email address*):

[INSERT NAME and TITLE OF CONTACT PERSON, COMPLETE MAILING AND STREET ADDRESS, TELEPHONE AND FACSIMILE NUMBERS AND EMAIL ADDRESS HERE.]

- (2) The notice provision in Subparagraph A.(1), shall not apply when the DNR or representatives of the FWS considers that pending or ongoing activities of the Partner, or person authorized by the Partner, based on concerns or complaints made known to them, may adversely affect KBB occupied sites in a manner inconsistent with the Agreement, or result in damage to or destruction of KBB occupied habitat or that may jeopardize the Permit.
- B.** Any refusal of access authorized in Subparagraphs (1) or (2) shall be considered a breach of this Agreement and subject the Partner to all remedies available to the DNR under this Agreement or at law,
- C.** The FWS may accompany the auditor when auditing or monitoring under this Agreement or the HCP.
- D.** In addition to authority granted elsewhere in this Agreement, the FWS may enter the Lands Included or where permission by others with an ownership interest has been granted and access the records of the Partner required for the purpose of overseeing the Permit and activities under it or required by this Agreement.
- E.** Nothing in this Agreement, including this section, shall abrogate the authority of the Secretary of the Interior, through the FWS, to fulfill his or her responsibility in the administration and enforcement of the Endangered Species Act (ESA), 16 USC 1531 et seq. and all implementing regulations including but not limited to 50 CFR Parts 13 and 17.

9. ANNUAL REPORT.

- A.** The Partner shall submit an annual report no later than March 1 following the calendar year which is the subject of the report. Each report shall be consistent with the required conditions of the Permit, the HCP and its guidelines and processes in effect for the reporting period, and this Agreement.

10. REMEDIES.

- A. The Partner agrees that this Agreement and authorization under the Permit does not apply to conduct resulting in the take of a KBB that does not strictly conform to the requirements of this Agreement or the HCP, and in such a situation the landowner will be acting without a Permit or authority to take a KBB and shall be subject to all provisions, remedies and penalties of the ESA, 16 USC 1531 et seq. and all implementing regulations including but not limited to 50 CFR Parts 13 and 17, 29.415, Wis. Stats., the Wisconsin Endangered Species ACT (WESA) and ch. NR 27, Wis. Adm.Code.
- B. (1) Upon a breach or violation of this Agreement, as determined by the DNR, and in addition to any remedies provided or pursued under paragraphs 10.a., the DNR may revoke this Agreement and the authorization under it after considering recommendations of the HCP IOC. The Landowner and the FWS shall be notified of an alleged breach or violation by the Partner.

The DNR will notify the FWS of any violation of the Permit, HCP, or Agreement. Such notification shall be made in writing within five (5) calendar days of discovery of the violation, to the address listed below. Notification will include the name of the Party(ies) and individual(s) involved, the nature of the suspected violation, time period when the suspected violation occurred and the specific location(s) of the suspected violation.

**2661 Scott Tower Drive
New Franken, WI 54229
Telephone: (920) 866-1717
Fax: (920) 866-1710
Field Supervisor
U.S. Fish and Wildlife Service**

- B. (2) The Partner shall be provided an opportunity to present information to the DNR and the IOC on an alleged violation and what an appropriate remedy should be prior to the DNR's determination on whether a breach or violation occurred and the appropriate remedy. Information shall be presented to the DNR and the IOC by the Partner within thirty (30) days of notice of an alleged violation of this Agreement to the Partner.
- B. (3) If the DNR, after consideration of recommendations of the IOC, determines that action by the Partner may be taken that is reasonable and consistent with ensuring the conservation of the species and its habitat without the application of other remedies in this paragraph, it shall not seek additional remedies on the condition that the Partner completes the remedial action within a time considered reasonable by the DNR.
- C. The DNR retains all further remedies in law or equity, which it may apply to a breach or violation of this Agreement. Enforcement or other remedies available to the FWS under the ESA shall not be abridged or affected by any decision of the DNR under this paragraph.
- D. It is understood that unintentional violations of this Agreement may occur, and that the Partners may be required to act in emergency situations that do not allow them to follow all commitments in this Agreement. Should such a situation arise, it is expected that a Partner will report such an activity consistent with the HCP and the HCP Emergency Guideline, detailing the damage, if any, to KBB habitat and such action the Partner intends to take to

cure or mitigate any damage to KBB or its habitat. The DNR agrees to consider the circumstances and the Partner's offer to cure or mitigate in any decision it may make regarding appropriate remedial or enforcement action necessary under this Agreement.

11. TERMINATION.

This Agreement or its applicability to any land under it may be terminated by the Partner upon sixty (60) days written notice to the DNR and upon the occurrence of one of the following:

- E.** The Lands Included or management rights are transferred to another by land contract, fee title, easement, or otherwise;
- F.** The KBB is no longer protected by the ESA, (i.e. is delisted) or the KBB is downlisted to threatened and take activities of the Partner is allowed per a 4.d. rule.
- G.** The Partner ceases to exist, in fact or by law.
- H.** Other reasons for termination mutually agreed upon as reasonable by the Partner and the DNR, with advice of the IOC, provided that appropriate conservation and/or compensation has occurred for the take of occupied KBB habitat. It is the responsibility of the Partners to demonstrate to DNR that conservation has occurred prior to termination.

12. AMENDMENT.

This Agreement shall constitute the entire agreement of the parties and any previous communications or agreements are hereby superseded and no modifications of this Agreement or waiver of its terms and conditions shall be effective unless made specifically in writing and mutually agreed upon and signed by both parties.

13. CONTRACTING PARTIES.

In this Agreement, the DNR and the Partner include their respective officers, employees, agents, directors, partners, representatives, successors, heirs, members and servants.

14. STATUS OF PARTIES.

The Partner shall not be considered as an agent, contractor or an employee of the DNR for any purpose, including workers compensation. The DNR agrees that the Partner has sole control of the activities and work conducted on the lands of or under the control of the Partner. The DNR only reserves the right of ingress and egress to the lands and facilities, consistent with paragraph 8, to inspect the lands and records of the Partner, as provided herein, to assure compliance with this Agreement.

15. ASSIGNMENT

In the event the Partner sells, transfers or otherwise divests itself of all Lands Included or management rights to a subsequent owner and no longer has assets at risk due to the listing of

the KBB, the Partner may relinquish and assign this Agreement or performance under it that subsequent owner (Assignee) with the consent of the DNR. Consent to assign shall be conditioned upon the Assignee's agreement in writing to comply with all the terms of this Agreement following discussion with the DNR to assure a full understanding of the requirements of the Agreement. The FWS shall be notified of any assignment and shall issue a Certificate of Inclusion covering the Assignee.

16. TRANSFER

In the event that the Partner sells, transfers or otherwise divests itself of some portion of the Lands Included or management rights, but still has a portion of the Lands Included, management rights or assets at risk due to the listing of the KBB, and the Partner chooses to remain a signatory Partner, assignment of any incidental take authorization under this Agreement and the Permit may be transferred to a subsequent owner of the Lands Included or management rights (Transferee) if the Transferee enters into, agrees to and files with the DNR a SHCA, which is acceptable to the DNR. Following review and recommendation by the IOC, the SHCA may be signed. The FWS will be notified of the transfer and approved SHCA and shall issue a Certificate covering the Transferee. Unlike the complete transfer and assignment of an SHCA to an Assignee, incidental take authorization is not afforded to the Transferee until a SHCA unique to the Transferee is approved by the IOC and DNR and a Certificate is issued by the FWS.

The Partner agrees to notify the DNR of any transaction involving Lands Included, management rights, or assets relating to land within the High Potential Range, which may pertain to this Agreement, and coverage under the Permit. Notification of transfers can be made at any time, but must be included prior to any activity which would result in incidental take of KBB in order for incidental take authority to be valid. Incidental take is not authorized on newly acquired land until the transfer is reported to the DNR and added to the Partner's Lands Included.

17. MODIFICATION/ADAPTIVE MANAGEMENT.

The Partner agrees to modify responsibilities and duties under this Agreement consistent with the review and adaptive management process established in the HCP unless otherwise stated in this Agreement.

18. FUNDING COMMITMENTS.

The Partner commits to completing its conservation strategies and other obligations as provided in this Agreement, whether accomplished by employees, agents, contractors or cooperators.

[LIST OTHER FUNDING COMMITMENTS HERE.]

19. LIABILITY FOR AGENTS, ETC.

It is recognized that the Partner often conducts its land management or use activities through an agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser. The

Partner has and accepts the obligation to require, normally through written agreement or communication, that activities be conducted in a manner consistent with this Agreement, the HCP and the Permit. Take incidental to otherwise lawful activities by these persons or entities is authorized by the Permit so long as such activity and incidental take resulting from it is authorized by the Partner consistent with this Agreement, the HCP and the Permit. A violation of any authorization which includes procedures and activities for KBB conservation the Partner is required to follow or conduct, consistent with this Agreement, the HCP, and the Permit, by an agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser, shall not result in the suspension, revocation, or termination of the Permit or the authorization to the Partner under this Agreement, the HCP and the Permit; nor shall it affect other benefits, rights, or privileges under this Agreement, the HCP or the Permit, except as to that agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser, who is and will be subject to the provisions of the ESA, including remedies for its violation when acting inconsistent with the authorization from this Partner, this Agreement, the HCP and the Permit. The obligation to demonstrate that the Partner adequately communicated procedures and requirements of this Agreement, the HCP and the Permit to the agent, lessee, licensee, contractor, permittee, right-of way grantee, or purchaser is on the Partner, and cannot be waived by the DNR.

20. DATA SHARING

- C. Data provided by the DNR and which constitutes Natural Heritage Inventory data (NHI) may not be used for any purpose other than development of the SHCA or conducting of activities under the Permit. It may not be released or made available to any other person, agency or organization for any purpose unless agreed to in writing by the DNR. Documents or data containing NHI information is included in this restriction.
- D. Data provided to the DNR is subject to Wisconsin's Public Records Law, Ch. 19, Wis. Stats., and subject to that law regarding requests for it. Under s.23.27 (3), Wis. Stats., NHI information is considered confidential and release or use of it is controlled by the Department and administrative rules adopted to administer the NHI program.

21. ARTICLES OF PARTNERSHIP

The partner agrees to enter into and comply with the AOP, which are attached to and made part of this Agreement.

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

DATE _____

BY _____

Paul DeLong
Division Administrator of
Forestry, Wisconsin DNR

AND

DATE _____

BY _____

Laurie Osterndorf
Division Administrator of
Land, Wisconsin DNR

[INSERT PARTNER'S ENTITY NAME]

DATE _____ BY _____

(Partner signatory's name/title)

DATE _____ BY _____

(Partner signatory's name/title)

APPENDIX A

LANDS INCLUDED

[LIST LANDS FOR WHICH PARTNER WISHES INCIDENTAL TAKE COVERAGE. INCLUDE MAP(S) INDICATING LOCATION OF THESE LANDS, WHICH ARE SUFFICIENTLY SPECIFIC TO PROVIDE USFWS OR DNR ENOUGH INFORMATION FOR AUDITING AND ENFORCEMENT PURPOSES. NECESSARY MAP CHARACTERISTICS INCLUDE, PARTNER NAME, TOWN, RANGE, SECTION, AND COUNTY INFORMATION AND CARDINAL MARKER.]

APPENDIX B

PARTNER SPECIFIC MANAGEMENT GUIDELINES AND PROTOCOLS

[LIST AND ATTACH HERE ALL MANAGEMENT PROCEDURES, CONSERVATION MEASURES, AND MONITORING PROCEDURES NOT COVERED BY STANDARD HCP MANAGEMENT GUIDELINES AND PROTOCOLS THAT PARTNER WISHES TO APPLY WHEN PERFORMING ACTIVITIES LISTED IN 4.A. ON LANDS LISTED IN APPENDIX A.]

WISCONSIN KARNER BLUE BUTTERFLY

HABITAT CONSERVATION PLAN

SPECIES AND HABITAT CONSERVATION AGREEMENT

LIMITED PARTNER

THIS SPECIES AND HABITAT CONSERVATION AGREEMENT (Agreement) is entered into by and between the State of Wisconsin Department of Natural Resources (DNR) and [REDACTED], (Partner) for the purpose of implementing the Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan (HCP) and authorizing the incidental take of the Karner blue butterfly (Kbb) in the State of Wisconsin consistent with and during the period of the Incidental Take Permit (Permit) issued by the U.S. Fish and Wildlife Service (FWS).

WHEREAS, the DNR holds a Permit issued by the United States Department of the Interior, Fish and Wildlife Service (FWS) based upon the Habitat Conservation Plan, Species and Habitat Conservation Agreements (SHCA) with the Partners and Implementing Agreement submitted to the FWS with the application for a Permit;

WHEREAS, the statewide KBB conservation program relies on the inter-relationship of SHCAs, a HCP and an Incidental Take Permit (Permit) to form and direct the KBB conservation plan, as well as clarify commitments and obligations of landowners and land users in this effort;

WHEREAS, the Permit from the FWS authorizes the incidental take of the KBB subject to implementation of conservation measures and compliance with procedures, terms and conditions of this Agreement, the HCP and the Permit, by Partners entering into SHCAs with the DNR; and

WHEREAS, the Partner plans to engage in activities that may result in the incidental take of the KBB and agrees to implement conservation measures consistent with the HCP and the Permit on lands under its control and to the extent of the Partner's control to avoid, minimize or mitigate the take of such species as further provided herein.

IT IS HEREBY AGREED by the DNR and the Partner (Parties), based upon the mutual terms and conditions herein, that this Agreement shall constitute the Partner's commitment and agreement to undertake conservation measures for the KBB upon issuance of a Certificate of Inclusion (Certificate). The parties further agree this Certificate is conditioned on the premise that the Agreement shall be consistent with the HCP and conditions of the Permit.

1. DEFINITIONS.

For purposes of this Agreement, the following definitions apply:

- G.** "Certificate of Inclusion" (Certificate) is a document issued by the DNR as authorized by the FWS, which, thereby, includes the person or entity it is issued to under the provisions of the Permit and authorizes incidental take consistent with the HCP, the Permit and this Conservation Agreement.
- H.** "Implementing Agreement" is a legal contract entered into between the DNR and the FWS that: (1) identifies the responsibilities of all participants to the HCP; (2) legally binds the DNR to their obligations; and (3) is signed by the DNR.
- I.** "Incidental take" is the take of a species incidental to, and not for the purpose of, the carrying out of an otherwise lawful activity.
- J.** "Incidental Take Permit" (Permit) is a permit issued by the FWS under the authority of Section 10(a)(1)(B) of the Endangered Species Act to authorize the incidental take of a species listed as endangered or threatened under that Act.
- K.** "Intentional Take" means the purposeful take of a species not incidental to an otherwise lawful activity e.g. collecting.
- L.** "Partner", defined as "Limited Partners" within the HCP, means a person, agency or organization that is engaged in a limited suite of management activities, such as predefined best management practices, on a local level, typically resulting in short term take and subsequently, favorable habitat conditions. Examples include, but are not limited to, county highway departments, townships and municipalities,

2. PERIOD OF AGREEMENT.

The period of this Agreement shall be from its execution and the issuance of a Certificate authorizing incidental take consistent with this Agreement, during the period of the Permit, unless terminated in accordance with paragraph 11 or amended in accordance with paragraph 12.

3. LANDS SUBJECT TO AGREEMENT.

The lands subject to this Agreement include approximately acres and are more particularly described in Appendix A (Lands Included), which is attached to and made part of this Agreement, and all future ownership (including, but not limited to, easements and temporary work spaces) within the high potential range of the KBB, subject to the notification and reporting processes, and implementation of conservation practices consistent with this Agreement, the HCP and the Permit

4. ACTIVITIES/INCIDENTAL TAKE AUTHORIZED/PUBLIC OUTREACH AND EDUCATION/ INFORMATION

A. ACTIVITIES. The following specified land management or land use activities, in addition to any other activity covered by an HCP guideline, protocol or management direction, may be engaged in on the Lands Included in accordance with this Agreement, and the incidental take of KBB is authorized, if the activities are conducted consistent with the HCP, HCP standard guidelines and protocols, the Permit, this Agreement and any changes and improvements made with HCP participation processes which amend these documents; and other protocols or management directions attached to, and made part of this Agreement as Appendix B. Standard HCP guidelines and protocols are published and made available on the HCP webpage; any other protocols and management directions defined by the Partner will be listed and attached to Appendix B:

[LIST MANAGEMENT ACTIVITIES PARTNER WISHES TO ENGAGE IN HERE. Select from examples listed below.]

Highway or road right of way maintenance, including:

- (1) Mowing,
- (2) Brushing (including tree pruning and hazard tree removal),
- (3) Use of pesticides to control vegetation,
- (4) Shoulder maintenance and grooming,
- (5) Snowplowing.

Certain highway or road and road right of way construction, (may be subject to project plan or activity review and approval by WDNR and USFWS), including:

- (1) Ditch maintenance and construction,
- (2) Shoulder construction,
- (3) Road and road right of way construction,
- (4) Other construction, which may impact occupied Karner blue butterfly habitat.

B. INTENTIONAL TAKE. The Partner agrees not to engage in the intentional take of the KBB, as defined in Paragraph 1.E., and agrees that the entering into of this Agreement does not authorize the intentional take of such species.

C. PUBLIC OUTREACH AND EDUCATION. The Partner agrees to respond to questions by the public regarding their activities relating to KBB conservation and provide information on the KBB program when opportunities arise, e.g. budget deliberations, planning or information meetings, etc.

D. INFORMATION. Partner agrees to provide updated guidelines and protocols to those officers, employees, agents or contractors responsible for implementing this agreement.

5. SURVEYS.

The Partner agrees to conduct surveys for wild lupine (*Lupinus perennis*) consistent with the HCP and the survey protocols described in the HCP User's Guide (accessed

on the DNR's KBB HCP website or otherwise provided by the DNR), on lands identified in Appendix A or lands the DNR is notified of through the process provided in this Agreement and approves as being subject to it, and maintain written records of all surveys, including:

- a. identification and qualifications of the person conducting the survey,
- b. the results of the survey as to habitat and occurrences observed, and
- c. the written records shall be maintained by the Partner during the period of and retained for five years following termination of the Agreement, at the following facility:

(Include Organization Name, contact person, full mailing address, including street, road or RFD number, telephone number and email address):

6. MONITORING.

The Partner agrees to monitor and maintain written records regarding the effects of land management and use practices and activities, consistent with the Plan, on the lands subject to this Agreement, as identified in Appendix A during the period of this Agreement. Written records will be maintained, including, but not limited to:

- a. the location and dates of management activities on Kbb occupied (if known) lupine habitat,
- b. the conservation strategy/protocol applied, and
- c. written records will be retained for five years following termination of the Agreement, at the following facility:

(Include Organization Name, contact person, full mailing address, including street, road or RFD number, telephone number and email address):

7. DNR AND FWS INGRESS AND EGRESS.

A. COMPLIANCE MONITORING.

(1) During the period of this Agreement, the DNR may audit and monitor the activities and records of the Partner. Except as provided in A.(2), auditing and monitoring shall be preceded by reasonable notice, not to be less than 24 hours, and shall be conducted in the presence of a representative of the Partner, if the representative is available at the noticed time and date, or other time agreed upon by the Partner and auditing personnel. Access to the property involved, to the extent of the Partner's authority, is authorized. Access to the lands subject to this Agreement and records required by it, or the HCP, shall be for the purpose of assuring compliance with this Agreement and the HCP, and be unlimited. If the Partner does

not have authority to authorize access to the land identified in the notice to be monitored or audited, or during the audit, the Partner shall immediately notify the DNR of such lack of authority and the limited use it has in the property. Documents of title or interest in the property shall be provided to the DNR upon its request.

A copy of any final report, map or other record prepared by the DNR on the results of its going upon the land or reviewing the records shall be provided to the Partner within thirty (30) days of the DNR access and review.

Notification under this Paragraph shall be in writing, facsimile, or telephone to:

(Include Organization Name, contact person, full mailing address, including street, road or RFD number, telephone number and email address):

(2) The notice provision in Subparagraph A. (1), shall not apply when the DNR or representatives of the FWS considers that pending or ongoing activities of the Partner, or person authorized by the Partner, based on concerns or complaints made known to them, may adversely affect Kbb occupied sites in a manner inconsistent with this Agreement, or result in damage to or destruction of Kbb occupied habitat or that may jeopardize the Permit.

- F.** Any refusal of access authorized in Subparagraphs (1) or (2) shall be considered a breach of this Agreement and subject the Partner to all remedies available to the DNR under this Agreement or at law, as well as loss of KBB incidental take authorization provided by the FWS through use of this Agreement.
- G.** The FWS may accompany the DNR when auditing or monitoring under this Agreement or the HCP.
- H.** In addition to authority granted elsewhere in this Agreement, the FWS may enter the lands subject to this Agreement, which are owned by the Partner or where permission by others with an ownership interest has been granted and access the records of the Partner required for the purpose of overseeing the Permit and activities under it or required by this Agreement.
- I.** Nothing in this Agreement, including this section, shall abrogate the authority of the Secretary of the Interior, through the FWS, to fulfill his (her) responsibility in the administration and enforcement of the Endangered Species Act (ESA), 16 USC 1531 et seq. and all implementing regulations including but not limited to 50 CFR Parts 13 and 17.

8. ANNUAL REPORT.

The Partner shall submit an annual report no later than March 1 following the calendar year, which is the subject of the report which shall be on a form provided by the DNR and fully and accurately completed by the Partner with all attachments requested by the DNR, which may include maps, surveys, records, or other information.

9. ASSIGNMENT.

The Partner may not assign this Agreement or performance under it to another without the consent of the DNR. Consent to assign shall be conditioned upon the assignee's Agreement in writing to comply with all the terms of this Agreement following discussion with the DNR to assure a full understanding of the requirements of the Agreement. The FWS shall be notified of any assignment.

10. REMEDIES.

- E.** The Partner agrees that this Agreement and authorization under the Permit does not apply to conduct resulting in the take of a Kbb that does not strictly conform to the requirements of this Agreement or the HCP, and in such a situation the Partner shall be acting without a Permit or authority to take a Kbb and shall be subject to all provisions, remedies and penalties of the Endangered Species Act (ESA), 16 USC 1531 et seq. and all implementing regulations including but not limited to 50 CFR Parts 13 and 17, 29.415, Wis. Stats., the Wisconsin Endangered Species Act (WESA) and ch. NR 27, Wis. Adm.Code.
- F.** (1) Upon a breach or violation of this Agreement, as determined by the DNR, and in addition to any remedies provided or pursued under paragraph 10.A., the DNR may revoke this Agreement and the authorization under it after considering recommendations of the HCP Partners' Implementation and Oversight Committee. The DNR shall notify the Partner and the FWS of an alleged breach or violation.

The DNR shall notify the FWS of any violation of the Permit, HCP or this Agreement. Such notification shall be in writing within five (5) calendar days of discovery of the violation and to the address listed below. Notification shall include the name of the Party(ies) and individual(s) involved the nature of the suspected violation, time period when the suspected violation occurred and the specific location of the suspected violation.

**Field Supervisor
U.S. Fish and Wildlife Service
2661 Scott Tower Drive
New Franken, WI 54229
Telephone: (920) 866-1717**

Fax: (920) 866-1710

(2) The Partner shall be provided an opportunity to present information to the DNR and the HCP Partners' Implementation Oversight Committee on an alleged violation and what an appropriate remedy should be prior to the DNR's determination on whether a breach or violation occurred and the appropriate remedy. Information shall be presented to the DNR and the HCP Partners' Implementation Oversight

Committee by the Partner within thirty (30) days of notice of an alleged violation of this Agreement to the Partner.

(3) If the DNR, after consideration of recommendations of the HCP Partners' Implementation Oversight Committee, determines that action by the Partner may be taken that is reasonable and consistent with ensuring the conservation of the species and its habitat without the application of other remedies in this paragraph, it shall not seek additional remedies on the condition that the Partner completes the remedial action within a time considered reasonable by the DNR.

- G.** The DNR retains all further remedies in law or equity, which it may apply to a breach or violation of this Agreement. Enforcement or other remedies available to the FWS under the ESA shall not be abridged or affected by any decision of the DNR under this paragraph.
- H.** It is understood that unintentional violations of this Agreement may occur, and that the Partner may be required to act in emergency situations that do not allow them to follow all commitments in this Agreement. Should such a situation arise, it is expected that a Partner shall report such an activity consistent with the HCP and the HCP Emergency Guideline, detailing the damage, if any, to Kbb habitat and such action the Partner intends to take to cure or mitigate any damage to KBB or its habitat. The Department agrees to consider the circumstances and the Partner's offer to cure or mitigate in any decision it may make regarding appropriate remedial or enforcement action necessary under this Agreement.

11. TERMINATION.

This agreement or its applicability to any land under it may be terminated by the Partner upon sixty (60) days written notice to the DNR and upon the occurrence of one of the following:

- E.** The land or management right over it is transferred to another by land contract, fee title, easement, or otherwise;
- F.** The KBB is no longer protected by the ESA, (i.e. is delisted) or the KBB is down listed to threatened and take activities of the Partner is allowed per a 4.d. rule.
- G.** The Partner ceases to exist, in fact or by law.
- H.** Other reasons for termination mutually agreed upon as reasonable by the Partner and the DNR, with advice of the HCP Partners' Implementation Oversight Committee, provided that appropriate conservation and/or compensation has occurred for the take of occupied Kbb habitat. It is the responsibility of the Partner to demonstrate to DNR that conservation has occurred prior to termination.

12. AMENDMENT.

This Agreement shall constitute the entire agreement of the Parties and any previous communications or agreements are hereby superseded and no modifications of this Agreement or waiver of its terms and conditions shall be effective unless made specifically in writing and mutually agreed upon and signed by both Parties.

13. CONTRACTING PARTIES.

In this Agreement, the DNR and the Partner include their respective officers, employees, agents, directors, partners, representatives, successors, heirs, members and servants.

14. STATUS OF PARTIES.

The Partner shall not be considered as an agent, contractor or an employee of the DNR for any purpose, including workers compensation. The DNR agrees that the Partner has sole control of the activities and work conducted on the lands of or under the control of the Partner. The DNR only reserves the right of ingress and egress to the lands and facilities, consistent with paragraph 7, to inspect the lands and records of the Partner, as provided herein, to assure compliance with this Agreement.

15. TRANSFER.

The Partner agrees to notify the DNR of any transaction involving Lands Included, management rights, or assets relating to land, which may pertain to this Agreement, and coverage under the Permit. Notification of transfers can be made at any time, but must be included prior to any activity, which would result in incidental take of Kbb in order for incidental take authority to be valid. Incidental take is not authorized on newly acquired land until the transfer is reported to the DNR and added to the Partner's SHCA Appendix A (lands included).

16. MODIFICATION/ADAPTIVE MANAGEMENT.

The Partner agrees to modify responsibilities and duties under this Agreement consistent with the review and adaptive management process established in the HCP.

17. FUNDING COMMITMENTS.

The Partner commits to completing its conservation strategies and other obligations as provided in this Agreement, whether accomplished by employees, agents, contractors or cooperators.

18. LIABILITY FOR AGENTS, ETC.

It is recognized that the Partner often conducts its land management or use activities

through an agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser. The Partner has and accepts the obligation to require, normally through written agreement or communication, that activities be conducted in a manner consistent with this Agreement, the HCP and the Permit. Take incidental to otherwise lawful activities by these persons or entities is authorized by the Permit so long as such activity and incidental take resulting from it is authorized by the Partner consistent with this Agreement, the HCP and the Permit. A violation of any authorization, which includes procedures and activities for KBB conservation the Partner is required to follow or conduct, consistent with this Agreement, the HCP and the Permit, by an agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser, shall not result in the suspension, revocation, or termination of the Permit or the authorization to the Partner under this Agreement, the HCP and the Permit; nor shall it affect other benefits, rights, or privileges under this Agreement, the HCP or the Permit, except as to that agent, lessee, licensee, contractor, permittee, right-of-way grantee, or purchaser, who is and shall be subject to the provisions of the ESA, including remedies for its violation when acting inconsistent with the authorization from this Partner, this Agreement, the HCP and the Permit. The obligation to demonstrate that the Partner adequately communicated procedures and requirements of this Agreement, the HCP and the Permit to the agent, lessee, licensee, contractor, permittee, right-of way grantee, or purchaser is on the Partner, and cannot be waived by the DNR.

19. DATA SHARING

- Data provided by the DNR and which constitutes Natural Heritage Inventory data (NHI) may not be used for any purpose other than development of the SHCA or conducting of activities under the Permit. It may not be released or made available to any other person, agency or organization for any purpose unless agreed to in writing by the DNR. Documents or data containing NHI information is included in this restriction.
- Data provided to the DNR is subject to Wisconsin's Public Records Law, Ch. 19, Wis. Stats., and subject to that law regarding requests for it. Under s.23.27 (3), Wis. Stats., NHI information is considered confidential and release or use of it is controlled by the Department and administrative rules adopted to administer the NHI program.

20. NOTIFICATION

Partner agrees to notify the Department of any change in the responsible agent, employee, officer or representative responsible for implementing this agreement.

**STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES**

DATE _____

BY _____

Paul DeLong
Division Administrator of
Forestry, Wisconsin DNR

AND

DATE _____

BY _____

Laurie Osterndorf
Division Administrator of
Land, Wisconsin DNR

[PARTNER NAME below line]

DATE _____

BY _____

(Print name/title below line)

DATE _____

BY _____

(Print name/title below line)

APPENDIX A

PARTNER LANDS INCLUDED

Partner lands included are those road ROWs that the partner has management responsibility for, and which are highlighted on the attached map.

The lands subject to this agreement include roads and highways, and the rights-of- ways (ROW) of which the ROWs are approximately:

_____ feet, meters (*circle one or delete other*) wide on each of two sides, and

_____ feet, meters, miles (*circle one or delete other*) in length.

Total Acres Included for Incidental Take Coverage
= _____ ACRES

Acreage Calculator:

1 meter = 3.2808 feet	_____ meters x 3.2808 = _____ feet
1 mile = 5,280 feet	_____ miles x 5,280 feet = _____ feet
1 acre = 43,560 square feet	_____ ft. wide x _____ ft. long = _____ sq. ft.

_____ sq. ft. divided by 43,560 sq. ft. = _____ acres (include in block above)

Attach county or township map with roads partner manages marked with a highlighter. Map will contain:

- County name
- Township name(s)

- **Town & Range**
- **Cardinal marker**
- **Distance scale (and/or section lines)**

APPENDIX B

PARTNER SPECIFIC MANAGEMENT GUIDELINES AND PROTOCOLS

[LIST AND ATTACH HERE ALL MANAGEMENT PROCEDURES, CONSERVATION MEASURES, AND MONITORING PROCEDURES NOT COVERED BY STANDARD HCP MANAGEMENT GUIDELINES AND PROTOCOLS THAT PARTNER WISHES TO APPLY WHEN PERFORMING ACTIVITIES LISTED IN 4.A. ON LANDS LISTED IN APPENDIX A.]

KBB HCP Partners User Guide



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	Title: KBB HCP Users Guide	
	Date: September 6, 2007	Revision: 01

I. Purpose and Applicability

This User's Guide is intended for Karner Blue Butterfly (KBB) HCP partners and their staff for the purpose of providing a simple, user-friendly approach to assist in decision making about routine management and maintenance activities that take place within the KBB High Potential Range (HPR). The User's Guide is comprised of two main sections: the guidelines and the protocols. Guidelines are designed to be general and describe the kinds of activities that an entity group may conduct or that are frequently used in a specific type of land management. Protocols are specific and provide the detailed conservation measures for how partners should implement an activity.

The guidance provided here after is intended to be applied for use within the KBB HPR and should not be considered a substitute for other management protocols outside of this range. This User's Guide applies to any Corridor, Construction, Conservation, Forestry, Recreation, Emergency, or Limited Partner management guideline and the associated management protocols. The attached flow chart provides a step-wise process that will help you determine the appropriate type of management to be conducted and the conditions under which certain management protocols may be used.

	Title: KBB HCP Users Guide	
	Date: September 6, 2007	Revision: 01

I. Purpose and Applicability

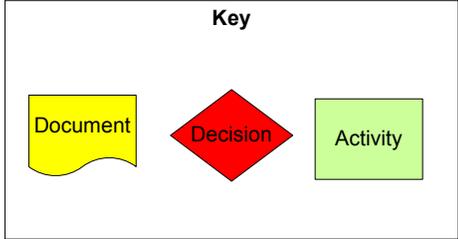
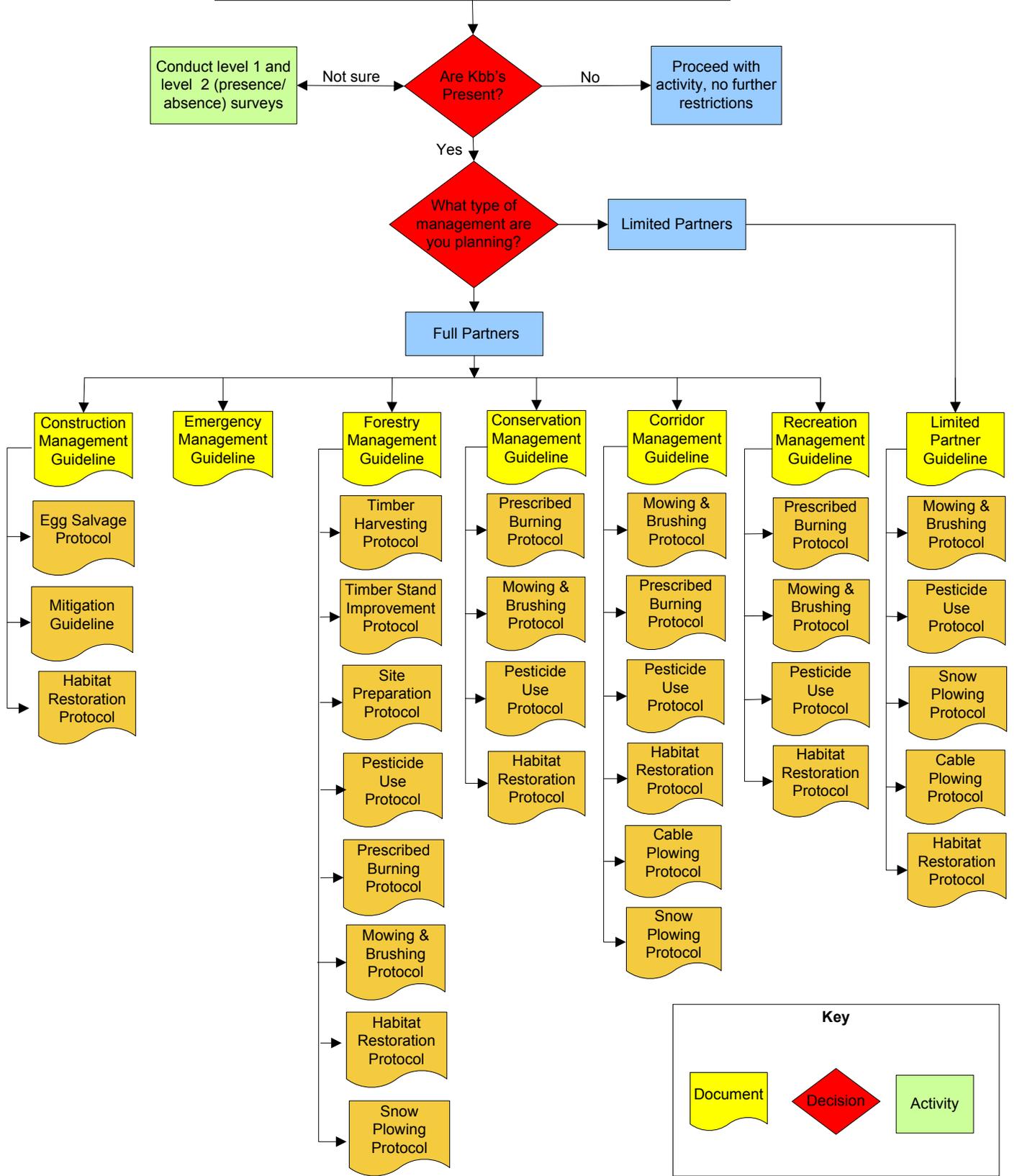
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The guidance provided here after is intended to be applied for use within the KBB HPR and should not be considered a substitute for other management protocols outside of this range. This User's Guide applies to any Corridor, Construction, Conservation, Forestry, Recreation, Emergency, or Limited Partner management guideline and the associated management protocols. The attached flow chart provides a step-wise process that will help you determine the appropriate type of management to be conducted and the conditions under which certain management protocols may be used.

II. HCP Users Guide Flow Chart



HCP User's Guide



III. Guidelines



	Title: Conservation Management Guideline	
	Date: September 6, 2007	Revision: 01

I. Scope and Applicability

Conservation management activities will be conducted with consideration for the Karner blue butterfly (Kbb) and in a manner that will allow for continued beneficial disturbance management within the High Potential Range of the Kbb.

This guideline applies to all conservation management activities that may occur within the High Potential Range of the Kbb. Conservation management activities include: routine, planned, and maintenance actions that may occur on State Wildlife & Fishery Areas, State Natural Areas (SNA's), or other partner owned lands of similar type (*see III. Specific Activities below*).

This guideline does not apply to construction activities, emergency situations, forestry management practices, and recreational management or corridor management practices. These activities are addressed as separate guidelines, each with protocols that are specific to them.

II. General Requirements

- a. Pre-management surveys will be conducted prior to conducting management activities unless specifically detailed in a management protocol, emergency situations or in a specific conservation agreement (DNR's Implementing Agreement (IA) or other partner's Species and Habitat Conservation Agreement (SHCA)).
- b. Kbb and Kbb habitat surveys will be conducted following approved HCP monitoring guidelines and protocols.
- c. When Kbb are present, conservation measures described in approved HCP management guidelines and protocols will be followed.
- d. In addition partners are required to follow any specific provisions in their conservation agreements (SHCAs or IA).

III. Specific Activities

See Conservation Management flow chart for process depiction

- a. If burning activities are to be used for conservation management the Burning Protocol will be implemented.
- b. If mowing, brushing, or hand cutting, is to be used, the Mowing and Brushing Protocol will be implemented.

- c. If pesticides are to be applied for corridor management, the Pesticide Protocol will be implemented.
- d. If chemicals are to be used, either as a site preparation or release measure for desirable woody vegetation, see the Pesticide Protocol for proper implementation
- e. When creating or restoring habitat, follow the Restoration Protocol.
- f. For routine maintenance and construction activities that would result in short term take of occupied Kbb habitat that would temporarily remove all vegetation, but will be replaced within 5 years, follow the Construction Management Guideline.
- g. For construction or other activities that result in permanent take of occupied Kbb habitat, consult with DNR's HCP Coordinator as soon as possible to determine appropriate course of action.

IV. Referenced Documents

Manual of Control Techniques Recommended for Ecologically Invasive Plant Species Occurring in Karner Blue Butterfly Habitat (Larsen, et al January 2000)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement, Appendix F. (March 2000)

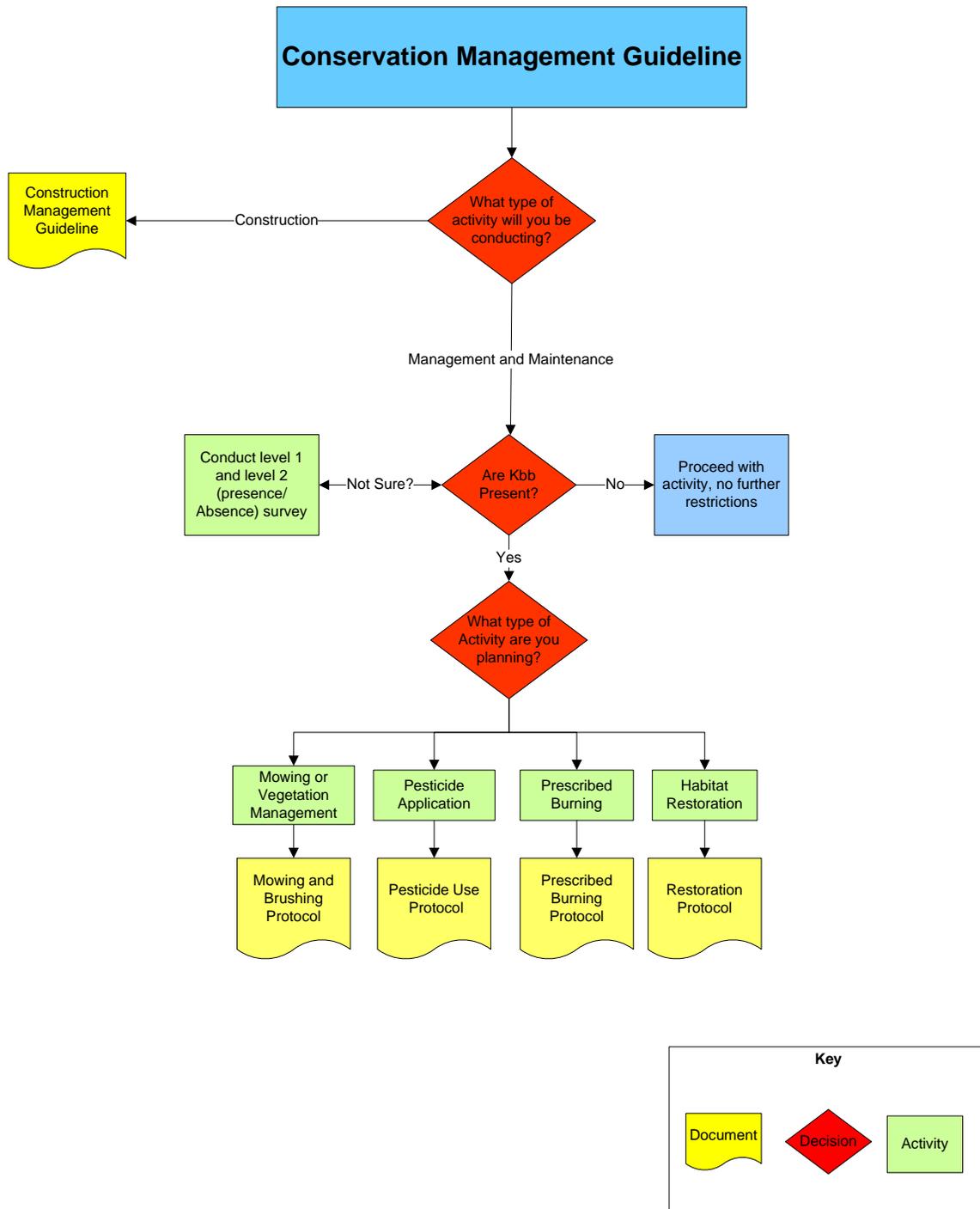
Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Prescribed Burning Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Mowing and Brushing Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Pesticide Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Restoration Protocol. (2006)

Conservation Management Flow Chart



**Karner Blue Butterfly HCP
Management Guideline**

	Title: Construction Management Guideline	
	Date: Reserved	Revision: 00

Under Development

	Title: Corridor Management Guideline	
	Date: September 6, 2007	Revision: 01

I. Scope and Applicability

Corridor management activities will be conducted with consideration of the Karner blue butterfly (Kbb) and in a manner that will allow for continued beneficial disturbance management within the High Potential Range of the Kbb.

This guideline is applicable to all corridor management activities that may occur within the High Potential Range of the Kbb. Corridor management activities include routine, planned, and maintenance activities that may occur on utility rights-of-way, roadsides, logging roads, recreation trails and other linear features.

This guideline does not apply to construction activities, emergency situations, forestry management practices, and recreational management or conservation management practices.

II. General Requirements

- a. Pre-management surveys will be conducted prior to conducting management activities unless specifically detailed in a management protocol, emergency situations or in a specific conservation agreement (DNR's Implementing Agreement (IA) or other partner's Species and Habitat Conservation Agreement (SHCA)).
- b. Kbb and Kbb habitat surveys will be conducted following approved HCP monitoring guidelines and protocols.
- c. When Kbb are present, conservation measures described in approved HCP management guidelines and protocols will be followed.
- d. In addition, partners are required to follow any specific provisions in their conservation agreements (SHCAs or IA).

III. Specific Activities

See Corridor Management flow chart for process depiction

- a. If burning activities are to be used for corridor management the Burning Protocol will be implemented.
- b. If mowing, brushing, or hand cutting, is to be used, the Mowing and Brushing Protocol will be implemented.
- c. If cable plowing will be used the Cable Plowing Protocol will be implemented.
- d. If pesticides are to be applied for corridor management, the Pesticide Protocol will be implemented.

Karner Blue Butterfly HCP Management Guideline

- e. If plowing snow on corridors the Snow Plowing Protocol will be implemented.
- f. If doing recreation trail or woods trail maintenance including grading, bulldozing, ditching, widening, re-routing of trails, etc., refer to Construction Management Guideline.
- g. For facility and equipment inspections the following is applicable:
 - i. All lupine areas will be avoided to the greatest extent practicable.
 - ii. Pre-management surveys are **not required**.
- h. For routine maintenance and construction activities that would result in *short term take* of occupied Kbb habitat that would *temporarily* remove all vegetation, but will be replaced within 5 years, follow the Construction Management Guideline.
- i. For construction or other activities that result in *permanent take* of occupied Kbb habitat, consult with DNR's HCP Coordinator as soon as possible to determine appropriate course of action.

IV. Referenced Documents

Manual of Control Techniques Recommended for Ecologically Invasive Plant Species Occurring in Karner Blue Butterfly Habitat (Larsen, et al January 2000)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement, Appendix F. (March 2000)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Prescribed Burning Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Mowing and Brushing Protocol. (2006)

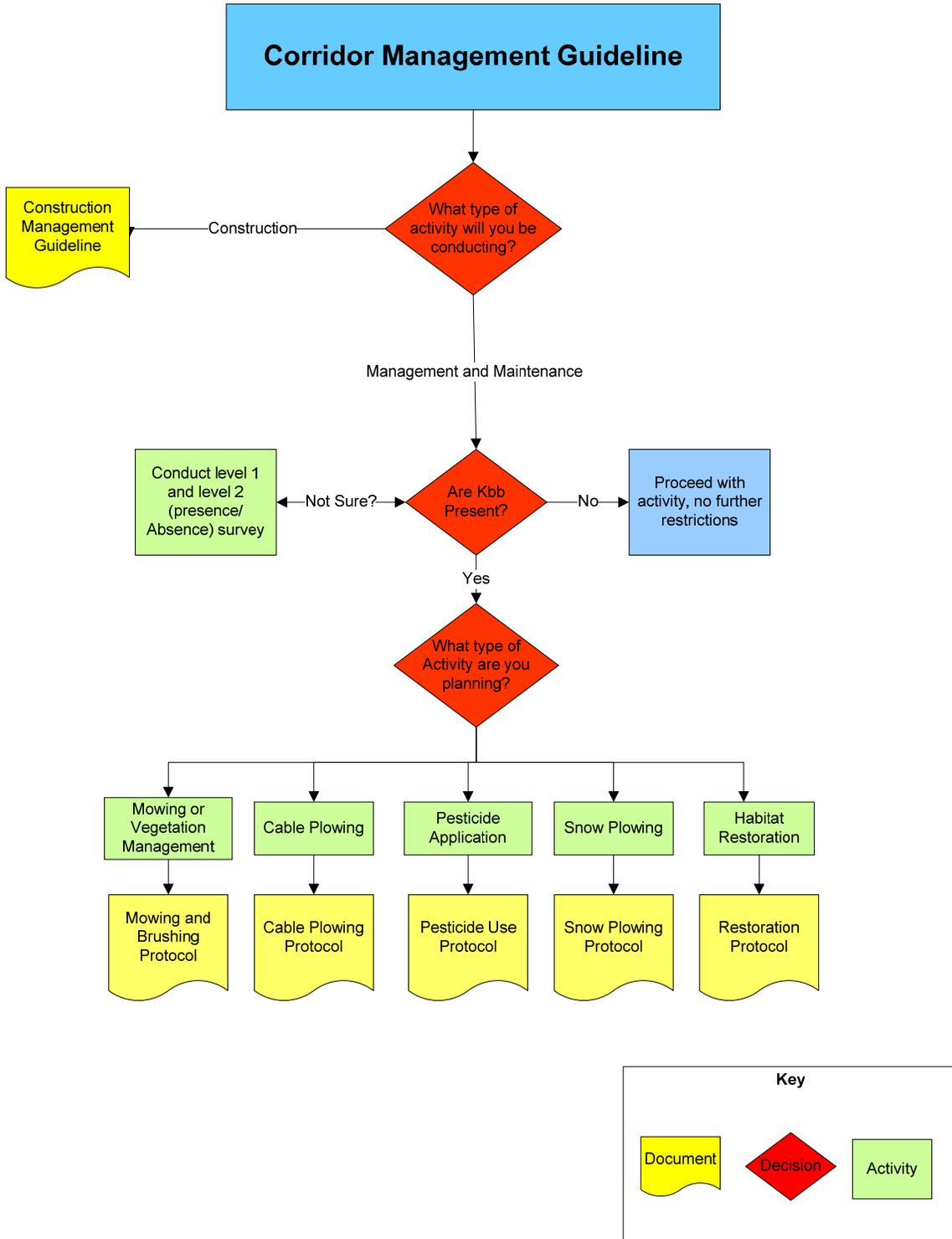
Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Pesticide Use Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Habitat Restoration Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Snow Plowing Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Cable Plowing Protocol. (2006)

Corridor Management Flow Chart



	Title: Forest Management Guideline	
	Date: September 6, 2007	Revision: 01

I. Scope and Applicability

Forest management activities will be conducted with consideration for the Karner blue butterfly Kbb and in a manner that will allow for continued beneficial disturbance management within the High Potential Range of the Kbb.

This guideline applies to all forest management activities that may occur within the High Potential Range of the Kbb. Forest management activities include planned vegetative manipulation practices that are conducted on lands owned or managed by HCP partners in the “shifting mosaic” and “management to feature and enhance” categories of participation in the HCP. More specifically, it includes most timber harvesting, site preparation and timber stand improvement activities that are routinely used to ensure healthy and productive forests from the time of stand establishment through the final harvest of mature timber.

This guideline does not apply to construction activities, emergency situations, corridor management practices, recreational management, or conservation management practices.

II. General Requirements

- a. Pre-management surveys will be conducted prior to conducting forest management activities unless specifically detailed in a management protocol, in emergency situations, or in a specific conservation agreement (DNR’s Implementing Agreement (IA) or other partner’s Species and Habitat Conservation Agreement (SHCA)).
- b. Kbb and Kbb habitat surveys will be conducted following approved HCP monitoring guidelines and protocols.
- c. When Kbb are present, conservation measures described in approved HCP management guidelines and protocols will be followed.
- d. In addition partners are required to follow any specific provisions in their conservation agreements (SHCAs or IA).

III. Specific Activities

See Forestry Management Guideline flow chart for process depiction

- a. If burning activities are to be used for forest management refer to the Burning Protocol.
- b. If mowing, brushing, or hand cutting, is to be used, refer to the Mowing and Brushing Protocol.

Karner Blue Butterfly HCP Management Guideline

- c. If pesticides are to be applied for forest management purposes, refer to the Pesticide Use Protocol.
- d. When plowing snow on corridors refer to the Snow Plowing Protocol.
- e. For intermediate stand management activities including but not limited to weeding, thinning, improvement cutting, sanitation cutting, release treatments and pruning, refer to the Timber Stand Improvement Protocol.
- f. For general access to forest stands to conduct inspections, to collect data and information, to establish forest management activities, or for other non-disturbance management purposes, the following is applicable:
 - i. Avoid travel through lupine areas to the extent practicable.
 - ii. Pre-management surveys are **not required**
- g. For routine maintenance and construction activities, e.g. new access roads, or improvement of existing roads that would result in *short term take* of occupied Kbb habitat that would *temporarily* remove or destroy all vegetation, but will be replaced within 5 years, follow the Construction Management Guideline.
- h. For construction or other activities that result in *permanent take* of occupied Kbb habitat, consult with DNR's HCP Coordinator as soon as possible to determine appropriate course of action.
- i. For emergency situations that require immediate management action such as forest fire suppression activities or salvage cutting of damaged timber from windstorms, forest fires, flooding or insect and disease epidemics, refer to the Emergency Guideline.

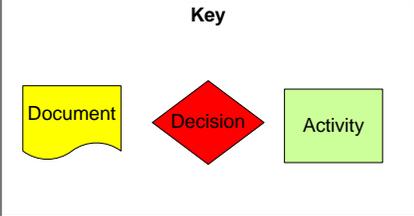
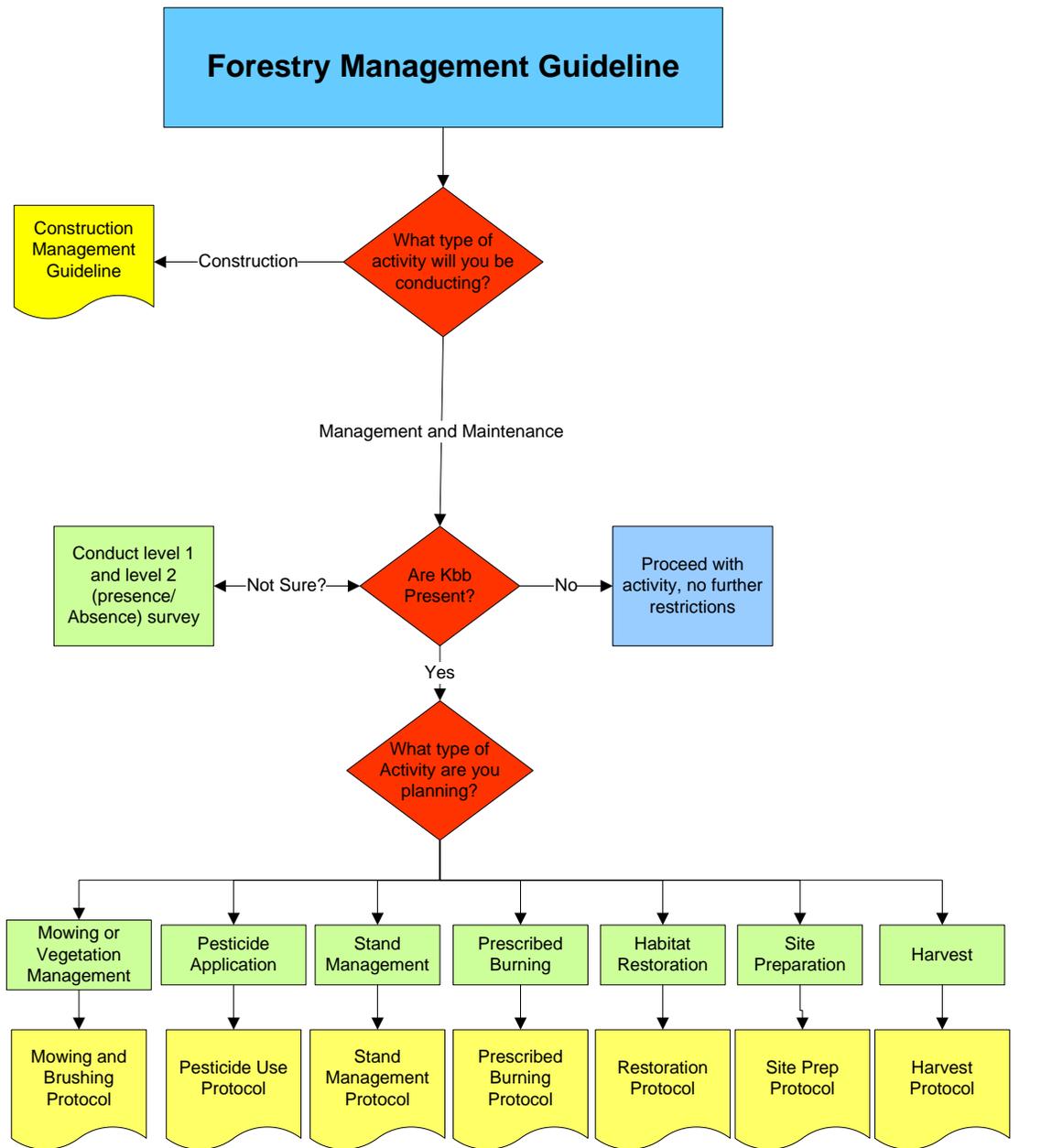
IV. Reference Documents

Manual of Control Techniques Recommended for Ecologically Invasive Plant Species Occurring in Karner Blue Butterfly Habitat (Larsen, et al January 2000)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement, Appendix F. (March, 2000)

Wisconsin DNR Silviculture Handbook 2431.5

Forestry Management Flow Chart



	Title: Recreation Management Guideline	
	Date: September 6, 2007	Revision: 01

I. Scope and Applicability

Recreation management activities will be conducted with consideration for the Karner blue butterfly (Kbb) and in a manner that will allow for continued beneficial disturbance management within the High Probability Range of the Kbb.

This guideline is applicable to all recreation management activities that may occur within the high probability range of the Kbb. recreation management activities include routine, planned, and maintenance activities that may occur on State Parks, Forests, Wildlife and Fishery Areas or other properties maintained for recreational purposes.

This guideline does not apply to construction activities, emergency situations, forestry management practices, and conservation management or corridor management practices. These activities are addressed as separate guidelines, each with protocols that are specific to them.

II. General Recommendations/Requirements

- a. Avoid conducting activities in lupine areas within the high probability range known to be occupied by Kbb's or areas where the presence of KBB is unknown.
- b. Pre-management surveys will be conducted prior to conducting conservation management activities unless specifically detailed in a Management Protocol, emergency situations or in a specific Species and Habitat Conservation Agreement.
- c. Post-management surveys for lupine and Kbb presence/absence will be conducted. For survey methodology and requirements see KBB Survey Protocol.
- d. Compensatory mitigation is not required for conservation management activities. See the Mitigation Protocol for more information.

III. Specific Activities

See Recreation Management flow chart for process depiction

- a. If burning activities are to be used for conservation management the Burning Protocol will be implemented.
- b. If mowing, brushing, or hand cutting, is to be used, the Mowing and Brushing Protocol will be implemented.

- c.* If pesticides are to be applied for corridor management, the Pesticide Protocol will be implemented.
- d.* If chemicals are to be used, either as a site preparation or release measure for desirable woody vegetation, see the Pesticide Protocol for proper implementation
- e.* For routine maintenance activities that may involve short-term or temporary-take, consult with DNR to determine appropriate actions.

IV. Referenced Documents

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement, Appendix F. (March 2000)

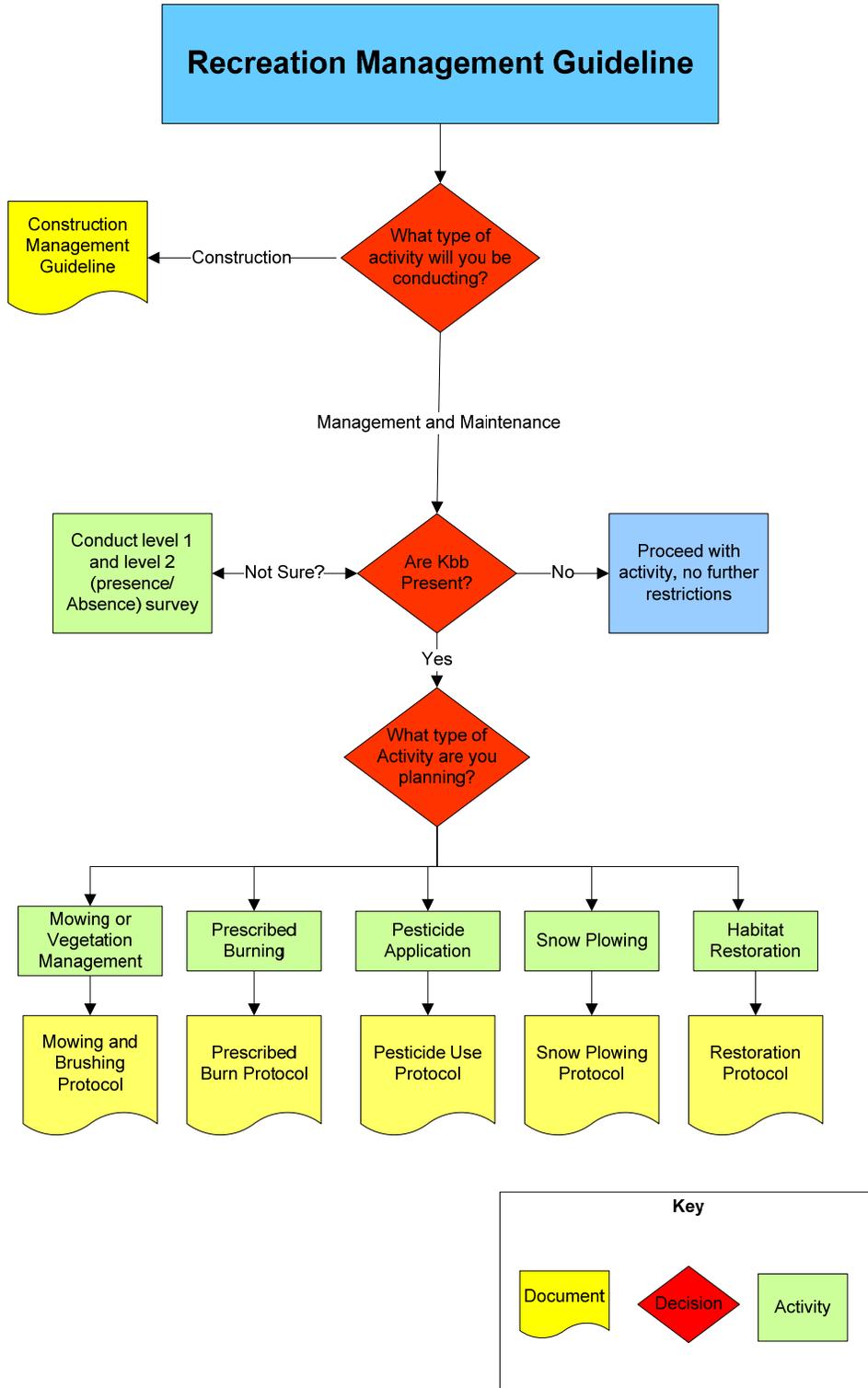
Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Prescribed Burning Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Mowing and Brushing Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Pesticide Use Protocol. (2006)

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan Habitat Restoration Protocol. (2006)

Recreation Management Flow Chart



	Title: Emergency Guideline	
	Date: September 6, 2007	Revision: 01

I. Scope and Applicability

Partners in the Karner blue Butterfly (Kbb) Habitat Conservation Plan may be required to respond to emergency situations in areas of that are known to be occupied by Kbb or areas where the presence of Kbb is unknown.

This guideline applies only to emergency situations with the High Potential Range for the Kbb in Wisconsin.

II. General Recommendations/Requirements

- a. In an emergency situation, repairs to infrastructure and safety of the public and work crews will take precedence.
- b. Avoid lupine areas within the High Potential Range that are known to be occupied by Kbb or areas where the presence of Kbb is unknown, to the extent that these areas are known during an emergency response or identified to the greatest extent practicable.
- c. Permanent take of Kbb occupied habitat resulting from emergency response will be recorded on the annual report for the year in which the emergency response situation occurred.

III. Specific Activities

- a. Incidental take of Kbb due to emergency response is authorized by the Incidental Take Permit. If the emergency response results in take that is not permanent, no further action is required.
- b. If emergency situation results in extreme damage to or complete removal of Kbb occupied habitat the partner will replace the habitat within 5 years (refer to the Restoration Protocol).
- c. If emergency situation results in permanent take of occupied Kbb habitat consult with the DNR's HCP Coordinator.

IV. Reference Documents

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement, Appendix F. (*March, 2000*)

IV. Protocols, Management



	Title: Mowing and Brushing Protocol	
	Date: September 6, 2007	Revision: 01

I. Purpose and Applicability

This protocol is intended to avoid and minimize take of the Karner blue butterfly (Kbb) that is incidental to mowing and brushing activities. This protocol applies to sites known to be occupied by Kbb, and to lupine sites within the KBB High Potential Range where Kbb presence or absence is unknown.

II. Conservation Measures

Mowing

- a. To avoid take
 - i. Do not mow in lupine areas that are known to be occupied by Kbb, or in lupine areas where the presence of Kbb is unknown. When mowing on extensive sites with scattered Kbb populations, avoid those lupine areas that are occupied by Kbb.
 - ii. Mow in winter over frozen ground and snow cover at a blade height of at least 6 inches above ground unless the senesced herbaceous vegetation containing lupine is under the snow layer and only the target, woody vegetation protrudes above the snow. In this case mowing down to the snow level is acceptable.
 - iii. Mow between September 1 and April 15 with a side-mounted sickle bar or rotary mower where the tractor is operated from the roadside or outside the occupied habitat.

- b. To minimize take and promote Karner blue butterfly and habitat
 - i. Mow lupine areas where Kbb occur only between September 1 and April 1 (**required**).
 - ii. If practicable, avoid mowing until October 1 or the first hard frost to allow late-season flowering plants to set seed for reproduction. For added benefit to Kbb, apply this measure to nectar areas within 200 meters of the lupine area.
 - iii. Do not mow lupine areas where Kbb occur more than once per year. (**required**)
 - iv. Avoid mowing annually those lupine areas where Kbb occur unless safety considerations require it. Three to five years between mowing treatments is preferred.
 - v. Set blade height at a minimum of 6 inches (8 inches is better) above the ground to minimize impacts to Kbb eggs. This mowing

practice reduces egg mortality and leaves the lower stems of lupine plants where eggs are laid at the site of new perennial lupine plant available for newly hatching larva. The blade height may be lowered to 4 inches if needed to simulate fire or grazing, or to reduce litter or thatch buildup.

- vi. Let clipped vegetation lay where it falls when mowing in lupine areas where Kbb occur. The clippings may contain KBB eggs. **(required)**
- vii. Use light-weight or low-ground pressure equipment when possible to minimize impact on vegetation and KBB eggs.

Tree and Brush Removal

- c. To avoid take
 - i. Do not cut or mow brush and trees in lupine areas that are known to be occupied by KBB, or in lupine areas where Kbb presence is not known.
 - ii. When cutting brush and trees on extensive sites with scattered KBB populations, avoid those lupine sites that are occupied.
- d. To minimize take and promote KBB habitat when doing tree and brush removal
 - i. From September 1 to April 15 (preferred operating period)
 1. Restrict brushing with heavy equipment, e.g. brush hogs, flail choppers, and hydroaxes, etc. to this time period. **(required)**
 2. To the greatest extent practicable, restrict brushing with heavy equipment, e.g. brush hogs to the winter when the ground is frozen and/or covered with snow (preferably at least 3-4 inches) to decrease egg mortality.
 3. Tree and brush cutting or mowing on occupied sites during this time period should be done with hand tools or hand-operated power tools (chain or brush saw) if at all possible.
 4. Avoid trampling lupine plants or dragging brush across occupied sites or piling brush on occupied sites.
 5. If brush is to be chipped, spread the chips so that lupine plants are not covered.
 6. For brushing with rotary mowers, choppers, or flail choppers, the minimum cutting/chopping height should be 6 inches (8 inches is better).
 7. Brushing from July through early August may be considered for occasional use to control woody vegetation. Do not brush the entire occupied lupine areas, or isolated occupied sites during this period.
 8. For all brushing activities:

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Avoid driving transport equipment and operating mowing equipment in major lupine and nectar areas to the greatest extent practicable.

- ii. Anytime throughout the Year
 1. Trimming by hand may occur at any time.
 2. Avoid dragging brush through lupine patches.
 3. Avoid trampling or other impacts to lupine to the greatest extent practicable.
 4. Avoid operating and parking vehicles and heavy equipment in lupine areas to the greatest extent practicable.
- e. In Emergency Situations
 - i. Avoid lupine areas to the greatest extent practicable.
 - ii. If Kbb presence/absence was unknown at the time of the emergency activity, perform post-management surveys for lupine and KBB presence/absence in the following flight season.

III. Reference Documents

Forest Management Guidelines (Lane) 1997

Wildlife Management Guidelines for the Karner Blue Butterfly (WDNR) May, 1998

The Strategic Management Plan for Linear Corridors in Areas Inhabited by the Karner Blue Butterfly (Weaver Boos Consultants, Inc.)

Karner Blue Butterfly Habitat Conservation Plan, March, 2000

**Karner Blue Butterfly HCP
Management Protocol**

	Title: Habitat Restoration Protocol	
	Date: Reserved	Revision: 00

Under Development

	Title: Prescribed Burning Protocol	
	Date: April 4, 2007	Revision: 01

I. Purpose and Applicability

This protocol is intended to avoid and minimize take of the Karner blue butterfly (Kbb) that is incidental to prescribed burning activities. This protocol applies to sites known to be occupied by Kbb, and to lupine sites within the Kbb High Potential Range (HPR) where Kbb presence is not known. Managers implementing this protocol should incorporate their knowledge of Kbb occurrences, lupine distribution and metapopulation function when conducting prescribed burns. Managers are also encouraged to incorporate their own personal knowledge and expertise to the greatest extent practicable when planning prescribed burns. If prescribed burning is conducted for the purpose of recovering or improving Kbb populations or their habitat, then prescribed burning is allowed:

If the protocol outlined below is not feasible, or multiple listed species occur in a management unit please contact the Division of Forestry, Karner Blue Butterfly (KBB) Habitat Conservation Plan (HCP) Program at 608-261-6451. Staff from the Karner Blue HCP Program will work with DNR research staff, and species experts to develop an acceptable protocol for a specific site.

II. Conservation Measures: Required

- a.** Avoid take (no permit required)
 - i.** Do not burn lupine areas that are known to be occupied by Kbb, or lupine areas where the presence of Kbb is unknown.
 - ii.** When burning on extensive sites with scattered Kbb populations, avoid those lupine areas that are occupied.

- b.** Minimizing take and promoting Kbb habitat

1. If the management area is part of a large-scale barrens landscape, occupied lands are under single ownership, metapopulation management is occurring, and corridors connect occupied areas,

OR

2. If the management area is part of a large-scale barrens landscape, occupied lands are under multiple ownership, corridors connect occupied areas, and a signed management agreement(s) has been made between all parties,

OR

3. If the management area is not part of a large-scale barrens landscape, but habitat is comprised of high quality vegetation, and a refugia has been established for two consecutive years,

AND

- a. Burning occurs in the Spring or Fall,

then entire burn units may be burned,
 - i. As long as 2/3 of the lupine area within the metapopulation management area remains unburned for two consecutive years and refugia are located within dispersal distance of the burned area.
 - ii. There are no ITP issues for other species. If ITP issues exist, contact the BER for assistance developing an alternative protocol.
 - b. Burning occurs in early to mid-Summer (*see definition*),

then follow all requirements associated with Spring and Fall burning under *Ia.* above with the addition of,
 - i. 1/3 of the unit supporting nectar species remains unburned.
4. If habitat is comprised of high quality remnant vegetation, but less than 2/3 of the lupine has remained unburned for two consecutive years,

AND

- a. burning occurs in either the Spring or Fall,

then up to 1/3 of the lupine area may be burned as long as,
 - i. existing unburned lupine and the balance of previously burned lupine equals 2/3 of total lupine patch remains unburned for at least two consecutive growing seasons and refugia are located within dispersal distance of burned area.
 - ii. There are no ITP issues for other species. If so, contact the BER for assistance developing an alternative protocol.
- b. burning occurs in early to mid-Summer (*see definition*),

then follow steps outlined under *4a.* (above) with the addition of,

- i. 1/3 of the unit supporting nectar species remains unburned.

5. If the habitat is highly degraded or is a restoration,

AND

lupine is present,

then up to 3/4 of the lupine area may be burned as long as

- i. 1/4 of the lupine area remains unburned for at least two consecutive growing seasons and refugia are located within dispersal distance of burned area.
- ii. There are no ITP issues for other species. If ITP issues exist, contact the BER for assistance developing an alternative protocol.

Recommendations – to supplement Conservation Measures

- A. Burn units: The number and/or size of burn units should be site specific and depend largely on what is practical for the specific property conditions. Under most circumstances, preexisting burn units are dictated by natural boundaries such as roads, ditches, dikes, and flowages. Subdividing existing units into subunits is not recommended, as it is often impossible due to numerous wetlands within sites, cost, and the potential for establishment of invasive species. When developing new burn units, managers should use their professional judgment to decide when to use natural breaks and when to develop mowed, blacklined, or rotovated breaks.
- B. Burn Planning: Entire populations of Kbb's should never be burned at one time. Under circumstances in which an entire property can be considered a contiguous block of Kbb habitat, entire burn units or 33% of the lupine on the property can be burned in any given year.

When burn units are isolated and Kbb are incapable of dispersing to the site, unburned refugia (2/3 of lupine area) should be left within or excluded from the burn unit. Maintaining refugia will promote greater Kbb population survival and facilitate post-burn Kbb recolonization throughout the burn unit. The refugia may also be burned but over a longer timeframe, should be divided into more subunits, and have a Fire Return Interval (FRI) of 5-6 years. In lieu of more frequent fires at such isolated sites, consider use of mechanical management.

- C. Rotation: FRI's should be based on habitat management needs not on a fixed schedule. Factors such as habitat type, site condition, and site history, and the presence of invasive species should be considered when determining how often a site should be burned. Generally, occupied Kbb sites are burned once every 4-5 years, however, given the unpredictable nature of the variables described above, it is likely that no two burn units will have the same FRI.

Unsuitable Kbb Community/Habitat types i.e., wetlands, forest stands with $\geq 75\%$ canopy cover, and old fields, in which Kbb are unlikely to occur should not influence FRI's for Kbb occupied sites and may be burned at the land managers discretion to achieve the desired management objectives.

Site condition pertains to the successional changes of habitat as a result of the absence of land management activities leading to woody species encroachment and/or the presence of invasive species. Land managers that encounter these conditions may feel it necessary to conduct repeated annual burning (can be combined with brushing and herbiciding) to suppress woody plant encroachment and control the invasive species (*refer to protocols in II. 5a.*). Managers should be given the flexibility to use their professional experience to conduct intensive management practices to restore degraded areas. Once the desired goals are met, less intensive management practices can be implemented to maintain and perpetuate Kbb populations.

Highly disturbed areas that are/have been restored or mitigated may also require the flexible, intensive burn management as described above. Early restorations are often dominated by weed species and frequent burning is essential in promoting the establishment of native species.

[Rebuilding the population for Kbb appears to take at least 2 years post-fire, under favorable weather conditions. Population buildup for other invertebrate species that complete only 1 generation per year presumably will take longer.]

[Caution: Delay burning if populations decline severely due to weather or other factors (wildfires, flood, etc.)] Burn first the most degraded habitats supporting the fewest Kbb, as habitat needs permit.

- D. Burn Frequency: The optimal burn frequency per burn unit, with respect to the Kbb, is no greater than once every 4 years, to allow populations ample time to recover through recolonization from adjacent refugia. Burn frequencies of once every 5-10 years are preferred, unless woody succession or exotic invasion poses a more serious threat.

If sites are being burned more frequently than 4 years, consider alternatives such as mowing, brushing, and herbiciding. When feasible explore possibilities for excluding lupine areas which support the most Kbb from burns (e.g., by burning around them). Maintain refugia within units through appropriate mechanical

and/or herbicide management that leave significant portions of the population within a unit unharmed.

- E. Firebreaks: Utilize existing artificial or natural breaks such as trails, wetlands, or roads, as much as possible. If natural breaks cannot be used, mowed breaks are less intrusive and can be highly effective.

Avoid creating mineral breaks. While lupine may readily colonize the bare soil, so may other aggressive exotics. If mineral breaks are necessary to protect human safety, use rotovated or disked breaks rather than fire-plowed breaks. If construction of a mineral break destroys occupied Kbb habitat, refer to the *Construction Guideline*. Caution must be used to avoid spreading seeds of weedy plants via equipment.

- F. Monitor for potential invasion of aggressive exotic plants such as spotted knapweed or leafy spurge, and remove such invaders as soon as detected. Contact the WI DNR's Karner Blue Butterfly HCP Program, 608/266-6451 to receive a copy of the "Invasive Species Control Manual" for more information on control of weedy invaders. Be sure to follow pesticide use guidelines specific to the Karner blue butterfly. Pesticide Use Guidelines may be obtained from the Division of Forestry, Karner Blue Butterfly HCP Program (608) 266-1327.
- G. Type of Burn: If possible, conduct burns at varying intensity levels. Less intense burns may be more likely to result in fire skips resulting in patchy burns. The mosaic of burned and unburned areas throughout burn units expedites Kbb recovery throughout the site and is compatible with overall needs of the habitat. Kbb recolonization may also be promoted if large unburned lupine/barrens openings are left along the perimeter or corners of burn units.
- H. Timing of Burns: Fire is known to have different effects depending on when it occurs. To avoid selectively favoring some community components over others by repeated application of fire during the same time of year, vary the timing of prescribed burns to the extent weather permits.

II. Definitions/Background

Early to mid-Summer – pertains to growing-season burning and the timeframe beginning after June 21st through August 15th.

Contiguous – "Contiguous" Kbb breeding habitat is the total extent of an area supporting wild lupine and nectar plants (even if patchy and scattered) that is occupied by the Kbb and uninterrupted by obvious barriers to adult butterfly dispersal (usually dense forest). Presume adults to be quite capable of dispersing at least 300 meters over open areas of suitable habitat, and so include such areas as "contiguous" (refer also to *dispersal distance* below)

Dispersal Corridor – A pathway in the landscape (e.g., roads and trails) that Kbb can follow during their dispersal from one area of suitable habitat to another. A dispersal corridor may include unoccupied suitable habitat. Dispersal corridors might be useful for connecting habitat sites that are separated by unsuitable habitat. Characteristics that might improve suitability as a dispersal corridor include: a linear aspect, dominated by grasses, substantial number of flowering nectar plants, essentially canopy-free at least down the middle, having a dense wall of trees or shrubs along the sides, and being sunny for a significant part of the day. Presence of lupine in corridors is not essential, but is highly recommended (KBB Recovery Plan, Appendix A).

Dispersal Distance – The distance a Kbb can traverse when moving from one area of suitable habitat to another. Generally, adults are quite capable of dispersing at least 300 meters over open areas. However, Kbb dispersal distances vary depending on the nature of the landscape. In general, the more open the landscape, the greater the dispersal distance. For a more detailed discussion on dispersal distance refer to the Kbb Recovery Plan, Appendix G (http://ecos.fws.gov/docs/recovery_plans/2003/030919.pdf).

Fire Return Interval (FRI) – The timeframe in which prescribed fire is returned to a landscape/unit that has been burned in the past.

Fixed Return Interval – As it relates to prescribed fire, A FRI (above) that occurs at a predetermined period of years. For example, a land manager may choose to burn a site once every three years regardless of whether the site requires a burn at this frequency. NOT RECOMMENDED!

Incidental Take – Take of a federally-listed species which occurs incidental to and is not the purpose of, the carrying out of an otherwise lawful activity.

Incidental Take Permit (ITP) – A permit issued by the USFWS, under Section 10 (a) (1) (B) of the ESA as amended in 1973, which allows the incidental take of an endangered species.

Unit – A defined management area (e.g., burn unit) incorporating a portion of or an entire occupied Kbb site.

Metapopulation – a population of populations; each individual population within a metapopulation is referred to as a local population or sub population.

Metapopulation Management – The management of large-scale properties or barrens landscapes that supports Kbb subpopulations. Metapopulation management requires that a conscious effort be made to coordinate management efforts on the landscape to ensure the perpetuation of the metapopulation and that those Kbb subpopulations are within dispersal distance of other Kbb subpopulations.

Take – As described by the Endangered Species Act, take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such activity.

Recolonization – The emigration of Kbb's from refugia to suitable habitat where populations have been reduced due to management activities or that are unoccupied.

Refugia – For larger landscape scale metapopulation management areas (composed of multiple management units), refugia are Kbb occupied unburned lupine area(s) that are adjacent to or within dispersal distance of the burned areas (*see dispersal distance definition*). Refugia must remain unburned for at least two growing seasons following a management activity to help facilitate Kbb repopulation of the burn unit.

Site – A spatially explicit, relatively homogeneous portion of land characterized by specific physical and chemical properties that affect ecosystem functions, and where a more or less homogeneous vegetative type may be expected to develop or persist.

Subpopulation (local population) – A self-reproducing population of Kbb's that is associated with a site / area (KBB Recovery Plan).

II. Reference Documents

Wisconsin Statewide Karner Blue Butterfly, Habitat Conservation Plan and Environmental Impact Statement. 2000. Wisconsin Department of Natural Resources, Madison, Wisconsin. 377pp.

Wildlife Management Guidelines for the Karner Blue Butterfly (DNR) May, 1998

The Strategic Management Plan for Linear Corridors in Areas Inhabited by the Karner Blue Butterfly (Weaver Boos Consultants, Inc.)

Forest Management Guidelines (Cynthia Lane) February, 1997

U.S. Fish and Wildlife Service. 2003. Final Recovery Plan for the Karner Blue Butterfly (*Lycaeides melissa samuelis*). U. S. Fish and Wildlife Service, Fort Snelling, Minnesota. 273 pp.

**Karner Blue Butterfly HCP
Management Protocol**

	Title: Pesticide Use Protocol	
	Date: September 6, 2007	Revision: 01

I. Purpose and Applicability

This protocol is intended to avoid and minimize take of the Karner blue butterfly (Kbb) that is incidental to pesticide use activities. This protocol applies to sites within the Kbb High Potential Range known to be occupied by Kbb, and to lupine sites where Kbb presence or absence is not known.

II. Conservation Measures

- a. Avoid take (no permit required)
 - i. Do not apply pesticides on lupine patches that are known to be occupied by Kbb, or in lupine areas where the presence of Kbb is unknown.
 - ii. When applying pesticides on extensive sites with scattered Kbb populations, avoid those lupine sites that are occupied.

- b. Pesticide Use

REQUIRED ACTIONS:

Site management and herbicide application should be practiced in accordance with HCP strategies or with Partner species and habitat conservation agreements (SHCAs). Users should follow ***all pesticide label directions*** (even if differ from the requirements below) and warnings and Wisconsin Pesticide Law (ATCP 29 and others), with special care to avoid off-target applications and drift, runoff, leaching, and dripping. Apply under wind directions as detailed below. **See also the product recommendations on the attached table A.**

PRE-MANAGEMENT CONSIDERATIONS:

Conduct lupine and Kbb pre-management surveys as prescribed in the HCP or Partner SHCAs. Mark or document observed populations and patches of lupine and Kbb's.

MONITORING/REPORTING REQUIREMENTS:

Document lupine/Kbb survey results; pesticide use, dosage and timing, application methods, and buffer widths (if applicable); and weather at the time of application (temperature, wind speed, and wind direction) for reporting purposes and for future use in adaptive management.

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<p>Inside Kbb habitat, active season: (April 15 – August 31**)</p> <p>1. Make spot applications only (on basal bark, cut stems, and foliage) with hand-operated equipment only, using only pesticide-certified, or pesticide-experienced personnel, or personnel under the direction of a pesticide-certified supervisor. The operator shall be trained to identify Kbb's and lupine and must avoid trampling lupine plants. Heavy equipment shall not be used inside the habitat.</p>	<p>Inside Kbb habitat, non-active season: (September 1** - April 14)</p> <p><i>PREFERRED TREATMENT TIMING</i></p> <p>1. Make aerial applications as needed. 2. Make spot and ground applications using only pesticide certified, or pesticide experienced personnel, or personnel under the direction of a pesticide certified supervisor.</p>
<p>Near Kbb habitat, active season: (April 15 – August 31**)</p> <p>1. Make aerial applications <u>only</u> when the <u>wind is not blowing towards</u> the habitat, <u>and</u> allow the following non-chemical buffers*: 66 feet (20 meters) between the occupied site and the treatment site. The non-chemical buffer* width may be reduced where an adequate barrier to Kbb dispersal exists such as a forested area, or a tree/hedgerow at least 33 feet high x 33 feet wide (10 meters x 10 meters) between the occupied habitat and the treatment area.</p> <p>2. Make wick and other ground equipment applications <u>only when the wind is not blowing towards</u> the habitat <u>and</u> allow a 6 foot (2 meter) non-chemical buffer between the habitat and the treatment area.</p> <p>3. <u>Avoid</u> broadcast applications <u>within the distance likely to carry the chemical to</u> the closest edge of <u>the occupied habitat when the wind is blowing towards</u> the occupied habitat. Use a lateral drift table, found in training manuals for commercial pesticide applicators, to calculate this distance. For example, applying 100 micron droplets from 100 feet during a 10 mph wind requires a non-chemical buffer* of 1460 feet (445 meters) next to the occupied habitat. At a wind speed of 3 mph, the same situation would require a non-chemical buffer of 440 feet(134 meters). The use of drift-control products and methods may allow calculation of a smaller buffer*. All calculations must be done by a certified applicator and the rationale for any substantial adjustments documented.</p> <p>4. Make spot applications with hand-held equipment as needed. Check label for possible wind restrictions.</p>	<p>Near Kbb habitat, non-active season: (September 1** - April 14)</p> <p><i>PREFERRED TREATMENT TIMING</i></p> <p>1. Make aerial, ground and spot applications during this time if possible. Minimize impact to nearby nectar plants where possible.</p> <p>* Non-chemical buffers: Use larger buffers than given above if required on the product label.</p> <p>** Timing: Applications may be made anytime after August 15 if mature lupines have senesced and the Kbb second flight period has passed. For flight information call Karner Blue Hotline 1-877-4KARNER (52-7637).</p>

RECOMMENDED ACTIONS:

Implementation of these guidelines will further protect the Kbb from potential pesticide injury.

- Choose the management methods and the herbicides that allow for a maximum stand of lupine and Kbb nectaring plants over time while controlling the undesired species.
- Use Integrated Vegetation Management and non-pesticide alternatives (e.g. mowing, controlled grazing, etc) where feasible.

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- Develop initial test plots for the use of planned herbicides away from Kbb occupied sites.
- Initiate seed collecting for replacement.
- Reseed lupine, nectar plants, and other native species if these species are accidentally destroyed during site management.
- Replace ecologically invasive non-native vegetation with appropriate native vegetation such as lupine and nectar plants after treating a site.
- Consider monitoring the groundwater if using soil mobile products on a large scale.
- In key areas, or when the effect of herbicide use is uncertain, minimize lupine mortality by leaving some areas untreated.
- Near Kbb occupied habitat throughout the year, leave a 660 foot (200 meter) buffer between the habitat and the treatment area in addition to the requirement that application be made only when the wind is blowing from the habitat towards the treatment area. The 200 meter buffer will protect nectar plants growing within habitat areas used by Kbb's. The majority of butterflies range up to 200 meters from their home lupine patch.

Herbicides used (or likely to be used) in Karner blue butterfly-occupied habitat: see Attachment A.

Use of Fungicides, Insecticides, etc. Pesticide application plans for fungicides and insecticides must be submitted to the Wisconsin Department of Agriculture, Trade and Consumer Protection, the Wisconsin Department of Natural Resources, and the U.S. Fish and Wildlife Service for review and approval. Use of *Bacillus thuringiensis var.kurstaki* (B.t.k.) shall be as outlined in Chapter II. H, Volume 1 of the HCP, p.178.

* Use larger buffers if the product label requires ** Applications may be made anytime after August 15 if mature lupines have senesced **and** the second Kbb flight period has passed .

Note: In all situations (i.e. IN or NEAR Kbb habitat and all other situations in Wisconsin), and according to Wisconsin Pesticide Law (ATCP 29), pesticide certification is required if you make pesticide applications “for hire” or if you use an “RUP” (restricted use) pesticide (pesticide label statement – refer to label). If you have questions regarding pesticide use, call DATCP at 608-224-4548.

Attachment A: Herbicides used (or likely to be used) in or near Karner blue butterfly-occupied habitat

Kbb-HCP Pesticide Guidance Ad Hoc Committee: Dick Berry, Gary Birch, Dave Hall, Kit Hart, Ursula Petersen - coordinator, Shawn Puzen, Tim Wilder. Reviews by HCP Partners, UW-Agron. and USFWS.

Karner Blue Butterfly HCP Management Protocol

Note 1: These herbicides must be used according to their label and as noted in the “Requirements” section in this Pesticide Use Guidance.

Note 2: Herbicides, by product name or active ingredient, not found in this table, must be approved by DATCP, DNR, and FWS prior to use.

Product (active ingredient)	Concerns	Benefits and recommendations
Accord (glyphosate)	NON-SELECTIVE	Use after mature lupine senescence.
Accord/Garlon	NONSELECTIVE	Does not appear to impact lupine and Kbb after senescence. May remove heavy sedge and woody vegetation (Sucoff). May affect Kbb eggs. Use after senescence and seed maturity.
Arsenal (imazapyr)	Moderate to HIGH SOIL MOBILITY and HALF-LIFE; NONSELECTIVE	Controls clover. Avoid use.
Escort (metsulfuron methyl)	MODERATE MOBILITY; NON-SELECTIVE;	Use timing as a conservation tool.
Garlon 3a (triclopyr amine)	HIGH SOIL MOBILITY	Spares clovers and alfalfa, not vetch. Takes Canada thistle, not other noxious weeds. Use minimum amount; may be better for lupine habitat than Garlon 4 but consider the soil mobility aspect on non-target vegetation
Garlon 4 (triclopyr ester)	TOXIC TO AQUATICS	Spares weedy grasses, nutsedge. Takes Canada thistle and clovers, not alfalfa or vetch. Use for spot application.
Karmex (diuron)	MOD. MOBILITY; LONG HALF LIFE; NONSELECTIVE	Avoid drift and runoff to adjacent land. Use minimum necessary.
Oust (sulfometuron methyl)	Low to MODERATE SOIL MOBILITY	Kills sedges, grasses. Spares legumes, probably including lupines, also composites, others. Probably ok for broadcasting in lupine sites. Reseed associates if necessary.
Plateau (imazapic)	LONG-LIVED; HIGH SOIL MOBILITY IN SAND; COOL SEASON GRASS INJURY	Spares some warm season grasses, legumes, selected composites. Controls leafy spurge, Canada thistle. Use minimally, only spot application if possible.
Rodeo (glyphosate)	NON-SELECTIVE	Labeled for aquatic sites.
Roundup (glyphosate)	NON-SELECTIVE	See Accord.
Solution (2,4-D)	BROADLEAF WEEDS	Low drift formulation. Spares grasses. Contain within rail bed and 8' to each side of track center.
Tordon (picloram)	HIGHLY MOBILE IN SANDY SOILS; LONG-LIVED	Controls noxious species. Spares grasses. Use only for leafy spurge, minimally, only by spot application. Monitor adjacent vegetation.
Transline (clopyralid)	HIGH SOIL MOBILITY; LONG-LIVED; KILLS LEGUMES, COMPOSITES; TOXIC TO BEES	Spares cool-season grasses. Use alternatives if possible. Monitor sites for lupine and Kbb. Use sparingly and only for Canada Thistle, Spotted Knapweed.
Vantage (sethoxydim)	VERY SOLUBLE	Relatively short-lived. Spares legumes and composites.
Velpar (hexazinone)	Moderate to LONG HALF-LIFE, HIGHLY SOLUBLE, KILLS LARCH, SOME GRASSES	Spares some legumes. Pine release treatments. Avoid broadcast applications in known habitat.

III. Referenced Documents

ATCP 29. Pesticide Use and Control. Agriculture, Trade and Consumer Protection. Register, May 1998, No. 509; www.legis.state.wi.us/rsb/code/atcp/atcp.html.

DATCP's Endangered Species Habitat Program
<http://www.datcp.state.wi.us/arm/environment/plants/endangered-species/guidelines.jsp>

EXTOXNET (Extension Toxicology Network). Cooperative Extension, Cornell University, Michigan State University, Oregon State University, and University of California - Davis. 1994; <http://extoxnet.orst.edu/pips/ghindex.html> .

Farm Chemicals Handbook 2006. Meister Publishing Company, Willoughby, Ohio.

Hall, David and Tom Shockley. Herbicides for Forest Management 1999 (updated annually). Cooperative Extension UWEX No. 76.

Herbicide Handbook 1994, 1997. Weed Science Society of America, Champaign Illinois.

Lane, Cynthia. Forest Management Guidelines. Feb. 1997. Prepared for WDNR and USFWS.

Montgomery, J.H. 1993. Agrochemicals Desk Reference. Lewis Publishers.

Nekoosa Papers Inc. Integrating Conservation of the KBB into Industrial Forest Management.

Petersen, Ursula C. Herbicide Use and Alternate Management of Rights-of-Way in Wisconsin, 1999. WI DATCP.

Product Label Information.

Sucoff, Ed. Effect of Exposing Eggs to Herbicides on the Development of Karner Blue Butterfly. March 1, 1998. UMN, Dept. of Forestry.

Sucoff, Ed. Effect of Three Herbicides on The Vegetative Growth and Flowering of Wild Lupine. Final Report 2nd Year Observations. Dec. 31, 1997. U.MN., Forestry Dept.

Weaver-Boos Consultants, Inc. The Strategic Management Plan for Linear Corridors in Areas Inhabited by the Karner Blue Butterfly (*Lycaeides melissa samuelis* Nabokov). Prepared for the Linear Corridor Partners Wisconsin HCP Team.

Wisconsin DNR and Kbb-HCP Partner Species and Habitat Conservation Agreements. 1999. The Partners are: Alliant Energy, American Transmission Company, ANR Pipeline Co., Burnett County Forest, Clark County, Consolidated Papers Inc., Eau Claire County, Jackson County, Johnson Timber Company (includes Bayside Timber Company, Futurewood Corp. and Magnum Timber Corp.), Juneau County Land, Forestry and Parks, Lakehead Pipeline Company-Limited Partnership, Monroe County, Northern States Power

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Company, The Nature Conservancy, Northwestern Wisconsin Electric Company, Polk-Burnett Electric Cooperative, Thilmany Division - International Paper Company, The Timber Company/Georgia Pacific/Nekoosa Papers, Washburn County, Wausau-Mosinee Paper Corporation, Wisconsin Department of Agriculture, Trade and Consumer Protection, Wisconsin Department of Transportation, Wisconsin Gas Company, Wisconsin Public Service Corporation, Wisconsin River Power Company, and Wood County.

	Title: Timber Harvesting Protocol	
	Date: September 6, 2007	Revision: 01

I. Purpose and Applicability

This protocol is intended to avoid and minimize take of the Karner blue butterfly (Kbb) that is incidental to timber harvesting activities. This protocol applies to sites known to be occupied by Kbb, and to lupine sites within the Kbb High Potential Range where Kbb presence is not known.

II. Conservation Measures

- a.** To avoid take do not operate in lupine areas that are known to be occupied by Kbb or in lupine areas where Kbb presence is not known, to the greatest extent practicable.
- b.** To minimize take follow these measures to the greatest extent practicable.
 - i.** Conduct pre-management surveys on pre-planned timber harvest sites. (Required)
 - ii.** Do not concentrate slash piles on Kbb-occupied lupine sites. Slash should be dispersed, not piled.
 - iii.** Leave scattered occupied sites undisturbed as refugia for existing Kbb populations whenever practicable.
 - iv.** Leave scattered pockets of trees to provide shaded resting areas for Kbb on occupied sites.
 - v.** Timber harvesting activities on private residential and non-regulated properties are exempt from this protocol.
 - vi.** Post management surveys are needed only if the partner has agreed to participate in cause-effect surveys, or if it is required as part of the partner's SHCA. Refer to the Monitoring Protocol for specific information.

III. Special Activities

1. For construction and abandonment of access roads, trails, and landings associated with timber harvesting refer to the Construction Guideline.
2. For emergency salvage cutting or sanitation cutting operations resulting from forest fires, windstorms, or other natural disasters, refer to the Emergency Guideline.

IV. Background

“Tree harvesting operations that remove canopy and disturb soil can have beneficial effects on lupine and Karner blue. ...In general, many of the methods for removing and suppressing tree and shrub canopy can have a net positive effect on lupine and the Karner blue and should be timed and carried out in ways that minimize harm to the butterfly and its food resources (lupine and nectar plants).” (Karner Blue Butterfly Recovery Plan, September 2003).

“Based on the timber type and management goal or objective, a forest land manager may apply a variety of harvesting methods. The variables of the land, vegetation type, goals of land/forest management, and opportunities to 1) minimize adverse effects on the occupied habitat and species, and 2) promote habitat continuation or enhancement vary greatly with each stand. ...In addition, forest partners intend to apply harvesting strategies to land currently not occupied but having the potential for occupation because of the proximity to occupied habitat which serves to replace habitat lost through active management or natural loss, even though they have no legal obligation to mitigate or replace habitat lost naturally (e.g. succession of competing vegetation).” (Karner Blue Butterfly Habitat Conservation Plan, Appendix F. March 2000).

V. Reference Documents

Karner Blue Butterfly Habitat Conservation Plan, Appendix F. *March 2000.*

Karner Blue Butterfly Recovery Plan, (*September 2003*).

Karner Blue Butterfly Conservation Protocols For Forest Management By HCP Partners, Appendix F. *Zastrow et al. April 27, 1998.*

Wisconsin DNR Silviculture Handbook 2431.5

	Title: Mechanical Site Preparation Protocol	
	Date: September 6, 2007	Revision: 01

I. Purpose and Applicability

This protocol is intended to avoid or minimize take of the Karner blue butterfly (Kbb) incidental to mechanical site preparation activities. This protocol applies to sites that are occupied by Kbb, and to lupine sites within the Kbb High Potential Range where Kbb presence is not known.

II. Conservation Measures

- a. To Avoid Take
 - i. Avoid conducting activities on lupine sites within the High Potential Range that are occupied by Kbb.
 - ii. Avoid lupine sites where the presence of Kbb is unknown.

- b. To Minimize Take
 - i. Conduct Pre-management surveys.
 - ii. Implement Site preparation activities so that equipment disturbs Kbb-occupied habitat to the minimum extent practicable.
 - iii. If Kbb is present, establish scattered refugia to maintain the population. Include enough nectar plant areas to sustain the population until disturbed portions of the site can provide viable habitat.
 - iv. Post-management surveys are needed only if the partner has agreed to participate in cause-effect surveys, or if it is required as part of the partner's SHCA. Refer to the Monitoring Protocol for specific information.

III. Specific Activities

- a. When using chemicals for site preparation, refer to the Pesticide Use Protocol.

- b. When combining chemical and mechanical site preparation practices, refer both to this protocol and to the Pesticide Use Protocol. Adjust the timing of the practice accordingly.

- c. When using prescribed fire for site preparation, refer to the Prescribed Burning Protocol.

- d. If not satisfied with habitat conditions after treatment, refer to the Restoration Protocol.

IV. Description and Levels of Disturbance

Mechanical site preparation prepares a designated area of land for artificial or natural regeneration by using hand tools or power tools and implements to alter vegetative competition, expose mineral soil, and reduce logging residue and other woody debris. The extent of disturbance on the site has more effect on Kbb habitat than the intensity of the disturbance (see definitions below). Low disturbance site preparation applications affect less than 30 percent of the site. Medium disturbance applications affect 30 to 70 percent of the site. High disturbance applications affect more than 70 percent of the site.

A. Low Disturbance Practices

Since a low percentage of the surface area is affected by these applications, the floristic composition of vegetation immediately following site preparation is expected to be very similar to that preceding the activity, although vegetative height and biomass may be reduced. Examples of equipment that produces low disturbance include the following:

- Scalping with hand tools (shovel or mattock)
- Roller chopper – single drum
- Brush disk – single disk, one pass
- Patch scarifier

B. Medium Disturbance Practices

With medium levels of disturbance the effects on vegetation for the site will be more pronounced. Up to 70 percent of the site may require vegetative recolonization, which may differ from the original vegetative composition. Less than 30 percent of the site is expected to maintain the original vegetative composition. Equipment used in medium disturbance practices includes the following:

- Disk trencher
- Root rake – stumps and slash only
- Furrowing Plow – with undisturbed space between furrows
- Disk – tandem disk, one pass
- Roller chopper – tandem drum, one pass

C. High Disturbance Practices

These practices involve extensive removal of surface vegetation over most (>70%) of the site, drastically changing the structure and composition of the vegetation. Early successional species are expected to revegetate the site, primarily from seed origin. Late successional species may be able to recolonize the site through sprouting if viable roots are still present in the soil. Equipment used in high disturbance practices includes the following:

Furrowing Plow – berms of adjacent furrows touch or overlap

Root rake – removal of stumps and roots over the entire site

Roller chopper – tandem drum, multiple passes

Disk – tandem disk – multiple passes

Bulldozer – removal of stumps and brush with a straight blade.

VI. Reference Documents

Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement, Appendix F. (*March, 2000*)

Karner Blue Butterfly Conservation Protocols For Forest Management By HCP Partners, Appendix F. *Zastrow et al. April 27, 1998.*

	Title: Timber Stand Improvement Protocol	
	Date: September 6, 2007	Revision: 01

I. Purpose and Applicability

This protocol is intended for use by HCP partners with forest management responsibilities. The purpose is to avoid and minimize take of the Karner blue butterfly (Kbb) incidental to timber stand improvement (TSI) activities that occur after the stand has achieved crown closure but prior to the final harvest. This protocol applies to sites within the Kbb High Potential Range where Kbb presence is known, and to lupine sites within the Kbb High Potential Range where Kbb presence or absence is not known.

II. Conservation Measures

a. Initial Assessment

- i.** For initial stand assessment and for setting up the treatment area, avoid driving or walking across lupine patches to the greatest extent practicable. Pre-management surveys are not required for initial assessment of the stand.
- ii.** Identify openings within the stand and on the perimeter of the stand that might support lupine, nectar plants, and Kbb.
- iii.** Conduct pre-management surveys on openings identified in initial assessment to determine if lupine and Kbb populations exist. Refer to the Monitoring Protocol for specific information.
- iv.** If Kbb-occupied lupine patches are found, follow the appropriate course of action (Avoid Take or Minimize Take) below.
- v.** If Kbb is not present on the site there are no restrictions or requirements.

- b.** To avoid take do not conduct TSI activities on sites within the forest stand where Kbb presence is known, or on lupine sites where Kbb presence or absence is not known.

- c. To minimize take follow the steps listed below.
 - i. Set up the treatment area up to minimize the amount of occupied habitat that is impacted to the greatest extent practicable.
 - ii. If access roads, trails, or landing areas are to be used without any improvement or maintenance disturbance, avoid lupine to the greatest extent practicable. Otherwise, see Special Activities, below.
 - iii. TSI treatments on private residential and non-regulated properties are exempt from this protocol.
 - iv. Post management surveys are needed only if the partner has agreed to participate in cause-effect surveys, or if it is required as part of the partner's SHCA. Refer to the Monitoring Protocol for specific information.

III. Special Activities

- 1) For construction and improvement of roads, trails, and landings, refer to the Construction Guideline.
- 2) For mowing or clearing brush from roads, trails, and landings, refer to the Mowing and Brushing Protocol.
- 3) For intermediate stand treatments that are commercial thinning operations, refer to the Timber Harvesting Protocol.
- 4) For the use of pesticides to control vegetation or insects during the intermediate stand stage, refer to the Pesticide Use Protocol.
- 5) For soil and vegetation disturbance activities prior to the final harvest to promote advance regeneration on the forest floor, refer to the Site Preparation Protocol

IV. Background

The Karner Blue Butterfly Habitat Conservation Plan recognizes that forest stands from establishment to approximately 15 year of age are potential habitat for Kbb, given suitable soil and other habitat conditions. After 15 years most fully-stocked forest stands have developed sufficient crown closure to significantly reduce the frequency of shade-intolerant vegetation, including lupine and nectar plants needed to sustain Kbb populations. From the point of crown closure in a sapling stand until the final harvest of the stand, the persistence of suitable habitat for Kbb is unlikely.

During the period of tree growth and development, the late sapling stage until maturity, intermediate treatments are often used to enhance stand composition, structure, growth, health, quality, and the production of specific benefits desired by the landowner or property manager. These tend to be non-commercial treatments, and are commonly known as timber stand improvement, or TSI. TSI practices include, thinning and improvement cuts, salvage cuts, sanitation cuts, tree release treatments, and pruning.

With full crown closure the presence of lupine and nectar plants sufficient to support Kbb is unlikely. However, natural openings are common within intermediate-aged stands, as well as on the perimeters of those stands. It is possible that lupine, nectar plants, and Kbb, could persist in those openings, and on the perimeter of those stands. Therefore, an initial stand assessment is necessary to identify potential lupine and Kbb sites both within the stand and around the stand.

VI. Reference Documents

Karner Blue Butterfly Habitat Conservation Plan, Appendix F. *March 2000.*

Karner Blue Butterfly Conservation Protocols for Forest Management by HCP Partners, Appendix F. *Zastrow et al. April 27, 1998.*

Wisconsin DNR Silviculture Handbook 2431.5

	Title: Cable Plowing Protocol	
	Date: June 27, 2006	Revision: 02

I. Purpose and Applicability

This protocol is intended to avoid and minimize take of the Karner blue butterfly (Kbb) that is incidental to cable plowing activities. This protocol applies to sites known to be occupied by Kbb, and to lupine sites within the KBB High Potential Range where Kbb presence or absence is not known.

Note: Cable plowing activities on private residential and business property is exempt from this protocol. (See additional discussion in part III below.)

II. Conservation Measures

a. Avoid Take

- i.* Lupine areas that are known to be occupied by Kbb, or in areas where the presence of the Kbb is likely to occur (e.g., in lupine patches near occupied habitat) will be avoided to the greatest extent practicable (In the event that complete avoidance is not possible or practicable, refer to b.ii below).

b. Minimize Take

- i.* Pre-management surveys for lupine and Kbb presence or absence will be done on pre-planned cable plowing sites whenever practicable.
- ii.* Cable plowing will be done so that the minimum amount of occupied habitat is impacted by the tractor or plow. Measures that can be taken to minimize and avoid harm include clearly marking the boundaries of lupine areas with flagging or other means, avoiding the more dense lupine areas with the cable plow, and operating and parking transport vehicles and equipment in areas that do not support lupine.
- iii.* If pre-management surveys were not able to be conducted, post-management surveys for lupine and Kbb presence/absence will be conducted no later than the following flight season.

c. Emergency

- i.* In emergency situations lupine areas will be avoided to the greatest extent practicable.
- ii.* Post-management surveys for lupine and Kbb presence/absence will be conducted no later than the following flight season.

III. Definitions/Background

a. Cable Plowing

Cable plows are commonly used by electrical utilities for installing underground electrical distribution cables along rights-of-way and to homes and businesses between transformers and electrical meters.

b. Note on Applicability:

- i. If initiated by the HCP partner: When a HCP partner is installing cable on a project they initiate, e.g., cable replacement projects, or new installations, the partner will implement the conservation measures noted above.*
- ii. If requested by a private landowner in the HCP's voluntary category: Residential and business underground cable installations occur almost exclusively on privately owned land and are installed under a contractual arrangement with the utility. When a HCP partner is installing underground cable under contract with (and at the request of) a private landowner who meets the criteria to be included in the "voluntary participation category" and is therefore exempt from these requirements, then the partner is not required to apply these guidelines. It is still recommended that avoidance or measures to minimize impacts are taken when lupine habitat is known or site is suspected to be occupied by KBB. The HCP partner can consider this as an opportunity to extend outreach and educate the landowner. (Refer to HCP Chapter 2.F. to determine if a private landowner is in the "voluntary category". If at all unsure, contact the HCP Coordinator).*
- iii. If requested by a private landowner in the HCP's regulated category: For all other non-voluntary (regulated) landowners, i.e. residential and commercial developers requesting installation, the landowner or developer is responsible to consult with the U.S. Fish and Wildlife Service if any of their project development activities (e.g., roads, buildings, electrical service, etc.) could result in the take of the Kbb. To the extent practicable, the HCP partner will advise the contracting private landowner (developer) as early as possible in the planning phase whether their project site supports (if known), or has a likelihood to support Kbb. The HCP partner may further advise the developer that if project activities could result in take of the butterflies that the U.S. Fish and Wildlife Service should be consulted. Projects that may result in take of the Kbb shall not*

proceed in occupied Kbb habitat without a permit that covers that take.

c. Recommendations & Suggestions When Approaching Developers and Other Regulated Entities:

When advising developers of their potential to take Kbbs, use whatever tools and data that are available and reasonably reflect the potential for Kbb presence and that will appropriately caution the developer of their risk of unauthorized take. Possible tools could be: (a) surveys at nearby sites, (b) observed presence of wild lupine on or near the cable insertion site, (c) the KBB Probability Model, (d) your suspicions based on Kbb ecology, i.e. dispersal distance from other known sites (Kbbs are known to disperse about 2 miles over open landscapes), etc.

Be mindful that as an HCP partner you do not speak on behalf of the FWS or with any regulatory authority, in fact or implied. Advise your client/customer (e.g. the developer) in the spirit of sound and responsible business practices and customer concern, while demonstrating your own company's concern for the welfare of the Karner blue butterfly and for "doing the right thing". If appropriate, suggest that the developer contact the USFWS-Green Bay Field Office for permitting options and information or the DNR's HCP Coordinator for additional HCP information.

IV. Referenced Documents

(reserved)

	Title: Snowplowing Protocol	
	Date: August 29, 2006	Revision: 01

I. Purpose and Applicability

This protocol is intended to avoid and minimize take of the Karner blue butterfly (Kbb) that is incidental to snow plowing activities, specifically “winging operations” along road rights-of-way. Winging operations (the manipulation of snow beyond highway shoulders) should define the shoulder pivot point.

Important: This protocol applies to sites within the KBB High Potential Range known to be occupied by Kbb, and to lupine sites where Kbb presence or absence is unknown.

II. Conservation Measures

- 1) To avoid take
 - i. Do not wing plow beyond the traveled way.
 - ii. When wing plowing beyond the traveled way, do so at a sufficient height to avoid displacing shoulder gravel onto the sodded (vegetated/duff) area on the right-of way and to avoid damage to the sod (vegetation/duff) under the snow.

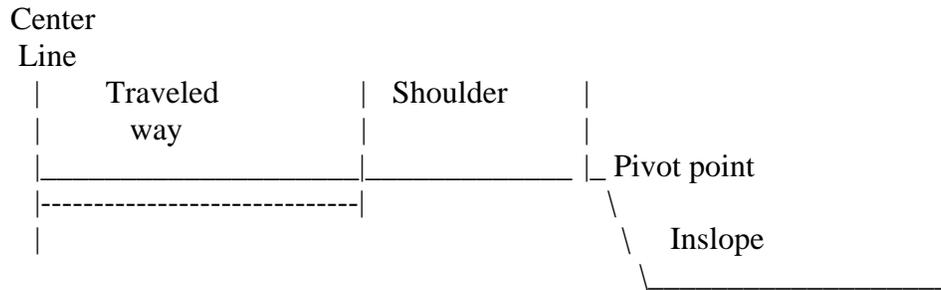
- 2) To minimize take and of Karner blue butterfly and habitat
 - i. When wing plowing beyond the traveled way, take care to not displace shoulder gravel onto the sodded (vegetated) area or cause damage to the sod (vegetation) under the snow. It is understood that all ROW surfaces are not completely level and smooth. If it is not practicable to raise the wing plow high enough to assure complete avoidance of all contact with the gravel and sod, and some impacts result, minimize disturbance to the greatest extent practicable.

III. Definitions/Background

Snowplowing/snow removal: For the purpose of this protocol snowplowing and snow removal includes the use of plows, blades and wing plows mounted on front end loaders, graders and other mechanized equipment to wing, bench and otherwise remove snow from the traveled way and road shoulder.

Definition and diagram of terms used:

Traveled Way	lane, driving surface
Shoulder	paved or unpaved portion of the roadtop – able to accommodate vehicles between traveled way and inslope
Pivot Point	transition area between shoulder and inslope
Inslope	non-drivable bank between shoulder and ditch bottom
ROW	The land over which a public road legally passes, normally described in terms of distance from the centerline of the road.



IV. Referenced Documents

- 1) State Highway Maintenance Manual, Exhibit 32.10 Storm Cleanup Winging and Benching, Effective January 1, 2001.

**Karner Blue Butterfly HCP
Management Protocol**

	Title: Egg Salvage Protocol	
	Date: Reserved	Revision: 00

Under Development

**Karner Blue Butterfly HCP
Management Protocol**

	Title: Mitigation Guideline	
	Date: Reserved	Revision: 00

Under Development

IV. Protocols, Management



**A GUIDE TO CONDUCTING MONITORING
FOR THE WISCONSIN KARNER BLUE BUTTERFLY
HABITAT CONSERVATION PLAN**

Revision Date: May 18, 2009



Updated May 18, 2009 by D. Lentz
Updated May 22, 2008 by D. Lentz
Updated and reformatted May 23, 2007 by D. Lentz
Updated May 23, 2006 by D. Lentz
Updated May 10, 2005 by D. Lentz and R. Hess
Updated May 11, 2004 by D. Lentz
Updated May 15, 2003 by Y. Hernandez
Updated May 20, 2002 by S. Carter
Wisconsin Karner Blue Butterfly Habitat Conservation Plan
Previously updated January 18, 1999 by the Effectiveness Monitoring Subteam

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C. LEVEL 2 PROTOCOL: KBB PRESENCE OR ABSENCE MONITORING

D. CAUSE AND EFFECT (C-E) LEVEL 1 MONITORING PROTOCOL

I. INTRODUCTION

In 2005-06 a KBB probability model was developed that predicts the likely locations of the Karner blue butterfly in Wisconsin. This model formed the basis for an adaptive management effort to reassess the overall monitoring strategy during the winter of 2004 and spring of 2005. In 2006 the focus of monitoring was provisionally changed while the monitoring strategy, especially the sampling strategy was being refined and a final, streamlined set of guidelines and protocols were being developed and ultimately put in place in 2008. Earlier versions of the HCP monitoring guidance was wholly contained under this title as a single, continuous document. The monitoring guidance has been reorganized into individual guidelines and protocols effective beginning in 2007. The survey methods for Levels 1 and 2 have not significantly changed; only their formatting. Relative abundance surveys are no longer required, so the Level 3 protocol has been removed.

II. INFORMATION SOURCES

Contacts

David R. Lentz
Karner Blue HCP Coordinator
Wisconsin DNR, FR/4
101 S. Webster St., Box 7921
Madison, WI 53707-7921
Phone: (608) 261-6451
Email: David.Lentz@Wisconsin.gov

HCP project management
Coordinates monitoring training
To submit annual reports and monitoring surveys
To Report Kbb element occurrences
almost anything to do with HCP

Cathy Carnes
U.S. Fish and Wildlife Service
Green Bay Field Office
2661 Scott Tower Dr.
New Franken, WI 54229
Phone: (920) 866-1732
Email: cathy_carnes@fws.gov

E.S.A. regulatory issues
incidental take
Karner blue butterfly information

Darcy Kind
WDNR
Conservation Biologist
(608) 267-9789
Darcy.Kind@Wisconsin.gov

private landowner issues (non-HCP partners)
Landowner Incentive Program (LIP)

Mike Engel
U.S. Fish & Wildlife Service – Private Lands
(608) 221-1206 x21
Mike_Engel@fws.gov

private landowner issues (non-HCP partners)
habitat restoration consulting and funding

WEBSITES

Karner Blue Butterfly HCP

<http://www.dnr.state.wi.us/org/land/forestry/karner/>

Conservation and Monitoring Protocols and Guidelines

<http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>

Good photos

http://dnr.wi.gov/org/land/er/invertebrates/butterflies_moths/barrens.asp

General Information

<http://www.wisconsinbutterflies.org/butterflies/species/154>

For Kids

<http://www.dnr.state.wi.us/org/caer/ce/ee/critter/insect/karner.htm>

**Karner Blue Butterfly HCP
C-E Monitoring Protocol -Level 1**

	Title: Cause & Effect (C-E) Monitoring Protocol (Level 1)	
	Date: December 12, 2009	Revision: 03

I. Scope and Applicability

The following protocol is a version of the standard Level 1 Lupine Presence or Absence Monitoring Protocol, which has been modified specifically to study the Cause and Effect relationships of HCP partner’s management activities on Karner blue butterfly habitat or areas of potential habitat on HCP Partners’ land included under the federal Incidental Take Permit TE 010064-5.

The basic protocol is taken from the original Wildlife Management Guidelines for the Karner Blue Butterfly, Appendix II, Wisconsin DNR Karner Blue Technical Team as revised with information from the Biological sub-team (A.K.A. BioTeam) of the Wisconsin Statewide Habitat Conservation Plan for the Karner Blue Butterfly, May, 1998 Revision. The original protocol was developed by the HCP Monitoring sub-team in 1993. In 2005 the monitoring form was modified to include parameters for assessing the results of habitat reclamation following activities that result in complete habitat removal and other habitat restoration. This protocol has been reformatted from “*A Guide to Conducting Monitoring for the Wisconsin Karner Blue Butterfly Habitat Conservation Plan*” (prior to 2007) and made consistent with HCP streamlining strategies developed in 2006-2007. The most up to date revision can always be found in the Habitat Conservation Plan User’s Guide on the DNR webpage (<http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>).

Purpose: To assess the vegetative response related to a variety of important habitat components of the Karner blue butterfly (*Lycaeides melissa samuelis*), including wild lupine (*Lupinus perennis*), which result from selected management activities and conservation measures in order to inform the adaptive management process. C-E studies can be selected to (1) validate the anticipated and desired affects of a management practice or conservation measure, (2) study a new or proposed management activity or conservation measure, and (3) study multiple conservation measures for an activity to compare the results and improve the efficiencies of the activity and/or effectiveness of the conservation measure.

Forms: A standardized *Level 1: Habitat Response to Management: Management Cause and Effect (C-E) Monitoring form* is used for recording all Level 1 C-E monitoring information. A blank form can be copied from the DNR’s Karner Blue webpage. Always use the current form as forms may change as a result of adaptive management.

II. Protocol

Where to Survey

A site is eligible for a C-E study if it meets the following criteria:

1. The site is within the High Potential Range (HPR) (see Karner Blue HPR map <http://dnr.wi.gov/forestry/karner/pdf/rangemap.pdf>).
2. The site meets the definition of potential habitat. Potential habitat includes sites on dry, sandy soils that could potentially support Karner blue butterfly habitat.
3. The site is on lands included by an HCP partner in their Species and Habitat Conservation Agreement or Implementing Agreement.
4. The site should support the objectives and design of the management activity or conservation measure(s) being studied.

When to Survey

- BEFORE (pre-management survey) and AFTER (post-management survey) the management activity and/or conservation measure being studied is applied
- Each pre-management and each post-management survey must be performed in both Kbb flight periods to reflect early and late flowering nectar plants and other conditions
- In places where lupine flowers early (sunny areas), survey from late May to mid-June (for first flight period visits)
- In places where lupine flowers rarely or not at all (usually more shaded areas), surveys can be conducted from late May through July.
- Open and sunny places should be surveyed earlier in the season because lupine flowers and senesces earlier there
- Areas with more shading and canopy cover can be surveyed later because lupine flowers and senesces later in these locations (except during hot and droughty summers).
- Lupine surveys should not be conducted after July 31st.

How to Survey

Surveys for lupine can be conducted in a number of ways. The following are suggested methods to use. The method you choose will normally depend upon the resources available (number of personnel), and the size and landscape characteristics of the area to

Karner Blue Butterfly HCP C-E Monitoring Protocol -Level 1

Estimate the collective availability of all nectar plants, which will be available in each Kbb flight period, e.g.:

General availability of nectar plants during **1st flight period** (*First flight periods are generally late May- June*):

- ① Abundant - (50% or more coverage of nectar area)
- ② Common - (25-50% coverage)
- ③ Scarce - (<25% coverage)

General availability of nectar plants during 2nd flight period (*Second flight periods are generally mid-July to mid-August*):

- ① Abundant - (50% or more coverage of nectar area)
- ② Common - (25-50% coverage)
- ③ Scarce - (<25% coverage)

III. Definitions

- **High Potential Range:** The high potential range is the region of the state containing all documented occurrences of the Karner blue butterfly, and extending 5 miles beyond documented Kbb occurrences to include areas with similar habitat, soils, and climate where the Karner blue butterfly is most likely to occur based on the Kbb probability model developed in 2006-2007. (See Karner Blue HPR map <http://dnr.wi.gov/forestry/karner/pdf/rangemap.pdf>).

IV. Referenced Documents

- Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement, Appendix F. (March 2000)
- Karner Blue Habitat Conservation Plan User's Guide (<http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>)
- Karner Blue High Potential Range Map in Wisconsin "Karner Blue Butterfly Habitat Conservation Plan Regulatory Range, September 15, 2007"

	Title: Lupine Presence or Absence Monitoring Protocol (Level 1)	
	Date: December 12, 2009	Revision: 03

I. Scope and Applicability

The following protocol is intended to determine the viable presence or absence of wild lupine (*Lupinus perennis*), the only known host plant of the Karner blue butterfly (*Lycaeides melissa samuelis*) larvae on HCP Partners' land included under the federal Incidental Take Permit TE 010064-5.

The following protocol is taken from the original Wildlife Management Guidelines for the Karner Blue Butterfly, Appendix II, Wisconsin DNR Karner Blue Technical Team as revised with information from the Biological sub-team (A.K.A. BioTeam) of the Wisconsin Statewide Habitat Conservation Plan for the Karner Blue Butterfly, May, 1998 Revision. The original protocol was developed by the HCP Monitoring sub-team in 1993. In 2005 the monitoring form was modified to include parameters for assessing the results of habitat reclamation following activities that result in complete habitat removal and other habitat restoration. This protocol has been reformatted from "A *Guide to Conducting Monitoring for the Wisconsin Karner Blue Butterfly Habitat Conservation Plan*" (prior to 2007) and made consistent with HCP streamlining strategies developed in 2006-2007. The most up to date revision can always be found in the Habitat Conservation Plan User's Guide on the DNR webpage (<http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>).

Purpose: To find and map wild lupine (*Lupinus perennis*) patches to expedite future Karner blue butterfly (*Lycaeides melissa samuelis*) surveys.

Forms: A standardized *Level 1: Lupine Presence/Absence survey form* is used for recording all Level 1 monitoring information. A blank form can be copied from the DNR's Karner Blue webpage. Always use the current form as forms may change as a result of adaptive management.

II. Protocol

Where to Survey

A site is eligible for sampling presence of habitat if it meets the following criteria:

1. The site is within the High Potential Range (HPR) of the Karner blue butterfly (see Karner Blue HPR map <http://dnr.wi.gov/forestry/karner/pdf/rangemap.pdf>).

Karner Blue Butterfly HCP Monitoring Protocol – Level 1

2. The site meets the definition of potential habitat. Potential habitat includes sites on dry, sandy soils with dominant overstory vegetation of an age and/or character that could support Karner blue butterfly habitat.
3. The site is on lands included by an HCP partner in their Species and Habitat Conservation Agreement or Implementing Agreement.

Additional information describing sites eligible for Level 1 monitoring:

- Sites include forest stands and upland openings or existing corridors.
- If forested, the site supports trees 0-15 years of age. Exception: If forested and less than 15 years of age, dense stems of a regenerating stand may cause crown closure at an early age precluding the site from consideration for sampling.
- If non-forested, the site may be an upland opening or existing corridor such as a fuel break or woods road.

Since partners with larger holdings will not likely be able to survey all of their lands because of logistical constraints, the following information describes areas that should be considered of low potential/priority for Level 1 surveys, but are still theoretically considered valid sites if they meet the three criteria listed above:

- Wetlands or other areas flooded for most of the growing season
- Forests with dense canopy (>75%), which could be determined by aerial photo interpretation of forest stands with a continuous canopy >75%, categorized as pole or saw timber sized stands having 3-prime density class (lupine may occur here, especially if the area is adjacent to a lupine patch, but it may not flower and therefore may be difficult to detect)
- Sites on non-sandy soils
- Cultivated or otherwise developed areas supporting no native vegetation

When to Survey

- In places where lupine flowers early (sunny areas), survey from late May to mid-June
- In places where lupine flowers rarely or not at all (usually more shaded areas), surveys can be conducted from late May through July
- Open and sunny places should be surveyed earlier in the season because lupine flowers and senesces earlier there

Karner Blue Butterfly HCP Monitoring Protocol – Level 1

- Areas with more shading and canopy cover can be surveyed later because lupine flowers and senesces later in these locations (except during hot and droughty summers)
- Lupine surveys should not be conducted after July 31st.

How to Survey

Surveys for lupine can be conducted in a number of ways. The following are suggested methods to use. The method you choose will normally depend upon the resources available (number of personnel), and the size and landscape characteristics of the area to be surveyed.

OPTION 1: Surveyors walk a site spaced such that all areas between the surveyors can be seen by at least one surveyor. Thus, each surveyor walks a "strip transect," (also called straight-line transect) so named because a strip or corridor of habitat is surveyed by each surveyor. The distance between surveyors will depend upon visibility of lupine (flowering or not), density of vegetation, and the slope of the site.

OPTION 2: Surveyors walk a site spaced a pre-determined distance apart (e.g. 50 feet, 100 feet, etc). Each surveyor will be conducting a strip transect. Depending upon the distance between surveyors and density of vegetation, not all areas will be observed by a surveyor (i.e. only a percentage of the site will be surveyed). The distance between surveyors will depend upon the size of area to be surveyed and the time available.

OPTION 3: Random Walk Survey for a specified time (e.g. 5 minutes) that produces a description of what was found and the estimated % coverage of habitat.

Important: To minimize harm to Kbb, avoid trampling lupine to the greatest extent practicable. Kbb may be present in any or all life forms.

Mapping Lupine Patches

Boundaries of lupine patches should be mapped as accurately as possible. This will assist future KBB surveyors at the site.

When mapping lupine, it may be useful to characterize each site by relative abundance and pattern of lupine distribution. Options for such characterization are listed below:

Relative Abundance estimate

- Dominant: the dominant ground layer vegetation
- Locally Abundant: abundant in patches
- Infrequent: infrequently encountered
- Rare: very few plants seen

	Title: Kbb Presence or Absence Monitoring Protocol (Level 2)	
	Date: December 12, 2009	Revision: 03

I. Scope and Applicability

The following protocol is intended to determine if the Karner blue butterfly (*Lycaeides melissa samuelis*) is present on HCP Partners' land included under the federal Incidental Take Permit TE 010064-5. A determination of absence does not mean that Karner blue butterflies are absolutely not there. Kbb may be present at such low levels not to be observable under this protocol. This protocol is acceptable to the FWS and is approved under the federal Incidental Take Permit TE 010064-5.

The following protocol is originally taken from Wildlife Management Guidelines for the Karner Blue Butterfly, Appendix III, Wisconsin DNR Karner Blue Technical Team as revised with information from the Biological sub-team (A.K.A. BioTeam) of the Wisconsin Statewide Habitat Conservation Plan for the Karner Blue Butterfly, May, 1998 Revision and January, 1999 Revision. The protocol was originally developed by the HCP Monitoring sub-team for the 1995 field season. This protocol has been reformatted from "A Guide to Conducting Monitoring for the Wisconsin Karner Blue Butterfly Habitat Conservation Plan" (prior to 2007) and made consistent with HCP streamlining strategies developed in 2006-2007. The most up to date revision can always be found in the Habitat Conservation Plan User's Guide on the DNR webpage (<http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>).

Purpose: To determine if Karner blue butterflies (Kbb) occupy a particular habitat area (lupine and surrounding nectar plants). The following are **suggested minimum requirements** for conducting Karner blue butterfly (*Lycaeides melissa samuelis*) presence or absence surveys. For the purpose of this survey, **absence** means that no Kbb were detected at a particular site. It is not a 100% guarantee that Kbb do not exist at the site.

Forms: A standardized *Level 2: Karner Blue Butterfly Presence/Absence* form is used for recording all Level 2 monitoring information. A blank form can be copied from the DNR's Karner Blue webpage. Always use the current form as forms may change as a result of adaptive management.

II. Protocol

Where to Survey

A site is eligible for Level 2 monitoring if it meets the following criteria:

Karner Blue Butterfly HCP Monitoring Protocol – Level 2

1. The site meets the criteria listed for Level I Monitoring:
 - The site is within the High Potential Range (HPR) of the Karner blue butterfly (see Karner Blue HPR map <http://dnr.wi.gov/forestry/karner/pdf/rangemap.pdf>).
 - The site meets the definition of potential habitat. Potential habitat includes sites on dry, sandy soils with dominant overstory vegetation of an age and/or character that could support Karner blue butterfly habitat.
 - The site is on lands included by an HCP partner in their Species and Habitat Conservation Agreement or Implementing Agreement (see *Level 1 – Lupine Presence and Absence Monitoring Protocol* for additional information describing sites eligible for Level 1 monitoring), and
2. The presence of lupine has been confirmed on the site within the last five years using the Level I Monitoring Protocol, and
3. The site has at least 25 lupine plants or clumps of lupine, at a density of 50 lupine plants per acre (or 25 lupine plants per 200 m of linear distance for linear sites).

When to Survey

- Surveys for Karner blue butterflies can be conducted during both the first and second Karner blue butterfly flight periods. The first flight period normally begins in late May and ends in mid to late June. The second flight period normally begins in mid July and ends in mid to late August.
- Timing of flight periods can vary by as much as 2-3 weeks from year to year and from site to site.
- The length of flight periods may also vary from year to year (two to five weeks in length).
- If resources do not allow you to conduct surveys during both flights, priority should be placed on conducting surveys during the second flight period (see “Determination of NO KBB” listed below).
- Only one survey is needed if you detect Kbb during the first survey. If you do not detect Kbb during the first survey, you should conduct a second survey. If you do not detect Kbb during the second survey, you should conduct a third survey. **IMPORTANT:** The second and third surveys must be conducted during the second flight period. Surveys during the second flight period should be spaced so that there is at least a 3 day interval between site visits.
- Conduct surveys during optimal time and weather conditions as listed below:
 - between 8:00 a.m. and 6:00 p.m.
 - when temperatures are above 60°F
 - when temperatures are between 60°F and 70°F, conduct surveys only

Karner Blue Butterfly HCP Monitoring Protocol – Level 2

- under mostly sunny skies with calm to light wind
- when temperatures are above 70°F, there are no restrictions on cloud cover
- when winds are 18 mph or less
- Do not survey under drizzly or rainy conditions.

How to Survey

- Individuals conducting surveys must attend training in survey techniques and identifying Kbb offered by the Wisconsin DNR (see Monitoring Guideline, “Training”).
- The Kbb habitat area (lupine and associated nectar species) should be identified ahead of time when possible.
- If a site is being surveyed for Level 2 Monitoring only, the surveyor(s) should walk the entire habitat area at a leisurely pace until all likely locations of Kbb concentration areas are surveyed OR surveyors may cover the area by walking transects to look for the butterflies. The purpose of the survey is fulfilled when at least one Kbb is observed (during either the first or second flight period).
- Butterflies observed outside the site boundary that can be positively identified as Karners from within the site should be counted for that site.

Important: To minimize harm to Kbb, avoid trampling lupine to the greatest extent practicable. Kbb may be present in any or all life forms.

Intensity of Survey

Approximately 10 minutes of effort per survey are recommended for each acre of habitat (i.e. lupine patches and important nectar plants within 50 meters of the lupine patch) to determine Kbb presence/absence. If a Kbb is quickly spotted, it is not necessary to spend 10 minutes per acre of habitat. Surveying for a longer period of time is encouraged (but not mandatory) if Kbb are not found during the first 10 minutes of survey effort per acre of habitat.

Determination of No KBB

The determination that no Kbb are present at a site can be made once you have surveyed the site (without documenting any Kbb) three times during one year. No more than one of the surveys may have been conducted during the first flight period. Surveys should be spaced so that there is a 3-7 day interval between surveys. Again, once one Kbb is observed, the purpose of the survey is fulfilled and additional surveys are not required.

General Information

The "Determination of No KBB" is based primarily on surveys during the second flight period, since Kbb numbers are usually greater during this flight period.

Kbb flight periods vary within the year from site to site depending on the site's phenology (i.e. "fast" sites and "slow" sites). Flight periods normally occur earlier on sunny, open sites and later on shady sites. Spacing of the surveys is necessary to ensure that at least

Karner Blue Butterfly HCP Monitoring Protocol – Level 2

one survey is conducted during the peak of the main (second) flight period. A 3-7 day range is used because the duration and amount of suitable survey weather varies among years.

The Karner Blue Butterfly Emergence Model is used to determine when Karner blue adults may be present. Land managers familiar with the sites to be surveyed should consider variations between sites in the area to decide which sites may be “fast” or “slow”, and plan survey work accordingly. (For Kbb emergence predictions see <http://dnr.wi.gov/forestry/karner/emergence.htm>.)

III. Definitions

- High Potential Range: The high potential range is the region of the state containing all documented occurrences of the Karner blue butterfly, and extending 5 miles beyond documented occurrences to include areas with similar habitat, soils, and climate where the Karner blue butterfly is most likely to occur based on the Kbb probability model developed in 2006-2007. (See Karner Blue HPR map <http://dnr.wi.gov/forestry/karner/pdf/rangemap.pdf>).

IV. Referenced Documents

- Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement, Appendix F. (March 2000)
- Karner Blue Habitat Conservation Plan User’s Guide (<http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>)
- Karner Blue High Potential Range Map in Wisconsin “*Karner Blue Butterfly Habitat Conservation Plan Regulatory Range, September 15, 2007*”

	Title: Monitoring Guideline	
	Date: May 22, 2008	Revision: 02

I. Scope and Applicability

Monitoring is a critical component of adaptive management in the statewide Wisconsin Karner Blue Butterfly HCP. This guideline outlines and describes the monitoring strategy and monitoring activities performed by HCP Partners on HCP Partners' land included under the federal Incidental Take Permit TE 010064-4.

Monitoring activities will always be conducted with consideration for the Karner blue butterfly (Kbb) and in a manner that will allow for continued beneficial disturbance management within the High Potential Range of the Kbb.

Monitoring will be used to determine both the success of the partners in meeting their individual conservation agreement goals and of the HCP at meeting its statewide conservation goals.

This guideline applies to all monitoring activities that may occur within the High Potential Range of the Kbb in Wisconsin. Monitoring activities include monitoring required as a condition of the permit to assess the affects of conservation measures applied in concert with partners' management and maintenance activities that routinely occur on State Wildlife & Fishery Areas, State Forests, State Natural Areas, road right-of-ways, utility and gas corridors and other partner owned lands of similar type. Conservation measures for these activities are addressed in separate guidelines, each with protocols that are specific to them.

This guideline does **not** apply to Recovery Monitoring. A monitoring tool to estimate population sizes, called Distance Sampling is currently being used for Recovery Monitoring and is addressed elsewhere.

II. The HCP and Adaptive Management

The HCP applies adaptive management to address conservation within the context of a working landscape. This adaptive management approach offers partners in the HCP the flexibility needed to meet their respective goals. Monitoring is essential to the HCP adaptive management process, and ultimately to document the need for the dynamic landscape necessary to maintain viable populations of Karner blue butterflies.

III. Objectives of Monitoring

The purpose of monitoring is to provide an economical and biologically sound means of detecting (1) the presence of Karner blue butterfly (Kbb) habitat and (2) the presence of Kbb occupied sites. The results of these surveys allow HCP partners to determine if and where Kbb are present and inform them when to apply conservation measures included in HCP management protocols. Information collected through monitoring will also be used to assess the efficacy of the HCP and to inform adaptive management decisions. Cause and Effect Monitoring will assess the affects of management activities on Kbb, Kbb populations and Kbb habitat, which will be used to direct continuous improvement of conservation measures in HCP management protocols.

IV. Components of Monitoring

Level 1 Monitoring: Sampling for the presence of habitat. For habitat surveys, the presence or absence of wild lupine is determined and its abundance broadly quantified (see Lupine Presence/Absence Monitoring Protocol - Level 1). On sites where the presence of habitat has been established, lupine surveys need to be repeated after several years in response to habitat changes brought about by disturbance management activities or natural succession.

Level 2 Monitoring: Sampling for the presence of the Karner blue butterfly. Sites where lupine is present are subsequently surveyed to determine the presence or absence of Karner blue butterflies (see Karner Blue Butterfly Presence/Absence Monitoring Protocol – Level 2).

Cause and Effect (C-E) Level 1 Monitoring: To assess the vegetative response related to a variety of important habitat components of the Karner blue butterfly (*Lycaeides melissa samuelis*), including wild lupine (*Lupinus perennis*), which result from selected management activities and conservation measures in order to inform the adaptive management process. C-E studies can be selected to (1) validate the anticipated and desired affects of a management practice or conservation measure, (2) study a new or proposed management activity or conservation measure, or (3) study multiple conservation measures for an activity to compare the results and improve the efficiencies of the activity and/or effectiveness of the conservation measure.

Habitat Evaluation

Further habitat evaluation beyond the elements required for Levels 1 and 2 monitoring is not generally a required component of the monitoring program. Exceptions are:

- When required to assess the success of habitat reclamation as part of a construction project,
- When required to demonstrate the success of mitigation plan following permanent take.
- Whenever useful to inform adaptive management decisions, i.e. to assess habitat alterations as a result of management or as a component of research.

V. Training

All persons collecting field data for monitoring under the WI KBB HCP must have attended a training session offered by the Wisconsin DNR. Depending on partners' needs, one or more training sessions are held each spring, during the first Karner blue butterfly flight period (late May-early June). The training covers survey protocol procedures, lupine and Karner blue butterfly identification, issues of variability in habitat, habitat elements, Karner blue butterfly behavior, etc. It is mandatory for previously certified field personnel to undergo refresher training at least once every 5 years.

VI. General Requirements and Recommendations

Required:

- a. Those who perform monitoring for WI KBB HCP purposes and under the authority of the associated Incidental Take Permit will successfully complete a monitoring training session provided by the DNR's HCP program and taught by qualified, authorized trainers.
- b. Certification to perform monitoring protocols under the permit is valid for 5 years after which time a refresher course will be required.
- c. Kbb and Kbb habitat surveys will be conducted following approved HCP monitoring protocols.
- d. In addition partners are required to follow any specific provisions in their conservation agreements (SHCAs or IA).

Recommended:

- e. It is recommended that non-required surveying at the discretion of the partner follow HCP approved protocols and documentation procedures.

VII. Specific Activities

- a. If surveying for the presence or absence of Kbb habitat, follow the Level 1 - Lupine Presence/Absence Monitoring Protocol.
- b. If surveying for the presence or absence of the Karner blue butterfly, follow the Level 2 - KBB Presence/Absence Monitoring Protocol.
- c. If surveying to assess the Cause & Effect relationship of HCP management activities, follow the C-E Level 1 Monitoring Protocol.

VIII. Definitions

- **Adaptive management:** For the WI Karner Blue HCP, adaptive management is defined as a formal, structured approach to dealing with uncertainty in natural resources management, using the experience of management and the results of research as an on-going feedback loop for continuous improvement. Adaptive

approaches to management recognize that the answers to all management questions are not known and that the information necessary to formulate answers is often unavailable. Adaptive management also includes, by definition, a commitment to change management practices when determined appropriate.

- **High Potential Range:** The high potential range is the region of the state containing all documented occurrences of the Karner blue butterfly, and extending 5 miles beyond documented occurrences to include areas with similar habitat, soils, and climate where the Karner blue butterfly is most likely to occur based on the Kbb probability model developed in 2006-2007.

IX. Referenced Documents

- Karner Blue Habitat Conservation Plan User's Guide (<http://dnr.wi.gov/forestry/karner/hcp-userguide.htm>)
- Karner Blue High Potential Range Map in Wisconsin "Karner Blue Butterfly Habitat Conservation Plan Regulatory Range, *September 15, 2007*"

Glossary

Broadcast Seeder: An implement for applying seed to the surface of a planting site. It consists of a hopper to hold the seed. Beneath the hopper is rotating disk. Seed is metered onto the rotating disk, which throws the seed in a circular pattern away from the device. Small broadcast seeders can be carried by a person and powered by a hand crank. Larger seeders are normally mounted on the rear of an ATV, tractor, or a pickup truck and powered by electricity or by a power take-off shaft.

Brush Disk: A heavy duty implement with circular, concave steel cutters mounted in series on a rotating shaft and pulled across the site by a prime mover. The discs cut into the sod and turn it over, exposing mineral soil. Disks can have one or two gangs (shafts with mounted disks).

Brush Hog: A heavy duty rotary mower, usually pulled behind a rubber tired tractor, and capable of chopping large diameter brush and saplings up to several inches in diameter at ground level.

Bulldozer: A prime mover fitted with a front-mounted steel blade that can be raised or lowered. It is used to push or excavate dirt, stumps, rocks, trees, and other items or materials.

Cable Plowing: Cable plows are commonly used by electrical utilities for installing underground electrical distribution cables along rights-of-way and to homes and businesses between transformers and electrical meters.

Conservative Forbs: Prairie or barrens wildflowers that are indicative of high quality plant communities. These species are some of the first to disappear in the absence of natural processes, i.e., fire or heavy disturbances such as grazing or cultivating.

Construction: Any action that involves grading, building, excavation, or other heavy disturbance activity.

Contiguous: "Contiguous" Karner blue breeding habitat is the total extent of an area supporting wild lupine (even if patchy and scattered) that is occupied by the Karner blue and uninterrupted by obvious barriers to adult butterfly dispersal (usually dense forest). Presume adults to be quite capable of dispersing at least 300 meters over open areas of suitable habitat, and so include such areas as "contiguous".

Disk Trencher: An implement consisting of two large diameter concave, toothed steel disks mounted on opposite sides at the rear of a prime mover. As the prime mover proceeds across the site, the disks gouge the soil surface and create a continuous shallow furrow of mineral soil.

Dispersal Corridor: A pathway in the landscape that Karner blue butterflies follow during their movement from one area of suitable habitat to another. A dispersal corridor may include unoccupied suitable habitat. Dispersal corridors might be useful for connecting habitat sites that are separated by unsuitable habitat. Characteristics that might improve suitability as a dispersal corridor include: a linear aspect, dominated by grasses, substantial number of flowering nectar plants, essentially canopy-free at least down the middle, having a dense wall of trees or shrubs along the sides, and being sunny for a significant part of the day. Presence of lupine in corridors is not essential, but is highly recommended (KBB Recovery Plan).

Dispersal Distance: A pathway of no longer than 350 meters that Karner blue butterflies can traverse when dispersing from one area of suitable habitat to another.

Early to mid-Summer: Pertains to growing-season burning and the timeframe beginning after June 21st through August 15th.

Emergency Response: Any action taken to remedy a facility or property emergency situation, or other unforeseen occurrence.

Extent of Site Disturbance: The amount of the surface area (in percent) of the site that is impacted by a site preparation activity.

Final harvest: A final cutting trees from a forest stand that extracts salable trees.

Fire Return Interval (FRI): The timeframe in which prescribed fire is returned to a landscape/unit that has been burned in the past.

Fixed Return Interval: As it relates to prescribed fire, A FRI (above) that occurs at a predetermined period of years. For example, a land manager may choose to burn a site once every three years regardless of whether the site requires a burn at this frequency.

Flail Chopper: An implement mounted on the front of a prime mover with a horizontal spinning drum. Attached to the drum are hardened steel cutting hammers that shred woody debris upon contact.

Fuel Loading: A buildup of fuels, especially easily ignited, fast-burning fuels.

Furrowing Plow: An implement mounted to the front or rear of a tractor that can be raised or lowered to control plowing depth. The plow is V-shaped and rolls sod, roots and debris to both sides as it moves through the ground, leaving an exposed strip of mineral soil.

Harvesting: The process of gathering a timber crop. It includes felling, skidding/forwarding, on-site processing, and removal of products from the site.

High Potential Range: Land in High Probability Range that is within 5 miles of known Kbb occurrences. Also known as the regulatory range.

High Probability Range: Lands in the KBB Probability Model that fall into 50% and greater probability classes.

Hydroaxe: A very heavy duty rotary mower mounted on the front of a rubber-tired prime mover and powered by a hydraulic motor. Hydroaxe is a brand name of the Pettibone Corporation.

Improvement Cutting: The removal of less desirable trees of any species in a stand of poles or larger trees, primarily to improve composition and quality.

Incidental Take: Take of a federally-listed species which occurs incidental to, and is not the purpose of, otherwise legal activities.

Incidental Take Permit (ITP): A permit issued by the USFWS, under Section 10 of the ESA, which allows the incidental take of an endangered species.

Intensity of site disturbance: The level of impact to vegetation at the point of disturbance. (Virtually all site preparation practices have a high level of impact, in that vegetation is removed and mineral soil is exposed at the point of application).

Intermediate Treatment: Any treatment or tending designed to enhance growth, quality, vigor, and composition of the stand after establishment of regeneration and prior to final harvest.

Metapopulation: A population of subpopulations; each individual population within a metapopulation is referred to as a local population.

Metapopulation Management: The management of large-scale properties or barrens landscapes that supports Kbb populations. Metapopulation management requires that a conscious effort be made to coordinate management efforts on the landscape to ensure the perpetuation of the metapopulation and are within dispersal distance of other Kbb subpopulations.

Mowing and Brushing: For the purpose of this protocol mowing and brushing includes the use of mowers, trimmers, choppers, and other mechanized equipment or hand tools to control woody vegetation, forbs and grasses as a vegetation management practice.

No-till Drill: A heavy duty seed drill that exerts downward force on the seeding disks, allowing penetration through sod, corn stubble, and other debris on the

ground. These drills are normally used after herbicide applications to eliminate grasses and unwanted forbs from competing with the planting. Several makes of no-till drills are modified to accept “fluffy” prairie and barrens seeds. Currently those makes are Truax, Tye, and certain models of Brillion no-till drills.

Patch Scarifier: A forestry implement that, when pulled across the landscape, gouges out patches of sod at periodic intervals, exposing mineral soil. These patches can be used as micro-sites for planting or seeding of trees or other vegetative species.

Permanent take: An impact to Karner blue butterfly habitat, through land management or land use activities, that precludes Karner blue butterfly occupation. Such long-term impact involves taking that does not allow for the restoration and reoccupation of the site for a minimum of five years. Activities or projects that may fall within the definition of permanent take include, but are not limited to:

- Construction of roadways or parking lots
- Construction of buildings or structures and associated facilities
- Other construction or development projects that cover or replace the habitat in a permanent manner (at least five years), such as an airport or a flowage; and
- Commercial or residential developments. [Note: This category does not include a permanent or second home or structure that are owned or built by the owner for his or her own use. This provision applies only to those housing developments approved after the date of permit issuance.]

Pesticide Application: For the purpose of this protocol pesticide application includes the use of any Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) approved chemical used to control both woody and herbaceous vegetation as a vegetative maintenance practice. Pesticides can be applied with hand held sprayers, or boom sprayers mounted on any type of vehicle.

Pruning: The removal, close to the branch collar or flush with the stem, of side branches and multiple leaders from a standing tree.

Prime Mover: A motorized tractor with either steel tracks or rubber tires.

Recolonization: The emigration of Kbb’s from refugia to suitable habitat where populations have been reduced due to management activities or that are unoccupied.

Refugia: Kbb occupied, unburned lupine (2/3 of total lupine on site) that is adjacent to or within 350 meters (\leq 200 meters is preferable) of the burn unit (see dispersal distance).

Release: A treatment designed to free young trees (not past the sapling stage) from undesirable, usually overtopping, competing vegetation.

Roller Chopper: A large diameter steel drum with horizontal steel blades set perpendicular to the circumference of the drum and parallel to each other. The drum is mounted within a steel frame and is pulled across the site by a motorized prime mover. As the drum rolls along the ground, the steel blades cut into the sod and chop brush and woody debris lying on the surface. Roller choppers often have a tandem arrangement, with two chopper drums mounted within the frame for more effective chopping in a single pass.

Root Rake: A front-mounted implement that attaches to a prime mover. The implement consists of a horizontal steel bar that can be raised and lowered. It is fitted with vertical teeth that can be lowered into the ground to “root out” stumps and brush. It can also be pushed along the surface to collect woody debris for deposit in piles.

Salvage Cutting: The removal of dead trees or trees damaged or dying because of injurious agents other than competition, to recover economic value that would otherwise be lost.

Sanitation Cutting: The removal of trees to improve stand health by stopping or reducing the actual or anticipated spread of insects or diseases.

Seed Drill: A farm implement that is towed behind a tractor. It consists of one or more wide bins to hold seed. A metering system drops seeds into tubes that lead to paired sets of discs spaced closely together beneath the seed bins. The disks penetrate the soil and open a slit into which the seeds drop. The slit in the soil closes behind the disks covering the seed.

Short-Term Incidental Take: An impact to occupied Karner blue butterfly habitat resulting from land management or land use activities, which provides habitat disturbance that renews declining habitat and/or creates new habitat to replace habitat lost to succession or as a result of management activity. Short-term take is conducted following approved conservation measures in the HCP in a manner to avoid and/or minimize harm to the Kbb (e.g. through appropriate timing of activities, selective routing and siting of projects, etc) and maintain, enhance, and/or restore Kbb Habitat.

Old Definition: Short-term take is an impact to occupied Karner blue butterfly habitat resulting from land management or land use activities, which provides habitat disturbance that renews declining habitat and/or creates new habitat to replace habitat lost to succession or as a result of a management activity. Short-term take is conducted following approved conservation measures in the HCP in a manner to avoid and/or minimize harm to the KBB (e.g. through appropriate timing of activities, selective routing and siting of projects, etc.) and maintain, enhance, and/or restore KBB habitat. Such short-term impacts allow Kbb survival or the restoration and reoccupation of the site within five years.

Site: A spatially explicit, relatively homogeneous portion of land characterized by specific physical and chemical properties that affect ecosystem functions, and where a more or less homogeneous vegetative type may be expected to develop or persist.

Site Preparation: Hand or mechanized manipulation of a site, designed to enhance the success of regeneration. Treatments may include bedding, burning, chemical spraying, chopping, disking, raking, and scarifying and are designed to modify the soil, litter, or vegetation and to create microclimate conditions conducive to the establishment and growth of desired species.

Subpopulation (local population): A self-reproducing population of Karner blue that is associated with a site / area (KBB Recovery Plan).

Thinning: A cultural treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or recover potential mortality.

Timber Harvest: The process of gathering a timber crop. It includes felling, skidding/forwarding, on-site-processing, and removal of products from the site.

Timber Stand Improvement (TSI): For the purposes of this user's guide TSI means a non-commercial intermediate treatment made to improve stand composition, structure, condition, health and/or growth.

Take: To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage.

Unit: A defined management area incorporating a portion of or the entire property of an occupied Kbb site.

Weeding: A release treatment in stands not past the sapling stage that eliminates or suppresses undesirable vegetation (including shrubs and herbs) regardless of crown position.

VII. Referenced Documents



Wisconsin Karner Blue Butterfly Habitat Conservation Plan

Appendix F: Glossary of Terms and Acronyms

This glossary is intended to clarify technical terms and acronyms and provide a context in which words with unclear or multiple connotations are used.

Adaptive management: A formal, structured approach to dealing with uncertainty in natural resource management, using the experience of management as an ongoing, continually improving process; the underlying operating principle of the Wisconsin Statewide Karner blue Butterfly Habitat Conservation Plan.

Articles of Partnership: Partners' goals and operating rules and procedures. All Full HCP Partners agree to follow the Articles.

Audit (compliance): independent evaluation of various aspects of partner performance under their legally-binding conservation agreements.

Autecology: the ecology of a species or of individual organisms in relation to the environment. (see also "synecology")

Barrens: areas of sandy soil that are dominated by grasses, low shrubs, and small trees, and are subject to frequent disturbance. In general, the barrens community takes the form of pine barrens in northern and central Wisconsin and oak barrens in southern and west-central Wisconsin. Bracken grasslands are also part of the barrens community.

Biological opinion: a document which includes: (1) the opinion of the USFWS as to whether or not a federal action is likely to jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of designated critical habitat; (2) a summary of the information on which the opinion was based; and (3) a detailed discussion of the effects of the action on listed species or designated critical habitat.

Biological Recovery Zone: Biological Recovery Zones (BRZ's) are areas including and around recovery properties (all) which constitute and/or support the same metapopulation on and around the recovery property. This can include areas of known or high probability habitat such as dispersal corridors, living corridors, open habitat and forested land that has a Kbb probability class equal to or greater than 50% and that are spatially located and could likely support viable habitat associated with the recovery property metapopulation.

Biotope: a region with uniform environmental conditions, as well as populations of plants and animals.

Bivoltine: a species that completes two generations per year.

Compensatory mitigation: a form of mitigation in which impacts are compensated for by replacing or providing substitute resources or environments; land banking a particular habitat type; one of four conservation strategies being applied in the statewide HCP.

Canopy: the coverage of branches and foliage formed collectively by the crowns of trees or shrubs.

Canopy cover: the proportion of overstory (trees) or understory (shrubs) canopy that blocks out sunlight.

Cause and Effect Monitoring (C-E): Used to assess the effects of a management activity

Changed circumstances: changes in circumstances affecting a species covered by an HCP and ITP that can be reasonably anticipated by the plan developers during plan development and negotiation. (see also "unforeseen circumstances")

Congressional Federal Register (CFR): the official publication and proceedings of the United States Congress.

Conservation agreement: legally-binding contract between the DNR and HCP partners outlining lands and activities included in the Karner blue butterfly conservation effort, public outreach and education efforts partners agree to implement, partner monitoring, reporting, and auditing responsibilities, the period for which the agreement binds the partners, and partner obligations to modify land management practices through adaptive management. Conservation agreements form the basis of the DNR's application for a statewide incidental take permit; also called a "species and habitat conservation agreement."

DATCP: the Wisconsin Department of Agriculture, Trade and Consumer Protection, a state agency; an HCP partner.

Dispersal: both the movement of individuals between and within habitat sites.

Dispersal corridor: a corridor of open canopy through woodlands, connecting areas of suitable habitat and/or subpopulations.

Disturbance: activities, such as burning, mowing, or tree harvesting, that interrupt natural plant

succession and allow for early successional species to persist or colonize an area.

DNR: the Wisconsin Department of Natural Resources, a state agency; an HCP partner and the lead applicant for an incidental take permit.

Driftless Area: a region that includes southwestern Wisconsin, and immediately adjacent parts of Illinois, Iowa, and Minnesota. Continental ice sheets during the Pleistocene Epoch surrounded this area, but did not cover it.

Easement: a right, such as a right-of-way, to make use of the real property of another.

Ecosystem: a biotic community and its abiotic environment, considered together as a unit. Ecosystems are characterized by energy flow that leads to trophic structure and material cycling (exchange of matter between living and nonliving parts); short for ecological system.

Ecosystem management: a system to assess, conserve, protect, and restore the composition, structure, and function of ecosystems, to ensure their sustainability across a range of temporal and spatial scales and to provide desired ecological conditions, economic products, and social benefits; a management philosophy adopted by the DNR.

Element occurrence (EO): a discrete record of occupation as tracked by the DNR's Natural Heritage Inventory database; some occurrences may be combined into single populations or metapopulations pending further research on dispersal and behavior.

Endangered species: under federal law, any species or subspecies which is in danger of extinction throughout all or a significant portion of its range; under Wisconsin law, any species whose continued existence as a viable component of the state's wild animals or plants is determined by the DNR to be in jeopardy on the basis of scientific evidence.

Endangered Species Act (ESA): law enacted by the U.S. Congress in 1973 to protect plant and animal species that are in danger of, or threatened with, extinction.

Environmental assessment (EA): a public document that briefly provides evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact; a document prepared to comply with the Wisconsin Environmental Policy Act.

Environmental impact statement (EIS): a public document that provides an analysis of potential impacts of actions which potentially significantly affect the human environment; a document required by Section 102(2)(C) of the National Environmental Policy Act or by the Wisconsin Environmental Policy Act.

Exotic species: flora or fauna that are imported or not naturally occurring in a particular region, such as Wisconsin.

Extirpation: the elimination of a species from a particular area.

Federally-listed species: a plant or animal species listed as endangered or threatened by the USFWS under the federal ESA.

Forest land: an area of which at least one acre in size and contains at least ten percent tree cover.

Fragmentation: the breaking up of large and continuous ecosystems, communities, and habitats into smaller areas surrounded by altered or disturbed land or aquatic substrate.

Full Partner: land owners and managers that enter into an SHCA that do not meet the criteria for being a Limited Partner or the Voluntary (unregulated) Category.

Geographic information system (GIS): a system of computer hardware and software that can input, manipulate, and analyze large amounts of geographically referenced data to support decision making processes.

Habitat conservation plan (HCP): a formal plan, prepared pursuant to Section 10 of the federal Endangered Species Act, that specifies what the effects of landowner activities are likely to have on listed species, the measures that will be taken to minimize and mitigate these effects, the funding available to implement the measures, the alternatives that the applicant considered and reasons why such alternatives were not implemented, and any other measures the USFWS may require; Chapters I and II of this document.

Harass: an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering.

Harm: an act which actually kills or injures wildlife.

HCP: habitat conservation plan; a plan prepared under Section 10(a) of the Endangered Species Act. (see "habitat conservation plan")

Herbicide: a chemical use to control unwanted plants.

High potential range (HPR): the region of Wisconsin containing all Karner blue butterfly

documented element occurrences and extending beyond the documented range to include areas with similar habitat, soils, and climate, where the Karner blue butterfly is most likely to occur.

Implementing agreement (IA): legally-binding agreement between the USFWS and the applicant for an incidental take permit under Section 10(a) of the Endangered Species Act; in this conservation effort, an agreement between the USFWS and the DNR.

Implementation Oversight Committee (IOC): a subset of HCP partners and non-partner cooperators which primarily exists to represent the partners' interests during the permit period; an institutional structure that advises the DNR, makes decisions on behalf of the partners, actively plans and provides services, and makes HCP-related recommendations to the partnership and the DNR.

Incidental take: take of a federally-listed species which occurs incidental to, and is not the purpose of, other legal activities.

Incidental take permit (ITP): a permit issued by the USFWS, under Section 10 of the ESA, which allows the incidental take of an endangered species.

Incidental take statement (ITS): an authorization by the USFWS to a federal agency for a determined amount of take of a federally-listed species.

Inclusion: the process, outlined in the HCP, of obtaining Incidental Take Permit coverage.

Intentional take: an activity which results in the take of a federally-listed species which is not incidental to other legal activities (i.e. a violation of Section 9 of the ESA).

Known habitat: those areas that have been surveyed and in which wild lupine has been found in an abundance which can support Karner blue butterflies.

Known-occupied habitat: an area that currently supports Karner blue butterflies in association with wild lupine.

Land conversion: the change of land from rural or low intensity uses to urban or high intensity uses, such as agricultural land developed for a subdivision.

Landscape: an area composed of adjacent and interacting ecosystems that are related because of geology, land forms, soils, climate, biota, and human influences.

Landscape planning: planning at the landscape scale to allow for analysis and improvement of management activities that sustain ecosystem capability and achieve ecosystem management

objectives.

Larvae: the wingless, early stage of a newly hatched insect before undergoing metamorphosis; caterpillar.

Limited Partner: County Highway Departments and townships engaging in road ROW management activities that become HCP Partners by signing a SHCA.

Local population: a group of individuals living in the same habitat patch, a continuous area of resources specific to the species surrounded by unsuitable habitat.

Management with consideration: a level of conservation focus in which the biological goal is for Karner blue butterfly habitat gains to equal or exceed losses occurring through natural succession or otherwise.

Management to feature and enhance: a level of conservation focus in which the biological goal is for Karner blue butterfly habitat gains to equal or exceed losses. Additional measures are taken, however, to promote viable Karner blue butterfly populations despite potential economic costs.

Metapopulation: a population of populations; each individual population within a metapopulation is referred to as a local population. Several metapopulation models have been suggested (e.g., Boorman and Levitt 1973, Gilpin and Hanski 1991, Thomas 1995)

Mitigation: methods of reducing adverse impacts of a project by: (1) limiting the degree or magnitude of the action and its implementation; (2) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (3) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or (4) compensating for the impact by replacing or providing substitute resources or environments.

Morphology: the form and structure of an organism or any of its parts.

National Hierarchical Framework of Ecological Units: an information system defining the landscape as ecological units with particular physical and biological components.

Natural Heritage Inventory (NHI): an integrated system of computer databases, maps, and manual files that document the historical and current occurrence of rare plants, animals, and natural communities in Wisconsin. The Natural Heritage Inventory is maintained by the DNR's Bureau of Endangered Resources.

National Environmental Policy Act (NEPA): a federal law, enacted by the U.S. Congress in

1969, which establishes the nation's environmental policy, sets goals, and provides means for carrying out the policy. (PL 91-190, 42 USC 4321-4347 [January 1, 1970] as amended by PL 94-52 [July 3, 1975], and PL 94-83 [August 9, 1975]).

Native species: flora or fauna naturally occurring in a particular region, such as Wisconsin.

Natural Resource Conservation Service (NRCS): the Federal agency that works in partnership effort to help America's private land owners and managers conserve their soil, water, and other natural resources.

Nongame species: any species of wild animal not classified as a game fish, game animal, game bird, or furbearing animal in s. 29.01, *Wis. Stats.* Nongame animals include a wide variety of protected and unprotected species.

Nonpoint source pollution: pollution occurring in which the sources cannot be traced to a single point such as a discharge pipe. Nonpoint water pollution sources include soil erosion from farmland, forestry, and construction sites, chemicals from urban streets, and nutrients from storage piles and barnyards.

Nonvoluntary coverage: non-partner landowners and land users involved in activities and in locations that may significantly affect the Karner blue butterfly are required to obtain coverage for their actions by acquiring a Certificate of Inclusion as either a single project or as a partner.

"No Surprises" rule: USFWS rule, titled "Habitat Conservation Plan Assurances" and dated February 23, 1998 (CFR 63(35):8859-8873), intended to provide economic and regulatory certainty for non-federal property owners with approved and properly implemented HCPs in the event of "unforeseen circumstances." (see also "changed circumstances" and "unforeseen circumstances")

One-time Permittee: non-partners who do not manage land and only seek incidental take authority for permanent take for a single project.

Overstory: the layer of vegetation in the woodland setting that consists of the tree cover.

Participant: any parties desiring involvement in the Wisconsin Statewide Karner Blue Butterfly HCP process, but not wishing to be partners.

Partner: a landowner or user desiring to be included into the Karner blue butterfly conservation strategy for the term of the ITP; more than likely, a landowner or user intending to engage in various uses or activities over time on larger land holdings (e.g., large forest owner or entity engaged in right-of-way construction or maintenance). A partner is responsible to abide by the

HCP Articles of Partnership, enter into a conservation agreement with the DNR, and perform duties and responsibilities as required of other partners.

Partner group: a subdivision of the general partnership of this HCP in which those included have similar characteristics, such as land management practices or conservation strategies (e.g., forest industry, utilities, etc.).

Partnership: the public and private entities involved in the application to renew the incidental take permit, as well as future entities applying for and obtaining partner status.

Permanency of Habitat (POH): Permanency of Habitat is a category of management strategies whereby a habitat site receives periodic disturbance on a short enough rotation schedule that the site is maintained at a successional stage where it is continuously in a state of viable habitat for Kbb. Management strategies include savanna/barrens management, roadside and utility corridor right-of-way maintenance, recreational trail maintenance, etc.

Permanent take: an impact to Karner blue butterfly habitat, through land management or land use activities, that precludes Karner blue butterfly occupation of the site for a minimum of five years. Such long-term impact involves taking that does not allow for the restoration and reoccupation of the site for a minimum of five years. Activities or projects that may fall within the definition of permanent take include, but are not limited to:

- construction of roadways and parking lots;
- construction of buildings or structures and associated facilities;
- other construction or development projects that cover or replace the habitat in a permanent manner (at least 5 years), such as an airport or a flowage; and
- residential housing developments. [Note: This category does not include a permanent or second home and associated structures that are owned or built by the owner for his or her own use. This provision applies only to those housing developments approved after the date of permit issuance.]

Pesticide: a chemical used to control unwanted insects or plants.

Potential range/habitat: habitat that will meet certain biotic and abiotic conditions to support wild lupine at any point in time, but not currently doing so.

Pupae: the inactive stage of metamorphosis of many insects, following the larval stage and preceding the adult form.

Recovery: activities, under the provisions of Section 4 of the ESA, engaged in with the intent of recovering a population of an endangered or threatened species.

Recovery plan: a plan developed under Section 4 of the ESA for the conservation and recovery of a federally-listed species; a federal responsibility.

Right-of-way (ROW): the strip of land over which facilities such as highways, railroads, or power lines are built that is usually a leased right of passage over the property of another.

Roundwood: logs, bolts, and other round sections cut from trees (including chips from roundwood).

Sampling: the process of selecting a set of elements to estimate the characteristics of a population.

Sand prairie: a community consisting of xeric prairie vegetation that is dominated by sandy soils.

Savanna: a community that was historically part of a larger ecotone complex bordered by the prairies of the west and the deciduous forests of the east. This ecotone was a mosaic of plant community types that represented a continuum from prairie to forest. Savannas were the communities in the middle of this continuum. Characteristically, savannas have less than fifty percent crown cover.

Saw logs: the central stem between the stump and the top portion of a tree; saw logs are harvested for industrial roundwood products.

Senescent: a plant at the stage from maturity to dormancy or death.

Shifting mosaic (SM): a land management strategy where, for this HCP, habitat patches appropriate for the Karner blue butterfly are shifted across the broader landscape to allow for colonization from older patches as they are lost to natural succession. Land management activities would plan disturbance patterns in accordance with this concept.

Silviculture: the theory and practice of controlling the establishment, composition, growth, and quality of forest stands in order to achieve management objectives.

Short-term take: is an impact to occupied Karner blue butterfly habitat resulting from land management or land use activities, which results in habitat disturbance that renews declining habitat and/or restores habitat to replace habitat lost to succession or as a result of a land use activity. Short-term take is conducted following approved conservation measures in the HCP in a manner to avoid and/or minimize harm to the KBB (e.g. through appropriate timing of activities, selective routing and siting of projects, etc.) and maintain, enhance, and/or restore KBB habitat.

Such short-term impacts allow Kbb survival and/or the restoration and reoccupation of the site within five years. Activities or projects that may fall within the definition of short-term take include, but are not limited to:

- mowing of roadside rights-of-way
- repairing roadside ditches to restore proper drainage
- roadside ROW improvements
- brush removal along utility corridors
- forest management practices
- conservation management, e.g. mowing and brushing for wildlife management, herbicide applications, prescribed burning, etc.
- pipeline and road construction, electrical and cable installations, and other construction and development projects that DO NOT cover or replace the habitat in a permanent manner (see definition of permanent take) and allow for habitat restoration and Kbb re-occupation within 5 years.

Single project permittee (aka one-time permittee): a landowner or user confronted with the presence of Karner blue butterflies regarding a project, but not expecting to address the issue on a long-term basis or on other lands or regarding other activities (e.g., development of a commercial establishment).

Special concern species: species that appear to be threatened because they are uncommon, restricted to unique or highly specialized habitat, or vulnerable to loss for various reasons; a classification used by the DNR for management purposes, but which is not defined in state statute or administrative code and therefore has no regulatory significance.

Species and habitat conservation agreement (SHCA): A legally-binding agreement between the Wisconsin DNR and an HCP partner outlining the specific conservation strategies which the partner will undertake as a condition of the statewide incidental take permit coverage. Referred to in this HCP as a conservation agreement. (see also "conservation agreement")

Spring flight: the first and smaller of the two Karner blue butterfly flight periods in Wisconsin. Karner blue butterfly eggs overwinter and hatch in the spring; adults emerge in late spring to early summer (between May and late June).

State-listed species: a plant or animal species listed as endangered and threatened by the Wisconsin DNR under the state endangered species laws.

Succession: progressive changes in species composition, organic structure, and energy flow of a natural community over time.

Summer flight: the second and larger of the two Karner blue butterfly flight periods in Wisconsin, occurring between early July and mid-August.

Synecology: the study of the environmental interrelationships among communities or organisms. (see also "autecology")

Take: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.

Tension zone: the most pronounced environmental gradient in Wisconsin; located in a narrow band that runs from northwestern to southeastern Wisconsin. Many species of plants and animals reach the limit of their ranges in this zone. Although climate is a major reason for the tension zone, soil type and other factors also play a role.

Threatened species: under federal law, any species or subspecies which is likely within the foreseeable future to become endangered throughout all or a significant portion of its range; under Wisconsin law, any species which appears likely, within the foreseeable future, on the basis of scientific evidence to become endangered.

Timberland: forest lands capable of growing at least 20 cubic feet of commercial wood per year.

Understory: vegetative growth under the canopy layer on a woodland site.

Unforeseen circumstances: changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably have been anticipated by the plan developers, at the time of the HCP's negotiation and development, and that result in a substantial and adverse change in the status of the covered species; generally, catastrophic events of unprecedented nature. (see also "No Surprises" rule and "changed circumstances")

U.S.D.A.: the United States Department of Agriculture, a federal agency

USFWS: the United States Fish and Wildlife Service, a federal agency; agency with responsibility for implementing and enforcing provisions of the Endangered Species Act.

U.S.G.S.: the United States Geological Survey, a federal agency.

Viable population (VP): a population that is of sufficient size and distribution to be able to persist for a long period of time in the face of demographic variations, random events that influence the genetic composition of the population, and fluctuations in environmental conditions, including catastrophic events.

Vehicle miles of travel (VMT): a measure of traffic and highway use; the total number of miles travelled in one year

Voluntary coverage: those non-partner landowners that are not required to obtain a Certificate of Inclusion and are covered in the Wisconsin Statewide Karner Blue Butterfly HCP and ITP without further process.

Watershed: the land area that drains into an individual lake or river.

Wisconsin Environmental Policy Act (WEPA): a state law designed to encourage environmentally sensitive decision making by state agencies (s. 1.12, *Wis. Stats.*). This law describes Wisconsin environmental policy and requires state agencies to consider the environmental effects of their proposed action to the extent possible under their other statutory authorities.

Wis. Adm. Code: Wisconsin Administrative Code; a compilation of rules made by state agencies having rule-making authority; a component of Wisconsin state law.

Wis. Stats.: Wisconsin Statutes; Wisconsin's state laws.