

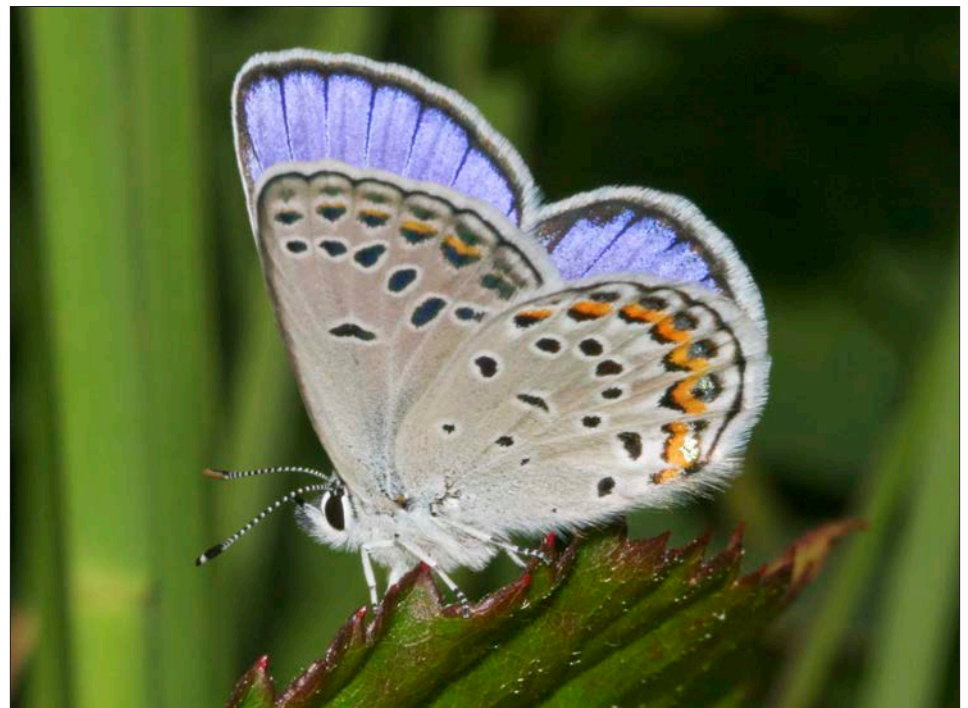


THE XERCES SOCIETY
FOR INVERTEBRATE CONSERVATION



CRP-SAFE for Karner Blue Butterflies

Recommendations for Wisconsin Landowners
and Conservationists



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CRP-SAFE for Karner Blue Butterflies

Recommendations for Wisconsin Landowners and Conservationists

Introduction

Nearly 2,000 acres of habitat for the federally endangered Karner blue butterfly (*Lycaeides melissa samuelis*) have been established in western Wisconsin through the CRP-SAFE program since 2008. These privately owned conservation lands have been planted with a USDA-approved seed mix containing wild lupine (*Lupinus perennis*), the only food plant used by Karner blue butterfly caterpillars. In addition to successfully protecting soil, improving water quality and providing habitat for wildlife, the program represents one of the largest opportunities nationwide to increase Karner blue populations on private land. If successfully colonized by the butterfly, it will provide a model for sustaining Wisconsin's natural resources legacy.

This fact sheet is a supplement to contract documents provided to participants by the USDA Farm Service Agency (FSA) and the Natural Resources Conservation Service (NRCS). Our hope is that the information contained here will help landowners and NRCS staff manage CRP-SAFE acres in the most effective way possible for restoring Karner blue populations and at the same time reaping the many benefits of maintaining land in CRP on what would otherwise be considered marginal croplands due to their highly erodible, light sandy soils.

Benefits

The Conservation Reserve Program (CRP) offers landowners annual rental payments for retiring agricultural land from crop production. Participating landowners agree to enroll their land in long-term contracts with year-round plant cover. In most cases, the USDA prioritizes land with high erosion potential for participation in CRP.

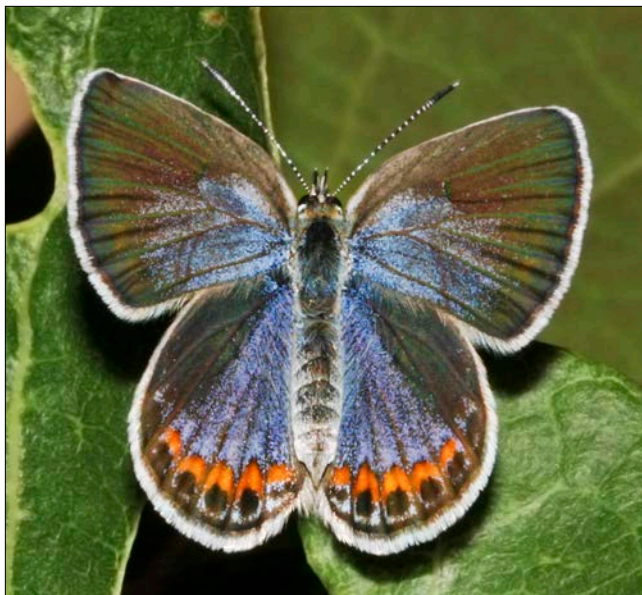


Photo: William Bouton.



Photo: Doug Taron.

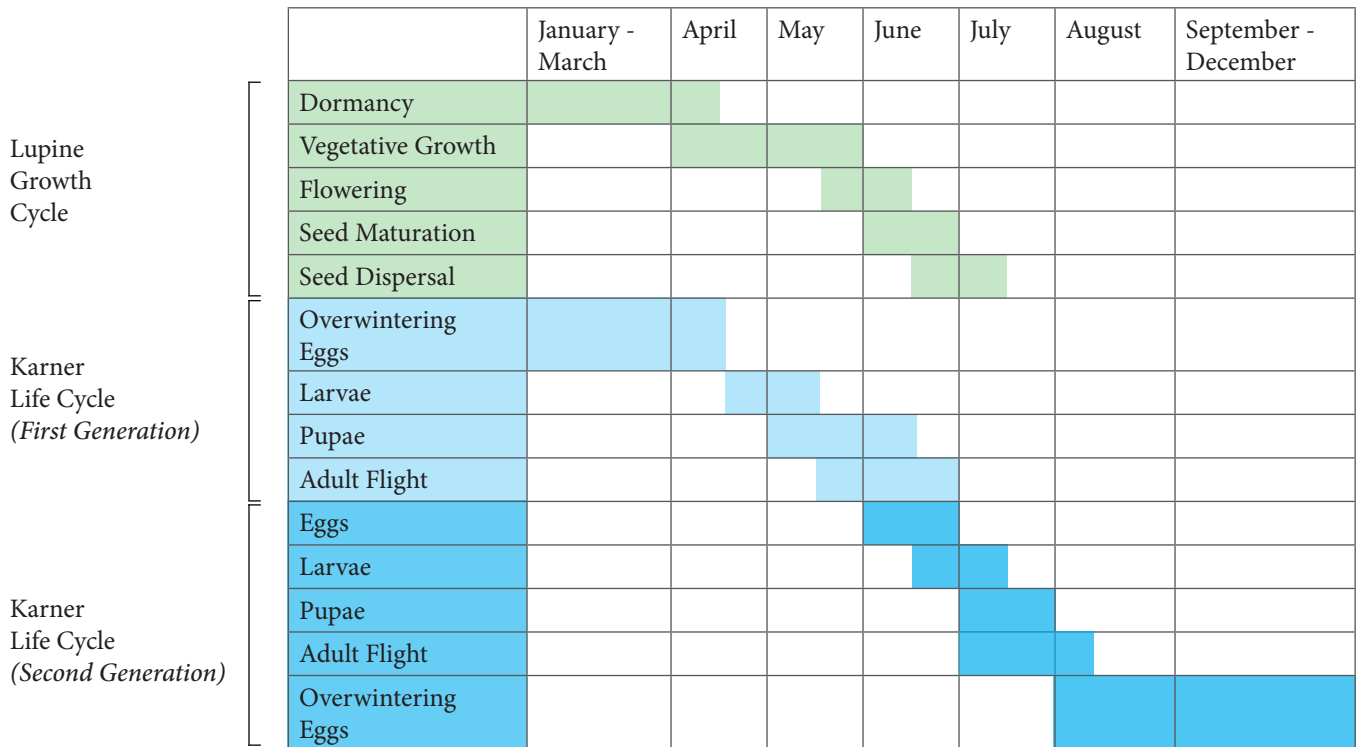
Within the CRP program, State Acres for Wildlife Enhancement (SAFE) is a conservation program that provides additional financial incentives for establishing and maintaining habitat that benefits specific wildlife species. In Eau Claire and Jackson counties of western Wisconsin, the focus of CRP-SAFE is to restore habitat for the Karner blue butterfly.

Along with the goal of expanding Karner blue populations, CRP-SAFE benefits numerous natural resources by reducing soil loss and sedimentation, improving surface and groundwater quality, and enhancing habitat for beneficial insects and wildlife. Many of the insects that would use this habitat are food for birds, and they provide “ecosystem services” such as pollination, predation of insect pests, and recycling of nutrients by decomposing dead plants and animals.

Pollinators, in particular, benefit from grasslands and meadows such as those established through the CRP-SAFE program. The wildflowers in this habitat provide nectar and pollen for adult butterflies, moths, bees, wasps, beetles, flies, and other insects. Many of the native grasses and wildflowers also serve as caterpillar host plants for other butterflies, and provide egg-laying sites for native bees. Recent studies suggest that natural habitat can increase wild pollinator abundance for adjacent bee-dependent crops—in some cases providing all of the pollination services a farm needs. This emphasis on pollinator conservation is more important than ever as populations of the domestic honey bee and wild pollinators, such as bumble bees, decline.

Along with pollinators, the native grasses and wildflowers used in the Karner blue CRP-SAFE program are known to support other wildlife, including rare grassland birds like the dickcissel (*Spiza americana*), listed as a Species of Special Concern by Wisconsin DNR.

Figure 1. Relative Development Time of Karner Blue Butterflies and Perennial Lupine



Karner Blue Biology

The Karner blue butterfly is a federally listed endangered species and is classified as a Species of Special Concern by the Wisconsin Department of Natural Resources.

The butterfly belongs to the family of gossamer-winged butterflies (Lycaenidae) and is associated with dry sand prairies, barrens, and savannas where its larval host plant, wild lupine (*Lupinus perennis*), grows—along with various wildflower nectar sources (Table 1). Over the past 20 years, Karner blue populations have declined, primarily due to the loss of habitat.

In Wisconsin, the Karner blue butterfly completes two generations (developing from egg to larva to pupa to adult) per year. (See Figure 1.) Across the central and northwestern parts of the state, small Karner blue populations presently occupy separate patches of habitat. These small populations should, in theory, be connected by the dispersal of individuals that mate and spread genetic diversity between the patchy population groups. Collectively, a group of small populations that are linked in this way is called a “metapopulation.”

Karner blue butterflies are known to disperse up to 1.24 miles, although recent research in Michigan suggests their median dispersal range might be 0.21 miles. The butterflies will disperse among forests, oak savannas, and open patches (such as meadows). They are not necessarily limited by barriers of dense, woody vegetation that reduce connected corridors of open habitat.

Both male and female adults tend to use open areas for drinking nectar, roosting, and locating mates. Female Karner blues tend to lay eggs more readily in partially shaded areas. Studies indicate that lupine growing in shade to partial shade conditions provides a high quality food source for larvae because it tends to be more lush and continues growing later in the season.

Maintaining a shifting mosaic of habitat types is the key component for the recovery and long-term survival of the Karner blue. This type of management supports lupine growth in sun and shade, wildflowers for nectar throughout the flight period of the adults, and provides adjacent habitat areas for dispersal.



Photo: Rufus Issacs, Michigan State University.

Pollinator on blueberry blossoms.

Measuring the Impact of Karner Blue CRP-SAFE

Since 2009, West Wisconsin Land Trust and the University of Wisconsin - Eau Claire have been monitoring lupine establishment on Karner blue CRP-SAFE sites. A sub-group of CRP-SAFE locations has also been monitored for overall plant diversity, as well as for the diversity and abundance of butterflies other than the Karner blue and bumble bees. Monitoring these factors will help assess program success and assist in developing future guidance for the USDA and participating landowners. For comparison, monitoring has also occurred on native grassland sites where wild lupine and Karner blue butterflies are already present.

At the time of this publication, 48 landowners have enrolled in the Karner blue CRP-SAFE program with roughly 2,000 acres planted, or pending planting, using the USDA-approved seed mix.

All of the participating landowners are within the historical range of the butterfly, and at least 11 are located within the range that the Wisconsin DNR classifies as having “High Potential” for Karner blue butterfly recovery (7 of the CRP-SAFE sites are also located 3 miles or less from locations currently occupied by the butterfly). Individual Karner blue butterflies typically disperse less than 1 mile, although local populations are normally patchy and dispersal varies from year-to-year.

Vegetation Monitoring

Karner CRP-SAFE participants are required to plant their land with a USDA-approved seed mix (Seed Mix 1, in Table 2). This seed mix includes the lupine along with various native grasses and wildflowers.

To understand the success rate of this seed mix, vegetation has been monitored for 3 years at 8 CRP-SAFE locations planted in 2009. For comparison, nearby native grassland sites were also monitored.

Sixty-two species of wildflowers were documented on CRP-SAFE acres, many of which are non-native, weedy species that rarely occur in native grassland areas. Some of these non-native species include: red clover (*Trifolium pratense*), white clover (*Trifolium repens*), alfalfa (*Medicago sativa*), common dandelion (*Taraxacum officinale*), smooth hawkbeard (*Crepis capillaris*), white campion (*Silene alba*), ragweed (*Ambrosia artemesia*), horseweed (*Conyza canadensis*), lambsquarter (*Chenopodium album*), and peppergrass (*Lepidium virginicum*). Of the 62 native and non-native wildflower species observed on CRP-SAFE sites, 37 have been documented as nectar sources for the butterfly (Table 1).



Photo: Eric Mader, The Xerces Society.

Grass dominated CPR-SAFE field.

On native grasslands, where the Karner blue is currently found, 50 wildflower species were observed. Many are documented nectar plants for the Karner blue, especially for first brood adults. Some of the nectar plants unique to these native grassland sites (and not found on CRP-SAFE sites) are sand-cress (*Arabis lyrata*), bastard toadflax (*Commandra umbellate*), downy phlox (*Phlox pilosa*), lance-leaved loosestrife (*Lysimachia lanceolata*), common yarrow (*Achillea millefolium*), hoary puccoon (*Lithospermum canescens*), rough blazing star (*Liatris aspera*), lead plant (*Amorpha canescens*), and various asters (*Symphotrichum* spp.).

The invasive spotted knapweed (*Centaurea biebersteinii*) was also found at these native sites, and is increasingly widespread throughout Eau Claire and Jackson counties. While it is used as a nectar plant by Karner blues, it crowds out other vegetation, reducing overall wildflower diversity. Control of spotted knapweed should be a priority for Karner blue butterfly conservation efforts across the region.

In 2011, the presence of lupine was monitored on nearly half of the previously seeded CRP-SAFE locations. Sixty-five percent of these sites had lupine present although in

low numbers. Most of the CRP-SAFE acres are dominated by large, aggressive native grasses that have out-competed the lupine and other wildflowers (see Table 4). Thus, there is good potential for future enhancement by planting more native wildflowers, if more pollinator habitat is desired. Native habitats where the Karner blue is currently found are characterized by wildflower-rich vegetation. We believe that the low abundance of lupine and other wildflowers at Karner blue CRP-SAFE locations is the most significant challenge facing the program today.

Domination by grasses is especially problematic on CRP-SAFE sites that were planted in the spring. Many native wildflowers require a period of winter dormancy for germination, while native grasses often do not. However it should be noted that the initial seed mix used to establish most Karner blue CRP-SAFE acres contained a high percentage of native grass, making significant wildflower establishment unlikely, regardless of when it was planted. The imbalance between native grass and wildflower seed has been adjusted in current seed mixes (read more in the “Seed Mix Specifications” section).

Invasive Species on CRP-SAFE Sites

Not surprising, many common roadside weeds, a few of which are particularly noxious and invasive, and some agricultural forage crops are found on CRP-SAFE sites. Such unwanted volunteers are abundant within the first few years of planting native prairie seeds. A few species, such as spotted knapweed, Canada thistle, and wild parsnip, have been observed on CRP-SAFE and will spread quickly unless controlled. Over 15 of commonly encountered species (listed to the right), have been observed to serve as adult Karner blue butterfly nectar sources. However, no non-native species (nectar producer or not) should serve as a substitute for native prairie species on a planted or restored prairie. In fact, non-natives can be detrimental to the successful establishment of native species due to their prolific seed production, aggressive growth and/or the production of inhibitory chemicals in some species. Hand removal, judicious use of herbicides, mowing and burning can all help to reduce the spread of these species on your SAFE site and encourage growth of native nectar species that can better serve Karners and other pollinators.

Species such as leafy spurge, spotted knapweed, and Canada, bull, plumeless, and milk thistle are all considered noxious invasive weeds by the WDNR and warrant control to limit their further spread (see DNR-PUB-FR-436-2010 and <http://www.ipaw.org/>). Proper identification of thistles is important, however, for

native thistles, such as field thistle (*Cirsium discolor*) are important nectar sources for variety of insect pollinators and an important seed source for songbirds.

Common Name	Latin Name
Spotted Knapweed	<i>Centaurea biebersteinii</i>
Chickweed	<i>Cerastium</i> sp.
Leafy Spurge	<i>Euphorbia podperae</i>
Orange Hawkweed	<i>Hieracium aurantiacum</i>
Common St. John's Wort	<i>Hypericum perforatum</i>
Butter-And-Eggs	<i>Linaria vulgaris</i>
Birdsfoot Trefoil	<i>Lotus corniculatus</i>
Black Medic	<i>Medicago lupulina</i>
Alfalfa	<i>Medicago sativa</i>
White Sweet Clover	<i>Melilotus alba</i>
Yellow Sweet Clover	<i>Melilotus officinalis</i>
Wild Parsnip	<i>Pastinaca sativa</i> (*not known as nectar species)
Sheep Sorrel	<i>Rumex acetosella</i>
Rabbit-Foot Clover	<i>Trifolium arvense</i>
Alsike Clover	<i>Trifolium hybridum</i>
Red Clover	<i>Trifolium pratense</i>
White Clover	<i>Trifolium repens</i>

Butterfly Monitoring

Along with vegetation, butterflies have been monitored at 10 research locations, 2- to- 3 times per season, since 2009. These research locations include both CRP-SAFE sites, and native grassland sites where the Karner blue is already present.

A total of 39 butterfly species have been observed to date, with 11 of those species found only at native grasslands, including the Karner, the silvery blue (*Glaucopsyche lygdamus*), Olympia marble (*Euchloe olympia*), and the Gorgone checkerspot (*Chlosyne gorgone*), a rare species of dry sand prairies and pine barrens.

Clouded sulphurs, cabbage whites, red admirals, and monarchs have been the most numerous species found on CRP-SAFE acres (Table 5).

Overall, butterfly diversity and abundance has declined on Karner blue CRP-SAFE sites every year since monitoring began. We believe this overall butterfly decline, despite erratic weather patterns, is due to a reduction of both non-native weeds and native wildflowers as aggressive native grasses begin to dominate the sites. This warrants the opportunity for further native wildflower establishment.

Bumble Bee Monitoring

Research in other parts of the U.S. and Europe has documented the importance of old fields and native prairie habitat for wild bees. These habitats provide both pollen and nectar, and nesting sites. Various fruit and vegetable crops located near this type of habitat can often receive all of the pollination services necessary from wild bees alone (reducing dependence on managed honey bees).

Among native bee groups, bumble bees are of particular importance for Karner blue butterfly conservation as they are the primary pollinators of wild lupine. Thus, declines in bumble bees could result in diminished seed production by lupines and further declines in Karner blue populations. Bumble bee species believed to be in decline in Wisconsin include the rusty-patched bumble bee (*Bombus affinis*), the yellow-banded bumble bee (*B. terricola*), the American bumble bee (*B. pensylvanicus*), and several others.

Scientists from UW-Eau Claire began monitoring bumble bees in 2010, and to date, have collected 10 species of bumble bees (Table 6). Among these, the yellow-banded bumble bee was recorded using a CRP-SAFE location.

Additional Management Recommendations

In order to better meet the goals of CRP and specifically, CRP-SAFE for Karner blue butterflies, other pollinators, and rare grassland species, additional maintenance and wildflower enhancement is needed. In this section we outline some additional key management recommendations beyond those required of the CRP-SAFE contract so lands will provide maximum benefit to the Karner blue butterfly and associates.

Time of Seeding

As of spring 2012, most seeding of Karner blue CRP-SAFE acreage has already been completed. However, where additional habitat is being established we strongly encourage fall planting of seed. In western Wisconsin, planting prairie wildflowers and grasses in October and November gives the seeds a head start the following spring, reducing competition from warm season grasses. Experience with native dry sand prairie plantings indicates that when wildflower dominance is important, as it is for butterflies, fall plantings are preferable.

For any new plantings, separate rows of grasses and wildflowers or patch seeding of grasses and wildflowers may result in better establishment of wildflowers. For example, using separate seed boxes on a no-till native seed drill will keep grasses and wildflowers in separate rows, and reduce competition during germination. Over time, species will self-seed and distribute more naturally.



Native thistle.

Photo: Eric Mader, The Xerces Society.

Seed Mix Specifications

Any newly seeded or supplemented Karner blue CRP-SAFE lands should receive an appropriate seed mix with a greater ratio of wildflowers to grasses. Ideally, this would be a mix of no more than 25% grasses. We provide a sample of an improved Karner blue CRP-SAFE seed mix in (Table 3), which includes documented and likely nectar plants used by Karner blue butterflies.

In any future seed mixes, there is a special need for early blooming, nectar-rich wildflowers to support the first generation of Karners, which is active in late May and early June.

Improving Established CRP-SAFE Acres Now and Beyond Contract

To improve existing sites that are now grass-dominated, we recommend inter-seeding additional wildflowers. To do this, narrow strips (a tractor width) or patches (less than 25 feet in diameter) of bare soil could be created by plowing, discing, burning, or herbicide spot treatments, and then re-seeded to abide by the 100% coverage required within the CRP-SAFE contract period.

If USDA financial assistance is not available, landowners might consider using native wildflower seed collected by hand from earlier planting to create these expanded wildflower patches.

Adjacent Habitats

Karner blue CRP-SAFE acres are open grasslands by design, as reflected in contract requirements. Therefore, if the sites are to attract and eventually become occupied by Karner blue butterflies, management of adjacent habitat is recommended to provide a variety of sub-habitats.

Recommended management of the land surrounding CRP-SAFE acreage includes planting a scattering of native



Photo: Eric Mader, The Xerces Society



Photo: Paula Kleintjes Neff

CRP-SAFE field.

trees, especially oak (*Quercus* spp.) or opening patches of adjacent woodland to create scattered sunny clearings.

Collecting and spreading lupine seed from established plots into these small clearing areas is also beneficial and increases the potential for Karners to eventually populate the site.

Mowing and/or Burning

Mowing CRP-SAFE acreage is important the first few years for weed control, and is required by contract. Specifically, recently established habitat should be mowed twice during the first growing season after planting. However, to protect nesting birds, no mowing should take place between the dates May 15 and August 1. Dates may need to be adjusted if the timing of spring is earlier than expected.

In addition to initial mowing during establishment, CRP-SAFE requires a mid-contract management practice for year 6 of 10-year contracts and years 6 and 11 for 15-year contracts. You can refer to Wisconsin NRCS Job Sheets 389 and 386 for general Tall Grass Prairie burning and mowing guidelines. However, it would be best to seek advice directly from NRCS for their fall management recommendations for your individual parcel(s), due to site variability and the promotion of short grass prairies species composition.

The intent of these management practices is to maintain open, prairie-like conditions. However, if CRP-SAFE acreage becomes occupied by Karner blues, mowing or burning could potentially result in unintended harm to the butterflies themselves. If given the choice, mowing is preferable to burning of Karner blue-occupied lupine patches, for it has been found to be less detrimental to both lupine and Karner blue populations in subsequent seasons.

It is recommended that the land be surveyed for Karner blue butterflies in year 6. If they are found, then mowing of lupine patches should cease until the landowner can consult with NRCS conservationists to minimize impacts. It should



Photo: Eric Mader, The Xerces Society.

be noted that all management activities engaged in by landowners and managers fall within the Endangered Species Act “Voluntary” participation strategy and are authorized to incidentally take Karner blues in the course of otherwise lawful activities [Incidental Take Permit (ITP) Permit TE010064-4) issued by the US Fish and Wildlife Service to the Wisconsin Department of Natural Resources]. In other words, landowners are protected by the ITP and are not liable for loss of Karner blues or their habitat.

To further reduce risks to Karners and other wildlife, it is recommended that unburned or unmowed habitat patches should be maintained. Butterflies in these undisturbed patches potentially serve as a population source to re-colonize areas where burning or mowing has been conducted. Ideally, any burning or mowing should be conducted to no more than ¼ of CRP-SAFE acreage in a given year. It is recommended that FSA and NRCS modify contracts where this management approach is currently not planned.

Annual Land Scouting

We recommend that landowners regularly walk their Karner blue CRP-SAFE acreage. This land scouting will enable landowners to assess the overall population of wildflowers that bloom each year. Specific scouting for lupine and noxious weeds is best conducted in late May and early June.

To scout the land, walk the parcel in a continuous zigzag pattern and try to keep disturbance to a minimum. Lupine should be in bloom in late May through early June and is easily visible, allowing counting of the plants.

While assessing CRP-SAFE acreage, landowners should be on the lookout for invasive noxious plants, such as spotted knapweed, wild parsnip, and non-native thistles. Scouting adjacent field and roadsides for infestations of these weeds is recommended, as they could move onto CRP-SAFE habitat. Ideally this scouting should be early enough in the season to spray or pull weeds before they set seed.

In particular, spotted knapweed has invaded Wisconsin over the past 15 years and become a dominant and widely distributed roadside weed. Once established, it can quickly spread and form a dense monoculture, especially on disturbed sandy soil sites. These are typically the same soils that support wild lupine as well as native nectar plants. Although it is used as a nectar plant by some species, the costs far outweigh the benefits. Knapweed has natural chemical properties that inhibit the growth of other plants, especially more preferable native species. The best management for spotted knapweed is to detect it and remove by hand digging and pulling with gloves when the ground is soft and before it spreads. Once established, it is challenging to remove and chemical spot treatment may be necessary. For more information see: <http://dnr.wi.gov/topic/invasives/fact/spottedknapweed.html>

Fire as a Management Tool

Fire can play an important role in prairie ecosystems and controlled burns are a common management tool. If used appropriately, fire can benefit pollinators through the restoration and maintenance of suitable habitat. For example, wild lupine and other SAFE-planted nectar species and native grasses are fire adapted and can outcompete non-native weeds when burned. Appropriate use of fire for isolated habitat patches, such as CRP-SAFE plots, includes proper timing, frequency, and leaving patches of unburned habitat as refuges for prairie species to eventually recolonize the burned areas. Research suggests that burning small habitat patches in their entirety or too frequently can eliminate some species because of

limited recolonization from adjacent habitats.

With this in mind, landowners should consult with the NRCS (see WI NRCS Job Sheet 389) and follow a rotational burning program in which different SAFE fields/farm or 1/3 of one SAFE field is burned every few years to help provide refuge for pollinators that will recolonize the burned areas. If possible, also leave unburned areas as scattered patches within the burn. And finally, avoid burning too frequently. Studies suggest 3--7 years may be the best burn frequency for maintaining prairies. Use low-intensity burning techniques such as burning early or late in the day to avoid creating too hot of a fire and to reduce impacts on other species of wildlife, such as grassland birds.

Table 1. Known Karner Blue Butterfly Nectar Sources

As documented in the USFWS Karner Blue Butterfly Recovery Plan (USFWS 2003) and Swengel and Swengel (2000).

First Generation Nectar Sources (May and June Blooming)

Common Name	Scientific Name	Most Favored Nectar Species	Planted on CRP-SAFE Sites	Documented Volunteer on CRP-SAFE Sites	Potential Nectar Source During Both Generations
Common Yarrow	<i>Achillea millefolium</i>	x		x	x
Thimbleweed	<i>Anemone cylindrica</i>				
Sandcress	<i>Arabis lyrata</i>	x			x
Oval Milkweed	<i>Asclepias ovalifolia</i>	x			
Prairie Wild Indigo	<i>Baptisia bracteata</i>				
Hoary Alyssum	<i>Berteroa incana</i>	x		x	x
Red Root	<i>Ceanothus ovatus</i>	x			
Bastard Toadflax	<i>Comandra umbellata</i>				
Lanceleaf Coreopsis	<i>Coreopsis lanceolata</i>	x			x
Ox-eye Daisy	<i>Chrysanthemum leucanthemum</i>				
Flowering Spurge	<i>Euphorbia corollata</i>		x	x	x
Duchesne Strawberry	<i>Fragaria virginiana</i>				
Huckleberry	<i>Gaylussacia baccata</i>				
Wild Geranium	<i>Geranium maculatum</i>				
Long-leaved Houstonia	<i>Hedyotis longifolia</i>	x			x
Frostweed	<i>Helianthemum canadense</i>				x
Two-flowered Cynthia	<i>Krigia biflora</i>				x
Hoary Puccoon	<i>Lithospermum canescens</i>				
Hairy Puccoon	<i>Lithospermum caroliniense</i>				x
Wild Lupine	<i>Lupinus perennis</i>		x		
Yellow Wood Sorrel	<i>Oxalis stricta</i>	x			
Lousewort	<i>Pedicularis canadensis</i>				
Downy Phlox	<i>Phlox pilosa</i>				x
Rough-fruited Cinquefoil	<i>Potentilla recta</i>			x	x
Common Cinquefoil	<i>Potentilla simplex</i> and other <i>Potentilla</i> spp.	x		x	x
Carolina Rose	<i>Rosa carolina</i> and <i>Rosa</i> sp.				x
Bramble /Blackberries	<i>Rubus</i> spp.	x			x
Ragwort	<i>Senecio pauperculus</i>				
Golden Ragwort	<i>Senecio aureus</i> and other <i>Senecio</i> spp.	x			
False Spikenard	<i>Smilacina racemosa</i>				
Star-flowered False Solomon Seal	<i>Smilacina stellata</i>				
Blue-eyed Grass	<i>Sisyrinchium campestra</i>	x			
Goat's Rue	<i>Tephrosia virginiana</i>				x

Common Names	Scientific Names	Most Favored Nectar Species	Planted on CRP-SAFE Sites	Documented Volunteer on CRP-SAFE Sites	Potential Nectar Source During Both Generations
Spiderwort	<i>Tradescantia ohiensis</i>				x
Blueberries	<i>Vaccinium</i> spp.				
Hairy Vetch	<i>Vicia villosa</i>			x	x
Bird Foot Violet	<i>Viola pedata</i>			x	
Golden Alexanders	<i>Zizia aurea</i>		x		

Second Generation Nectar Sources (July Blooming)

Common Names	Scientific Names	Most Favored Nectar Species	Planted on CRP-SAFE Sites	Documented Volunteer on CRP-SAFE Sites	Potential Nectar Source During Both Generations
Lead Plant	<i>Amorpha canescens</i>				
Spreading Dogbane	<i>Apocynum androsaemifolium</i>				
Swamp Milkweed	<i>Asclepias incarnata</i>				
Common Milkweed	<i>Asclepias syriaca</i>				
Butterfly Milkweed	<i>Asclepias tuberosa</i>	x	x		
Whorled Milkweed	<i>Asclepias verticillata</i>				
Fern-leaved False Foxglove	<i>Aureolaria pedicularia</i>				
False Foxglove	<i>Aureolaria</i> sp.				
Harebell	<i>Campanula rotundifolia</i>				
New Jersey Tea	<i>Ceanothus americanus</i>	x			
Prairie Tickseed	<i>Coreopsis palmata</i>	x	x		
Deptford Pink	<i>Dianthus armeria</i>				
Fleabanes	<i>Erigeron</i> sp.				
Cottonweed	<i>Froelichia floridana</i>				
Bedstraw	<i>Galium</i> sp.			x	
Sweet Everlasting	<i>Gnaphalium obtusifolium</i>				
Stickseed	<i>Hackelia deflexa</i>				
Woodland Sunflower	<i>Helianthus divaricatus</i>				
Western Sunflower	<i>Helianthus occidentalis</i> and <i>Helianthus</i> sp.	x	x		
Round-headed Bushclover	<i>Lespedeza capitata</i>				
Rough Blazingstar	<i>Liatris aspera</i>				
Dwarf Blazingstar	<i>Liatris cylindracea</i> and <i>Liatris</i> sp.	x			
Wood Lily	<i>Lilium philadelphicum</i>				
Old-field Toad Flax	<i>Linaria canadensis</i>				
Pale-spike Lobelia	<i>Lobelia spicata</i>				

cont. Second Generation Nectar Sources (July Blooming)

Common Name	Scientific Name	Most Favored Nectar Species	Planted on CRP-SAFE Sites	Documented Volunteer on CRP-SAFE Sites	Potential Nectar Source During Both Generations
Water Horehound	<i>Lycopus americanus</i>				
Loosestrife	<i>Lysimachia sp.</i>				
Winged Loosestrife	<i>Lythrum alatum</i>				
Wild Bergamot (Bee Balm)	<i>Monarda fistulosa</i>		x		
Dotted Mint (Horsemint)	<i>Monarda punctata</i>	x	x		
Evening Primrose	<i>Oenothera sp.</i>				
White Prairie Clover	<i>Dalea candidum</i>				
Purple Prairie Clover	<i>Dalea purpureum</i>		x		
Racemed Milkwort	<i>Polygala polygama</i>				
Knotweed	<i>Polygonum sp.</i>			x	
Mountain Mint	<i>Pycnanthemum virginianum</i>	x			
Black-eyed Susan	<i>Rudbeckia hirta</i>	x	x		
Soapwort	<i>Saponaria officinalis</i>				
Showy Goldenrod	<i>Solidago speciosa</i>	x	x	x	
Grass-leaved Goldenrod	<i>Solidago graminifolia and Solidago sp.</i>	x			
Marsh Skullcap	<i>Scutellaria epilobiifolia</i>				
Meadowsweet	<i>Spiraea tomentosa and Spirea alba</i>	x			
Hedge Nettle	<i>Stachys palustris</i>				
Aster	<i>Symphotrichum ptarmicoides, sericeus, and laevis</i>	x		x	
Fameflower	<i>Talinum rugospermum</i>				
Blue Vervain	<i>Verbena hastata</i>				

Table 2. Current USDA-Approved Seed Mix Specifications for Karner CRP-SAFE

The final weight of this seed mix is 5.78 lbs per acre. Of that total, 5 lbs consist of native grasses and 0.78 lbs are wildflowers. On a seeds per square foot basis this amounts to 37.2 seeds. Total seed per acre are 976,000 grass seeds and 644,475 wildflower seeds. Lupine seeds planted per acre total 3,600. There are seventeen total species in the mix consisting of 11 wildflower species and 6 grass species. Please note that the authors believe this seed mix could be improved by increasing the ratio of wildflowers to grasses. See Table 3 for an example.

Common Name	Scientific Name	Seeds per ounce	Ounces per acre	Total seeds per acre	Price per ounce	Total price
Golden Alexanders	<i>Zizia aurea</i>	11,000	1	11,000	\$6.75	\$6.75
Flowering Spurge	<i>Euphorbia corollata</i>	8,500	1	8,500	\$154.00	\$154.00
Perennial Lupine	<i>Lupinus perennis</i>	1,200	3	3,600	\$20.75	\$62.25
Black-eyed Susan	<i>Rudbeckia hirta</i>	130,000	0.4	52,000	\$3.00	\$1.20
Butterfly Milkweed	<i>Asclepias tuberosa</i>	4,375	1	4,375	\$51.25	\$51.25
Purple Prairie Clover	<i>Dalea purpurea</i>	23,000	2	46,000	\$4.50	\$9.00
Wild Bergamot	<i>Monarda fistulosa</i>	100,000	0.5	50,000	\$25.75	\$12.88
Prairie Coreopsis	<i>Coreopsis palmata</i>	14,000	0.5	7,000	\$15.25	\$7.63
Roundhead Bushclover	<i>Lespedeza capitata</i>	11,000	1	11,000	\$25.75	\$25.75
Rough Blazingstar	<i>Liatris aspera</i>	20,000	1	20,000	\$30.75	\$30.75
Western Sunflower	<i>Helianthus occidentalis</i>	15,000	1	15,000	\$30.75	\$30.75
Big Bluestem	<i>Andropogon gerardii</i>	12,000	8	96,000	\$1.50	\$24.00
Side Oats Grama	<i>Bouteloua curtipendula</i>	40,000	8	320,000	\$1.50	\$24.00
Switchgrass	<i>Panicum virgatum</i>	25,000	8	200,000	\$1.50	\$24.00
Canada Wild Rye	<i>Elymus canadensis</i>	6,000	16	96,000	\$0.75	\$12.00
Indian Grass	<i>Sorghastrum nutans</i>	12,500	16	200,000	\$1.00	\$16.00
Little Bluestem	<i>Schizachyrium scoparium</i>	20,000	24	480,000	\$1.25	\$20.00
TOTALS		92.4	1,620,475	-	\$608.21	

Table 3. Recommended Supplemental KBB CRP-SAFE Seed Mix

In this improved seed mix standard, the total weight of seed planted is less than the previously used seed mix. However, the total number of seeds planted is higher (due to the greater use of small-seeded species). In this seed mix, 3.78 lbs of seed is planted per acre, of which only 1.38 lbs are grasses and 2.4 lbs are wildflowers. At 39.1 seeds, the total number of seeds planted per square foot is higher than the previously used seed mix. The total number of seeds per acre amount to 436,960 grass seeds and 1,264,304 wildflower seeds. The number of lupine seeds planted per acre has increased to 5,184. In comparison with the previously used standard, this represents an almost 1/3 reduction in the amount of grass seed used and almost a doubling of the wildflower seed. There are 19 species included in the mix (14 wildflower species and 5 grass species), and a smaller number of larger, more aggressive grass species. Based upon seed pricing at the time of this writing, we estimate a cost increase of only \$1 above the previously used standard.

Common Name	Scientific Name	Seeds per ounce	Ounces per acre	Total seeds per acre	Price per ounce	Total price
Golden Alexanders	<i>Zizia aurea</i>	11,000	4.8	52,800	\$6.75	\$32.40
Perennial Lupine	<i>Lupinus perennis</i>	1,200	4.32	5,184	\$20.75	\$89.64
Lanceleaf Coreopsis	<i>Coreopsis lanceolata</i>	24,000	9.44	226,560	\$6.75	\$63.72
Black-eyed Susan	<i>Rudbeckia hirta</i>	130,000	1.6	208,000	\$3.00	\$4.80
Butterfly Milkweed	<i>Asclepias tuberosa</i>	4,375	1.92	8,400	\$51.25	\$98.40
Yarrow	<i>Achillea millefolium</i>	180,000	0.8	144,000	\$6.75	\$5.40
Purple Prairie Clover	<i>Dalea purpurea</i>	23,000	4.48	103,040	\$4.50	\$20.16
Wild Bergamot	<i>Monarda fistulosa</i>	100,000	1.12	112,000	\$25.75	\$28.84
Hoary Vervain	<i>Verbena stricta</i>	30,000	6.08	182,400	\$6.75	\$41.04
Prairie Coreopsis	<i>Coreopsis palamata</i>	14,000	1.28	17,920	\$15.25	\$19.52
Dotted Mint	<i>Monarda punctata</i>	102,000	0.8	81,600	\$51.25	\$41.00
Virginia Mountain Mint	<i>Pycnanthemum virginianum</i>	220,000	0.32	70,400	\$77.00	\$24.64
Rough Blazingstar	<i>Liatris aspera</i>	20,000	1.76	35,200	\$30.75	\$54.12
Western Sunflower	<i>Helianthus occidentalis</i>	15,000	1.12	16,800	\$30.75	\$34.44
Indian Grass	<i>Sorghastrum nutans</i>	12,500	4.16	52,000	\$1.00	\$4.16
Big Bluestem	<i>Andropogon gerardii</i>	12,000	4.32	51,840	\$1.50	\$6.48
Prairie Junegrass	<i>Koeleria pyramidata</i>	225,000	0.32	72,000	\$11.86	\$3.80
Little Bluestem	<i>Schizachyrium scoparium</i>	20,000	12.16	243,200	\$1.25	\$15.20
Prairie Dropseed	<i>Sporobolus heterolepis</i>	16,000	1.12	17,920	\$19.38	\$21.71
Totals			60.48	1,701,264		\$609.47

Table 4. Native Grasses Planted on Karner CRP-SAFE Sites*

Common Name	Scientific Name
Big Bluestem	<i>Andropogon gerardii</i>
Side Oats Grama	<i>Bouteloua curtipendula</i>
Canada Wild Rye	<i>Elymus canadensis</i>
Switchgrass	<i>Panicum virgatum</i>
Little Bluestem	<i>Schizachyrium scoparium</i>
Indian Grass	<i>Sorghastrum nutans</i>

*All other grasses are volunteers.

Table 5. Butterfly Species Observed on CRP-SAFE and Native Prairie Study Sites

All species have been found at one or both sites.

Common Name	Scientific Name	Found on Native Sites Only
Silver Spotted Skipper	<i>Atrytone logan</i>	
Meadow Fritillary	<i>Boloria bellona</i>	
Common Wood Nymph	<i>Cercyonis pegala</i>	
Gorgone Checkerspot	<i>Chlosyne gorgone</i>	X
Common Ringlet	<i>Coenonympha tullia</i>	
Orange Sulphur	<i>Colias eurytheme</i>	
Clouded Sulphur	<i>Colias philodice</i>	
Monarch	<i>Danaus plexippus</i>	
Delaware Skipper	<i>Epargyreus zestos</i>	
Olympia Marble	<i>Euchloe olympia</i>	X
Dun Skipper	<i>Euphyes vestris</i>	
Variegated Fritillary	<i>Euptoieta claudia</i>	
Eastern Tailed Blue	<i>Everes comyntas</i>	
Silvery Blue	<i>Glaucopsyche lygdamus</i>	X
Common Buckeye	<i>Junonia coenia</i>	
Viceroy	<i>Limenitis archippus</i>	X
White Admiral	<i>Limenitis arthemis arthemis</i>	X
Red Spotted Purple	<i>Limenitis arthemis astyanax</i>	
Bronze Copper	<i>Lycaena hyllus</i>	
American Copper	<i>Lycaena phlaeas</i>	
Karner Blue	<i>Lycaeides melissa samuelis</i>	X
Little Wood Satyr	<i>Megisto cymela</i>	
Dainty Sulphur	<i>Nathalis iole</i>	X
Milbert's Tortoiseshell	<i>Nymphalis milberti</i>	
Giant Swallowtail	<i>Papilio cresphontes</i>	X
Eastern Tiger Swallowtail	<i>Papilio glaucus</i>	
Black Swallowtail	<i>Papilio polyxenes</i>	
Northern Pearl Crescent	<i>Phyciodes selenis</i>	
Cabbage White	<i>Pieris rapae</i>	
Peck's Skipper	<i>Polites peckius</i>	
Banded Hairstreak	<i>Satyrium calanus</i>	X
Edward's Hairstreak	<i>Satyrium edwardsii</i>	X
Coral Hairstreak	<i>Satyrium titus</i>	X
Aphrodite Fritillary	<i>Speyeria aphrodite</i>	
Great Spangled Fritillary	<i>Speyeria cybele</i>	
European Skipper	<i>Thymelicus lineola</i>	
Red Admiral	<i>Vanessa atalanta</i>	
Painted Lady	<i>Vanessa cardui</i>	
American Lady	<i>Vanessa virginiensis</i>	

Table 6. Bumble Bees Observed at CRP-SAFE and Native Prairie Study Sites

All species have been found at one or both sites.

Common Name	Scientific Name	Found on Native Sites Only	Found on CRP-SAFE Sites Only
Black and Gold Bumble Bee	<i>Bombus auricomis</i>		
Two-spotted Bumble Bee	<i>B. bimaculatus</i>		
Northern Amber Bumble Bee	<i>B. borealis</i>		X
Common Eastern Bumble Bee	<i>B. impatiens</i>		
Brown-belted Bumble Bee	<i>B. griseocollis</i>		
Red-belted Bumble Bee	<i>B. rufocinctus</i>		
Sanderson Bumble Bee	<i>B. sandersoni</i>	X	
Tri-colored Bumble Bee	<i>B. ternarius</i>		X
Yellow-banded Bumble Bee	<i>B. terricola</i>		X
Half-black Bumble Bee	<i>B. vagans</i>		

Additional Resources

Web Resources

Southern Wisconsin Butterfly Association: Butterfly Conservation Management in Midwestern Open Habitats. Southern Wisconsin Butterfly Association, Madison.
<http://www.naba.org/chapters/nabawba/resources.html>

Prairie Primer.

<http://learningstore.uwex.edu/Assets/pdfs/G2736.pdf>

Wisconsin Biology Technical Note 8, “Pollinator Biology and Habitat.”

<ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/biology-tn8.pdf>

Wisconsin Job Sheet 130, “Pollinator friendly habitat.”

<ftp://ftp-fc.sc.egov.usda.gov/WI/jobsheets/js-130.pdf>

Wisconsin Job Sheet 135, “How to establish and maintain native grasses, forbs and legumes.”

<ftp://ftp-fc.sc.egov.usda.gov/WI/jobsheets/js-135.pdf>

Wisconsin Job Sheet 386, “CRP Required Management Practice Mowing.”

<ftp://ftp-fc.sc.egov.usda.gov/WI/jobsheets/js-386.pdf>

Wisconsin Job Sheet 389, “CRP Required Management Practice-prescribed burning.”

<ftp://ftp-fc.sc.egov.usda.gov/WI/jobsheets/js-389.pdf>

Wisconsin Job Sheet 397, “Maintenance on Established CRP.”

<ftp://ftp-fc.sc.egov.usda.gov/WI/jobsheets/js-397.pdf>

USDA, Natural Resources Conservation Service

Wisconsin Field Office Technical Guide, Section IV

http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=WI

Books

Mader, E., M. Shepherd, M. Vaughan, S. Hoffman Black and G. LeBuhn. 2011. *Attracting Native Pollinators: Protecting North Americas Butterflies and Bees*. 372 pp. North Adams, MA: Storey Publishing.

Packard, S., and C. Mutel (eds.). 1997. *The Tallgrass Restoration Handbook: For Prairies, Savannas, and Woodlands*. Island Press.

References

- Bleser, C. A. 1993. *Status survey, management and monitoring activities for the Karner blue butterfly* (*Lycaeides melissa samuelis*) in Wisconsin. 86 pp. Final Report submitted to the U.S. Fish and Wildlife Service.
- Colla, S., L. Richardson, and P. Williams. 2011. *Bumble bees of the Eastern United States*. USDA Forest Service FS-972.
- Davros, N., D. Debinski, K. Reeder and W. Hohman. 2006. Butterflies and continuous reserve program filter strips: landscape considerations. *Wildlife Society Bulletin* 34:936–943.
- Doxon, E., and J. Carroll. 2007. Vegetative and invertebrate community characteristics of Conservation Reserve Program Fields Relative to game birds in Western Kansas. *American Midland Naturalist* 158:243–259.
- Dunn, J. P. 2008. *Investigations of adult dispersal, habitat quality analysis, and the development of monitoring techniques for the Karner blue butterfly within the Muskegon Recovery Unit*. Final Report submitted to the Wildlife Division–Michigan DNR, 40 pp.
- Hopwood, J. L. 2008. The contribution of roadside grassland restorations to native bee conservation. *Biological Conservation* 141:2632–2640.
- Holzschuh, A. I. Steffan-Dewenter, D. Kleijn, and T. Scharntke. 2007. Diversity of flower-visiting bees in cereal fields: effects of farming system, landscape composition and regional context. *Journal of Applied Ecology* 44:41–49.
- 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. *Biological Conservation* 85:47–53.
- Grundel, R., N. B. Pavlovic, and C. L. Sulzman. 2000. Nectar plant selection by the Karner blue butterfly (*Lycaeides melissa samuelis*) at the Indiana Dunes National Lakeshore. *American Midland Naturalist* 144:1–10.
- Kleintjes, P. K., J. M. Sporrang, C. A. Raebel, and S. F. Thon. 2003. Habitat type conservation and restoration for the Karner blue butterfly: a case study from Wisconsin. *Ecological Restoration* 21:107–115.
- Kremen, C., N. M. Williams, R. L. Bugg, J. P. Fay, and R. W. Thorp. 2004. The area requirements of an ecosystem service: crop pollination by native bee communities in California. *Ecology Letters* 7:1109–1119.
- Lane, C. 1994. Habitat preferences of the Karner blue butterfly in Minnesota. In *Karner blue butterfly: a symbol of a vanishing landscape* (*Miscellaneous Publication 84-1994*), edited by D. A. Andow, R. Baker, and C. Lane (eds.), 63–72. St. Paul: Minnesota Agricultural Experiment Station, University of Minnesota – St. Paul.
- Lawrence, W. S. 1994. Karner Blue butterfly populations in the Allegan State Game Area, Michigan. In *Karner blue butterfly: a symbol of a vanishing landscape* (*Miscellaneous Publication 84-1994*), edited by D. A. Andow, R. Baker, and C. Lane (eds.), 53–62. St. Paul: Minnesota Agricultural Experiment Station, University of Minnesota – St. Paul.
- Leach, M. 1993. *Status and distribution of the Karner blue butterfly at Fort McCoy, Wisconsin: Final report on a two-year status survey*. 50 pp.+ appendix. Prepared by The Nature Conservancy, Wisconsin Chapter, for the Natural Resources Management Division, Fort McCoy Military Reservation, United States Army, Fort McCoy, Wisconsin.
- Losey, J., and M. Vaughan. 2006. The economic value of ecological services provided by insects. *BioScience* 56:311–323.
- Maxwell, J., and T. Givnish. 1994. *Research on the Karner blue butterfly at Fort McCoy, Wisconsin: Progress report for the 1993 field season*. Report to the U.S. Fish and Wildlife Service and U.S. Department of the Army.
- National Research Council. 2007. *Status of Pollinators in North America*. 307pp. Washington, D.C.: National Academies Press. Available from http://www.nap.edu/catalog.php?record_id=11761 (Accessed 1/14/13.)
- Ockinger, E. and H. G. Smith. 2007. Semi-natural grasslands as population sources for pollinating insects in natural landscapes. *Journal of Applied Ecology* 29:316–329.
- Papp, C. 1993. *Habitat study of the endangered Karner blue butterfly* (*Lycaeides melissa samuelis* Nabokov) in Michigan oak savanna. Preliminary report submitted to the Department of Natural Resources, Wildlife Division, Michigan.
- Sferra, N. J., D. N. Ewert, C. A. Clampitt, H. E. Ballard, Jr., J. M. Aguiar, and T. Darnell. 1993. “Management of oak savanna and oak barrens habitat in Nawaygo and Muskegon Counties, Michigan, for Karner blue butterflies (*Lycaeides melissa samuelis*) and other oak savanna invertebrates. Final Results.” (Unpublished Report.) 25 pp. The Nature Conservancy.

cont. References

Swengel, A. B., and S. R. Swengel. 1996. Factors affecting abundance of adult Karner blues (*Lycaeides melissa samuelis*) (Lepidoptera: Lycaenidae) in Wisconsin Surveys 1987–95. *The Great Lakes Entomologist* 29:93–105.

Swengel, A. B., and S. R. Swengel. 2000 (2002). Observations of *Lycaeides* (Lepidoptera: Lycaenidae) in the northern midwest U.S.A. during 1990–99. *Holarctic Lepidoptera* 7(1):21–31.

Swengel, A. 2001. A literature review of insect responses to fire compared to other conservation managements of open habitat. *Biodiversity and Conservation* 10:1141–1169.

Swengel, S. R., and A. B. Swengel. 2005. Spatial synchrony in Wisconsin Karner blue (Lepidoptera: Lycaenidae) populations. *Great Lakes Entomologist* 38:135–154.

Swengel, A. B., and S. R. Swengel. 2007. Benefit of permanent non-fire refugia for Lepidoptera conservation in fire-managed sites. *Journal of Insect Conservation* 11:263–279.

U.S. Fish and Wildlife Service. 2003. *Final Recovery Plan for the Karner Blue Butterfly (Lycaeides melissa samuelis)*. Fort Snelling, MN: U.S. Fish and Wildlife Service. 273 pp.

Wisconsin Department of Natural Resources. 2000. *Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan and Environmental Impact Statement*. PUBL-SS-947-00. 386 pp. Madison: Wisconsin Department of Natural Resources. (Available from the HCP Coordinator at 877-452-7637.)

Wisconsin Department of Natural Resources. 2010. *A Field Guide to Terrestrial Invasive Plants in Wisconsin*. Edited by T. Boos, K. Kearns, C. LeClair, B. Panke, B. Scriver, and B. Williams. DNR-PUB-FR-436-2010. Madison: Wisconsin Department of Natural Resources Bureau of Endangered Resources.

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