# Organizing an Aerial Spray for Forest Pests: Recommendations and Regulations

Wisconsin Department of Natural Resources, Division of Forestry,
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*This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.*

## Introduction

An aerial spray (Figure 1) can be a cost-effective way to manage a forest pest that is at damaging levels over many acres. However, it usually requires more effort than simply calling a pesticide applicator to take care of the problem. This guide describes the required steps and considerations for a safe and effective aerial spray of tree-feeding pests such as gypsy moth, forest tent caterpillar, jack pine budworm and spruce budworm.

Figure 1. Aerial spraying for gypsy moth in Manitowoc County.

***First***, correctly identify the pest of interest. Treatment methods and timing often differ between pests. Images of common caterpillar pests of deciduous trees can be found online at the UW-Extension gypsy moth website.

***Key recommendation:*** If the area considered for aerial spraying includes many property owners (i.e., a residential area), consider having a project coordinator - one individual or small group that is willing to see the project through to completion. The coordinator contacts aerial applicators, collects money, oversees communications to neighbors, and has the authority to decide whether the spraying should be postponed due to unfavorable weather conditions.

## Legal requirements for aerial sprays

Wisconsin law requires that pesticide only be applied to property where it is intended to be used. Spraying property without landowner permission, spraying outside the intended application area, or significant amounts of spray drift outside of the intended application area are violations of ch. ATCP 29, Wis. Adm. Code (Pesticide Use and Control). Endangered and threatened species laws may restrict where aerial spraying can take place, in order to protect populations of these species. More information can be found in Appendix A.

Property owner consent to spray

If property owners within the proposed treatment area have not given permission or object to having their property sprayed, steps must be taken to prevent pesticide overspray or significant spray drift on these properties (s. ATCP 29.50(1)(a), Wis. Adm. Code (negligent use) and s. ATCP 29.50(2)(a), Wis. Adm. Code (overspray and drift)). Under s. ATCP 29.50(2)(c), Wis. Adm. Code, significant spray drift is defined as any of the following:

- Amounts that cause actual harm to persons, property, or the environment.
- Amounts that could potentially harm persons, property, or the environment under any reasonably foreseeable circumstances, regardless of whether an actual exposure or harm has occurred.
- Amounts that are readily visible.

Landowner consent is of particular importance to property owner groups that want to treat many properties, since there are many landowners and the consent requirement also applies to public property in the proposed treatment area (such as parks, roads and right-of-ways). In order to avoid overspray or significant spray drift, it may be necessary to remove some properties from the treatment area even though they are owned by willing landowners. Work with the aerial applicator to determine the appropriate distance that must be left untreated. Responding to objectors and property owners who are removed from a treatment area can be a significant issue for spray coordinators.

If a property owner within the proposed treatment area raises an objection, a spray coordinator may be able to reach a compromise that results in the objector agreeing to have their property treated. Examples of compromises include:

- Providing notification to the objector a day or two prior to scheduled spraying, so that direct exposure can be avoided.
- Not charging that property owner for their share of the spray cost.
- Providing health studies or insecticide information (visit the Wisconsin gypsy moth website or contact DNR Forest Health staff for materials).
- Covering food plants or butterfly gardens with a tarp prior to spraying.

***Recommendation:*** Plan ahead to address any objections. Consider obtaining a signed consent-to-spray form from each property owner within the proposed spray area, to reduce the risk of objections being raised before or after the spray. Obtaining a signed form from adjacent landowners is also worth considering.

When aerial spraying is privately-organized, there is no deadline for objectors to raise their objection to being sprayed. The public can contact the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) and request an

investigation of suspected violations of state pesticide regulations (ch. 94, Wis. Stats. or a provision in ATCP Administrative Code).

"Forest" or "Landscape" applications?
Defining the land to be treated as a "Forest" or a "Landscape" affects the actions that are legally required of a spray coordinator and an applicator (ch. ATCP 29, Wis. Adm. Code). The definitions for the purposes of an aerial spray are:

- Forest: Any area on which trees exist, standing or down, alive or dead, actually or potentially valuable for forest products, watershed or wildlife protection or recreational uses in contrast to shade, horticulture or ornamental trees valuable for landscape, agricultural, aesthetic or similar purposes (s. 26.30(3)(d), Wis. Stats.). Forest nurseries, Christmas tree plantations, and tree seed producing areas are also considered to be forests for the purposes of pesticide applicator certification (s. ATCP 29.31(4)(a), Wis. Adm. Code).

- Landscape: Turf, ornamental and mulched areas, and areas being prepared for these purposes, that are located in or around residential premises, public or commercial facilities, parks, workplaces, care facilities, recreational areas and public lands. "Landscape" does not include utility or transportation right-of-way areas, greenhouses, nurseries, or areas used for agricultural production, forest production, or commercial turf production (s. ATCP 29.56(1)(d), Wis. Adm. Code).

An aerial applicator must have DATCP pesticide applicator certification in the appropriate categories (s. 94.705(1), Wis. Stats). An aerial applicator hired to do a "Forest" spray must have DATCP pesticide applicator certification in the "Forestry" and "Aerial Application" categories. An aerial applicator hired to do a "Landscape" spray must have DATCP pesticide applicator certification in the "Turf and Landscape" and "Aerial Application" categories.

"Turf and Landscape" certification is uncommon among Wisconsin aerial applicators, and spray coordinators should specifically ask about it when contacting applicators. If the area being considered for an aerial spray contains a mix of "Forest," "Landscape," or other areas, contact DATCP (608-224-4551 or datcppesticideinfo@wi.gov) to determine what applicator certification is required. When considering a spray within the exterior boundaries of Tribal Lands, spray organizers are encouraged to discuss requirements with an applicator, Tribe or DATCP.

Notifications to the owners of land being sprayed, and other individuals/entities in some situations, are required with aerial pesticide application (ss. ATCP 29.51, 29.52, 29.53, and 29.56, Wis. Adm. Code). Requirements differ between "Forest"

and “Landscape” applications. It is important to understand these requirements well in advance of the application.

Applicator licensing and regulations

Businesses and application personnel that apply pesticides must be licensed by DATCP (ss. 94.703 and 94.704, Wis. Stats.). Applicators will be familiar with the regulations pertaining to aerial spraying included in ch. ATCP 29, Wis. Adm. Code. Examples of regulations include record keeping, providing information to the customer and individuals on the “Landscape Registry,” posting warning signs on each landscape property that is sprayed, and having the required certification and licensing. Contact the applicator or DATCP (608-224-4551 or datcppesticideinfo@wi.gov) if there are questions about pesticide regulations.

Permit requirement for direct pesticide application to a ”Water of the State”

If direct pesticide application to a “Water of the State” such as a lake, pond, marsh, river, stream or drainage system (s. 283.01(20), Wis. Stats.) cannot be avoided, ensure that the aerial applicator or the sponsor of spraying (such as a lake association) has appropriate coverage under a water pollution permit, called a Wisconsin Pollutant Discharge Elimination System (WPDES) permit (ss. 283.31 and 283.35, Wis. Stats., and the federal Clean Water Act (33 U.S.C. Part 1251 et seq.)).

These permits are issued by the Wisconsin Department of Natural Resources. Aerial applicators may already have WPDES general permit coverage.

The WPDES general permit does not cover spray drift outside the treatment area. Applicators are expected to properly control spray drift and avoid direct application to water, as required by existing regulations (ss. ATCP 29.50(1) and ATCP 29.50(4), Wis. Adm. Code and the Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. Part 136 et seq.)).

The WPDES general permit is not applicable in some situations, including but not limited to: some discharges to outstanding and exceptional resource waters, discharges that would be expected to exceed any surface water or groundwater standards, and discharges within Tribal Lands. Contact the DNR Wastewater program if any of these exceptions may be applicable.

Use the flow chart in Figure 2 to determine if a permit may be necessary and which one would be obtained, as well as tips on filling out the form. Permit requirements may be complex. Spray organizers are encouraged to consult with their aerial applicator or DNR staff.

Information about permit requirements and responsibilities, and DNR staff contacts, can be found at the Wisconsin pest control pollutant discharge permit website.

Wisconsin Pollutant Discharge Elimination System (WPDES) Decision Flowchart

Does the spray area contain a "Water of the State" (such as a lake, pond, river, stream, marsh or drainage system), or is one adjacent or nearby?

→ **No.** A discharge permit is not needed.

↓

**Yes.** If direct application cannot be avoided, a permit would be needed to cover any pesticide discharge that enters the water.

↓

Does the pesticide intended for use have "*Bacillus thuringiensis* kurstaki" or "gypsy moth nucleopolyhedrosis virus" as the active ingredient?

→ **No**. The project doesn't meet the eligibility requirements for a general permit and an individual permit is necessary. Go to the DNR wastewater permits website and follow directions to apply for a new individual permit. Note that this may take up to 6 months.

↓

**Yes.** The general permit for forest canopy pest control may be used. Go to the pest control pollutant discharge permits website for information about the general permit.

Either the spray sponsor or the applicator must have WPDES coverage or submit a Pest Control Pollutant Discharge Notice of Intent (NOI) to obtain general permit coverage. Submit the completed form to WDNR, Water Permit Central Intake WT/3, P.O. Box 7185, Madison, WI 53707-7185. This permit must be issued before the spraying takes place. Allow 5 weeks for processing.

Tips for filling out Section VI: Eligibility of the Notice of Intent form (2019 version), for questions:

(2 ) Check "Yes" if the airborne pesticide droplets are expected to enter water that is located within the treatment area. The pollutant name is that of the pesticide used.
(4) In most cases the answer will be "No." Check the list of Outstanding and Exceptional waters. Most of these are trout streams, scenic rivers or these lakes (pages 16 and 16-1).
(5) See Appendix A for guidance on species that may be affected by an aerial spray.
(6) The answer to this question is "Yes" if following the requirements listed in the General Permit. Refer to the General Permit for specific requirements.

Figure 2. Flowchart that can be used to determine if a WPDES permit may be required for pesticide discharges to a body of water. Legal citations can be found on page 4.

## Determining the area to be sprayed

Consider whether an aerial spray treatment is appropriate
Aerial spraying is most appropriate for large areas that are square or rectangular in shape (Figure 3). Parallel boundaries are encouraged, with the exception of lake or river boundaries. A treatment area of at least 20 acres is recommended in situations where the treatment area is surrounded by infested forest that will not be sprayed.

Avoid designing treatment areas that are small, narrow or oddly-shaped because of potential problems with insect re-infestation, spray droplet deposition, and drift of pesticide away from the target area. Also, be aware that reports of poor spray coverage sometimes occur along the edge of a lake or river due to air currents and the legal inability of an applicator to spray while over water (ss. ATCP 29.50(1) and ATCP 29.50(4), Wis. Adm. Code and the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Part 136 et seq.)).

Figure 3. Examples of well-designed spray blocks, showing square and rectangular shapes with no curved boundaries (water boundaries exempted).

If the problem area is only a few trees or a few acres, aerial spraying is unlikely to be appropriate. Physical controls, an insecticide spray from the ground, or application of a systemic insecticide into the soil or the tree itself, are likely to be more practical treatment options. More information can be found on the Wisconsin gypsy moth website. Many insecticides can be purchased by a homeowner for their use, or a local arborist or tree service may be hired to do pesticide applications. To find a certified arborist, visit the Wisconsin Arborist Association website. Additional businesses offering pesticide treatments may be found online or in the phone book under “Tree Service” or “Pest Control.”

If an aerial spray is the appropriate treatment, it will be necessary to determine the area to be treated. Identify the area that is threatened and determine whether the property owners in this area are willing to pay for aerial spraying.

Identify the area that is threatened

An area threatened by a forest pest will have both high pest populations and abundant preferred hosts. Nuisance caterpillars or defoliation in the current summer are two easy indicators of potential problems next summer. Egg mass surveys can also be done to predict the next year's population level. Some population evaluations, such as those for gypsy moth and forest tent caterpillar, can be done by property owners. Instructions and a list of preferred tree species can be found in Appendix B.

Consider the distribution of preferred hosts in the potential spray area. Site visits and aerial photos can determine areas covered in broad-leaved trees such as oaks, areas dominated by conifers, and areas of open fields. It may be possible to exclude some areas that are unlikely to be damaged because they have no preferred tree species. Alternatively, it may be worthwhile to survey and expand the spray boundaries to include nearby areas dominated by preferred tree species.

Consider buffers

If pest populations are high around the treatment area, caterpillars may invade the treated area and reduce the effectiveness of the treatment along the edge. To reduce the risk of this happening, consider spraying an additional buffer of 150 or more feet around the core area to be protected. If this buffer extends onto the property of other landowners, make sure their permission has been obtained (preferably in writing). Offering to pay for treatment of the buffer area frequently helps in obtaining permission to spray their property.

Identify landowners

County planning and zoning departments commonly have free GIS websites that overlay property boundaries on top of aerial photos, as well as provide property owner information. Aerial photos and maps can also be obtained from many other websites. A property owners group, such as a lake association, may also have useful information.

While determining the area to be treated, consider whether the landowners would be willing to pay for its protection (Figure 4). It is recommended that a landowner consider property use, tree species, tree health and forest management plans (if appropriate) when deciding if the financial cost of the treatment is worthwhile.

***Recommendation:*** Raising funds through a lake association or other group is usually the easiest way to pay for spraying when many properties are involved.

Trees typically have higher value when located in residential or high-use recreational areas, and tolerance for defoliation and tree mortality is lower than in woodlots. In woodlots, the cost of spraying may exceed the value of the timber saved. Thus, a property owner whose land contains higher-value trees may be willing to pay for aerial spraying, whereas a landowner with lower-value trees may not.

Be cautioned that trees growing in very sandy soil, in poor health, or weakened by drought stress often have high levels of mortality if defoliated. Insecticide protection may be needed to prevent heavy mortality. Consult a forester or arborist.

Figure 4. This residential area in Oconto County was successfully protected from gypsy moth defoliation in 2010 (red lines added). The surrounding areas with a purple appearance were heavily defoliated.

## Selecting a pesticide

Aerial applicators often have several pesticide products to use, depending on customer preferences. Consider the advantages and disadvantages of each product. Determine who will be responsible for purchasing the insecticide and any additives or "carrier" liquids that may be used. If the proposed treatment area includes land that is enrolled in a forest certification system, confirm that the certification system allows for the use of the selected insecticide on that land.

Pesticide labeling may state that a product cannot be aerially-applied within a certain distance of habitat where some threatened or endangered species may be present. State and federal law requires that the labeling instructions be followed (s. 94.70(3)(g), Wis. Stats. and the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Part 136 et seq.)).

Bacterial insecticides

Bacterial insecticides containing the bacterium, *Bacillus thuringiensis* kurstaki (Btk), reliably control caterpillars when properly applied, affect only small caterpillars, and have an effective life of 7 to 10 days once sprayed. They are fairly environmentally benign and can be safely used near water. Impacts on human health, wildlife, fish, bees, natural enemies and other insects are minimal. In Wisconsin, these are the most frequently-used products for the treatment of defoliating forest pests.

Chemical insecticides

Chemical insecticides are much less specific than bacterial insecticides and may kill

any insects during their active period. Some chemical insecticides break down quickly, whereas others remain active for months. For these reasons, environmental impacts are greater than with bacterial insecticides. In addition, some chemical insecticides are very toxic to bees. The potential for adverse effects on human health is greater for chemical insecticides than for bacterial insecticides.

Insect growth regulators
Several insecticides known as “growth regulators” kill insects by interfering with their molting process. Some of these products are specific to caterpillars and have low impacts on the environment, animals or human health. Other products are less specific and have greater environmental impacts, especially to aquatic invertebrates. Some of these products have labeling restrictions on where they can be used.

Gypsy moth-specific insecticide
If spraying to control gypsy moth, there is a viral insecticide named “Gypchek” that only kills gypsy moth caterpillars. Other insects (including caterpillars) can feed on plants that have been sprayed with Gypchek but will not be affected. It is a powder that requires mixing with a special “carrier” liquid prior to application.

Gypchek is not commercially available. DNR forest health staff may be able to refer spray coordinators to Gypchek producers if there are no other insecticides that would avoid harm to threatened or endangered butterfly or moth species that are present. There is no guarantee of obtaining the product.

## Typical project timeline

Summer before spraying
If the area of interest is a residential or seasonal recreation area, talk to property owners while the caterpillars are present. They may also be unhappy with caterpillars or defoliation and may be interested in spraying next year. It is common for people to be less interested in spraying once the caterpillars have completed their development and only moths or egg masses are present.

Autumn before spraying
Determine the area to be treated next spring. If arranging a spray over multiple properties, obtain the permission of each landowner whose property is proposed for treatment (preferably in writing). Review the “property owner consent to spray” section on page 2. Most objections are for financial reasons, and many objectors will consent to having their property sprayed if the neighbors each contribute a few dollars and pay for it.

This is also a suitable time to conduct a preliminary Endangered Resources Review

using the DNR Natural Heritage Inventory Public Portal. Depending on the results, spray coordinators may not need to do any further review, or may need to work with DNR staff to do a further evaluation. Issues could be addressed early and would be less likely to disrupt the spray plans at a later stage.

Winter before spraying

Begin contacting licensed aerial applicators as soon as practical after determining the area to be treated. A searchable directory of aerial application companies can be found on the National Agricultural Aviation Association website. Some applicators in nearby states may also be interested in treating the area. Most applicators in the directory focus on agricultural spraying, but there are some that spray for tree pests. Ask applicators if they are willing to spray for the pest of interest, and if they do treatments in residential areas (when applicable to the project). Ask applicators to submit bids for the spray project, and make sure all involved parties understand which portions of a project they are responsible for.

***Recommendation:*** Examine the applicator's license, certification, insurance, history of forest pest treatments, and experience with treatments in residential areas (if the spray project is in or near a residential area).

After selecting an aerial applicator, spray coordinators will need to raise the money to pay for the project. The cost per acre can be highly variable and depends on factors such as location, size and shape of the treatment area, flight distance, pesticide to be used, and whether the applicator is doing other spraying in the area. In recent years, costs have ranged from about $40 to $75 per acre, and per-acre costs are usually lower for larger treatment areas. One aerial application of insecticide is usually done for tree pests. Consult the applicator if the population is very high and there is interest in doing a second spray a few days later.

If collecting funds from individuals, consider collecting more money than the per-acre cost of spraying their property. This is to cover the potential cost of spraying roads and ditches within a residential area, as well as property owners who agreed to the spraying but did not send payment. Expect one of several possibilities when raising money:

- Everyone will pay.
- Some property owners who wanted their property sprayed do not respond to requests for their share of the spray cost.
- Some property owners will not contribute money but will allow treatment of their property if someone else pays for it.
- A few property owners will neither respond, pay, nor allow treatment of their property.

If there is not enough interest and money to pay for the area initially proposed,

consider proceeding with a modified plan. For example, spray coordinators may have initially considered a 100-acre area but there is not enough interest to spray the whole area. However, there is a 20-acre core of adjacent homeowners who are interested and willing to pay, and the project could move forward with a spray of only that area.

After sufficient funds have been raised and a contract has been signed, it's time to wait until early spring.

Spring

By March, contact the applicator and determine how much advance notice is needed in order to spray the area at an appropriate time. Some applicators may only need a few days notice, while others may want more time.

Spray dates fluctuate from year to year because of variation in spring weather. In southern Wisconsin, spraying for most forest pests occurs in mid- to late May. In northern Wisconsin, spraying usually occurs in late May or the first half of June. Many products, particularly bacterial or viral insecticides, are most effective at specific stages of the insect's development. Sprays must also be applied when leaves and needles are large enough to intercept the spray droplets. Spray coordinators should decide who will monitor insect and foliage development, and work with the applicator to determine what development information is needed to properly time the application of the selected insecticide. See Appendix B for information on monitoring the development of the insect pest and its preferred hosts.

Spray notification

As the spray day approaches, project coordinators are encouraged to let property owners and local law enforcement know that the area will be sprayed soon, and that low-flying aircraft may be spraying very early in the morning. It is suggested that this notification mention that to avoid direct exposure, individuals within the treatment area may choose to stay inside, with doors and windows closed during spraying. Significant health effects are highly unlikely, but to be on the safe side, those with severe asthma or food allergies may consider leaving the area during spraying. Consult the applicator or medical professional for additional safety recommendations.

State regulations include requirements that:

- Prior to pesticide application, "Landscape" applications be posted with warning signs meeting specific text size and content requirements (s. ATCP 29.56(3), Wis. Adm. Code);
- If a "Landscape" is being treated, at least 12 hours advance notice be provided to individuals who listed nearby properties on the Landscape Registry (s. ATCP 29.56(8), Wis. Adm. Code); and,

- At least 24 hours advance notice must be provided to adjacent residents who have submitted a written request for notification of aerial applications, unless the application site is more than 1/4 mile from the adjacent parcel on which the requester resides (s. ATCP 29.53(2), Wis. Adm. Code). This applies to both “Forestry” and “Landscape” applications.

Additional details and requirements can be found in Wisconsin Administrative Code Chapter ATCP 29 - Pesticide Use and Control.

Spray day weather conditions

Aerial spraying is usually done during the early morning because relative humidity is higher and winds are calmer than later in the day. The project coordinator should be in communication with the applicator to decide whether the spraying should occur or be delayed due to unfavorable weather conditions before, during, or after the expected time of pesticide application.

Consult with the applicator about unfavorable weather conditions (such as wet tree leaves, expected rainfall or windy conditions) that would warrant delaying the treatment. Typically, spraying should not occur if it is too windy or if significant rainfall is forecast before the product could dry on the leaves (this varies by product). A wind speed of 10 miles per hour or greater is a common cutoff for spraying, although a lower limit may be advisable if the treatment area is small, thin or irregularly-shaped.

## Appendix A: Protection of non-target species, including threatened and endangered species

Certain animal and plant species are protected by state or federal laws (such as s. 29.604, Wis. Stats., ch. NR 27, Wis. Adm. Code, and the federal Endangered Species Act (16 U.S.C. Part 1531 et seq.)). Spray coordinators are encouraged to do an Endangered Resources Review early in project planning, to help determine if these species could be impacted by spraying.

### 1. Karner blue butterfly

The Karner blue butterfly, *Lycaeides melissa samuelis,* usually occupies prairies, road and utility rights-of-way, forest openings and other open or partially-cleared areas containing wild lupine, the only known larval host plant for the butterfly. Karner blue butterfly is a federally-listed endangered species that is protected by the Endangered Species Act (16 U.S.C. Part 1531 et seq.). Wisconsin has the nation's largest population of this butterfly. To protect this species and its habitat, Wisconsin has a Federal Incidental Take Permit and associated Habitat Conservation Plan (HCP) in coordination with the U.S. Fish and Wildlife Service. The Permit and HCP allow partners in the program to legally conduct forest management activities that may impact the butterfly.

**Spraying for forest pests where Karner blue butterflies may be present**

Planning an aerial spray in or near Karner blue butterfly habitat can be more complicated and restrictions may apply. The "High Potential Range" of the butterfly is shown in light blue in Figure 5, and more detailed maps are available on the DNR website. These maps are periodically revised, so it is important to check for updates before starting a spray project.

Under the Karner blue HCP, private landowners within the High Potential Range are allowed to spray for gypsy moths or other forests pests if they fall within the "Voluntary Category" (as identified in the HCP and listed below). The HCP recognizes that some Karner blue populations could be impacted by spraying to control gypsy moth or other forest pests. However, the HCP was designed to allow management activities to take place in certain areas while ensuring a healthy overall population in Wisconsin.

It is recommended that spray organizers contact the DNR Karner blue butterfly program if the proposed spray area is in the High Potential Range (Figure 5), to determine if a spray project would be covered under the HCP and make sure that

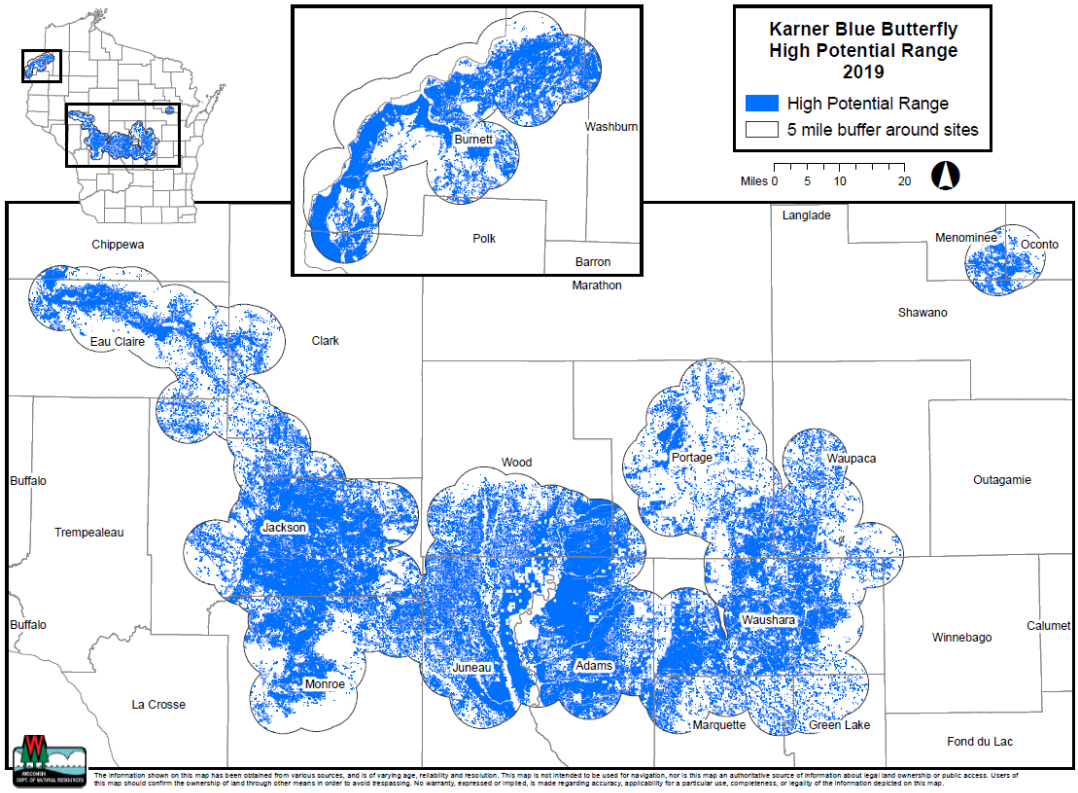


Figure 5. Karner blue butterfly "High Potential Range" as of June 2020 is shown in blue. The DNR Karner blue butterfly program should be contacted if aerial spraying is proposed in this blue area.

legal violations can be avoided. It is possible that some of property parcels within the proposed spray area are covered by the HCP, but other parcels are not covered because of their ownership or use. A situation such as this can be especially important for entities such as local governments and lake associations, where multiple types of property ownership are often present. In addition, Karner blue habitat may contain other protected species (page 17).

<u>Landowners in the Voluntary Category (non-regulated landowners)</u>
The HCP allows landowners who meet one of three criteria, listed below, to spray their property for gypsy moths or other forest pests <u>within</u> the Karner blue High Potential Range as long as they are not in a "Non-Voluntary Landowner Category."

1. Private forest landowner with less than 1,000 acres in Wisconsin.
2. Non-commercial forest landowner with greater than 1,000 acres of land, where the land is primarily managed for a purpose other than commercial forestry (e.g., managed for recreation, as camps or lake associations).
3. Agricultural landowner with the land currently in agricultural use.

However, protection of Karner blue populations is still encouraged.

Landowners in the Non-Voluntary Category (regulated landowners)
The following groups are not automatically authorized under the HCP to spray within the High Potential Range, and must contact the DNR Karner blue butterfly program for assistance.

- Railroads
- Municipal, cooperative or private utility or energy company
- Commercial forests larger than 1,000 acres (including county forests)
- Road or highway departments
- Land developers
- HCP partners

If a proposed spray area is outside of the High Potential Range, there are no special requirements for Karner blue butterfly protection. The species is either absent or impacts would be low and would not affect the butterfly's long-term viability in Wisconsin. However, voluntary protection is encouraged.

**Impacts of aerial spraying on Karner blue butterflies**

Aerial spraying for forest pests usually occurs in May and early June, which coincides with the period when Karner blue caterpillars are present where the species occurs. Reduced populations are likely if the species is present, but the impacts will be localized to the spray area. Populations can recover due to surviving larvae and movement of adult butterflies. In addition, HCP partners work to protect the butterfly and increase populations in areas where recovery efforts are focused.

**Conserving Karner blue butterflies while still treating forest pests**

Several methods can be used to reduce impacts on Karner blue butterfly and other rare or uncommon species.

Planning the spray
Aerial sprays can be conducted in ways that minimize their effects on Karner blue habitat. Options include:1) avoiding forest openings when spraying; 2) changing the direction of aerial application to avoid drift into Karner blue habitat; 3) avoiding spraying on windy days; and 4) altering the treatment boundaries. When planning a spray, discuss the options with the DNR Karner blue butterfly program, DNR Forest Health staff, or the aerial applicator.

Karner blue butterflies can recolonize suitable habitat once a pesticide has

degraded. When using a short-persistence product such as a bacterial insecticide, Karner blue can disperse to sprayed areas as early as that summer if there are nearby butterfly populations, abundant lupine and nectar plants.

Gypsy moth-specific insecticide

If spraying to control gypsy moth, there is a viral insecticide named “Gypchek” that only kills gypsy moth caterpillars. Karner blue larvae can feed on lupine plants that have been sprayed with Gypchek. Gypchek is not commercially available. DNR forest health staff may be able to refer spray coordinators to Gypchek producers if there are no other insecticides that could be used. There is no guarantee of obtaining the product. This insecticide may also be the best option if there are other legally-protected species present (see section 3 on page 17).

Temporary cover

Individual lupine plants and small patches can be protected from insecticide sprays by covering them with a tarp prior to the spray application. It is important to know when spraying will occur, so that the plants are not covered for longer than necessary. Take the tarp off once the spraying is complete. This technique works best with a short-persistence product such as a bacterial insecticide. If an insecticide with a long active life is used, Karner blue larvae that move away from the protected patch may be killed.

Small scale or individual tree treatments

Individual tree sprays or systemic insecticide treatments could be used if there are only a few trees to protect. Review product labeling and take care to avoid movement of an insecticide into sites where lupine is present. Systemic insecticides are applied to the soil or directly into the tree, and move within the tree up to the leaves. Karner blue caterpillars won’t be exposed to insecticides that are injected into a nearby tree, since they only feed on lupine plants. Below-ground movement (leaching) of an insecticide is more likely when applied to sandy soils.

Additional controls

For a small area or a few trees, there are additional controls that can be used to manage moderate pest populations or supplement insecticide treatments without harming Karner blue butterflies or other species. These techniques include: 1) removing egg masses; 2) treating gypsy moth egg masses with horticultural oil; 3) using sticky barrier bands and burlap collection bands; and 4) spraying with an insecticidal soap. Visit the Wisconsin gypsy moth website for more information.

What else can be done to help the Karner blue butterfly?

Efforts to help conserve the Karner blue butterfly are valued, especially in the “High Potential Range” shown in Figure 5. Detailed maps of these areas are

available. In addition, managing some sites as barrens habitat could benefit Karner blue and other rare species. Additional resources and contact information for DNR experts can be found on the Karner blue butterfly website.

## 2. Bald eagle nest avoidance

Bald eagles are protected by the federal Bald and Golden Eagle Protection Act (16 U.S.C. Part 668 et seq.) and the Migratory Bird Treaty Act (16 U.S.C. Part 703 et seq.), even though bald eagles were removed from the federal list of endangered and threatened species in 2007. These laws prohibit adversely affecting bald eagles. The U.S. Fish and Wildlife Service has developed guidelines for determining if a permit is needed to conduct a given activity near a bald eagle nest. These guidelines are based on several decades of behavioral observations, science, and conservation measures for avoiding or minimizing adverse impacts to bald eagles.

In order to avoid violating the laws that protect bald eagles, the National Bald Eagle Management Guidelines recommend that aircraft stay at least 1,000 feet away from active bald eagle nests during the breeding season (except where eagles have demonstrated tolerance for such activity), or a federal permit may be necessary.

In the Midwest, the breeding season is typically from late January through early August, and it is important to note that this period overlaps with the timing of forest pest spraying. More information and step-by-step guidance is available at the U.S. Fish and Wildlife Service Midwest Region - Eagle Permits website.

## 3. Avoiding injury to other threatened or endangered species

The Wisconsin Department of Natural Resources maintains a list of rare species that are protected by state law (s. 29.604, Wis. Stats. and ch. NR 27, Wis. Adm. Code), similar to the federal list of threatened and endangered species developed under the Endangered Species Act (16 U.S.C. Part 1531 et seq.). In order to avoid harming certain threatened or endangered species, it is possible that some insecticides may be prohibited from use where the species are known to occur.

A preliminary Endangered Resources Review can be conducted using the DNR Natural Heritage Inventory Public Portal. Further screening may not be necessary, or a spray coordinator may be need to work with DNR staff to do a further evaluation. Spray coordinator observations from the site (and other sources of rare species information) are also important for protecting species that could be affected by forest pest spraying.

**Threatened or endangered species that may be impacted by forest pest spraying**

Listed below are legally-protected species that could be affected by an insecticide or a low-flying aircraft conducting aerial spraying. State and/or federal laws prohibit the "take" (destruction or harm) of any of these species without a valid permit (s. 29.604, Wis. Stats., ch. NR 27, Wis. Adm. Code, the Endangered Species Act (16 U.S.C. Part 1531 et seq.), and the Migratory Bird Treaty Act (16 U.S.C. Part 703 et seq.)).

- Butterflies and moths (potentially impacted by both Btk bacterial insecticides and other insecticides): northern blue butterfly, swamp metalmark, Ottoe skipper, frosted elfin, Powesheik skipperling, silphium borer moth, phlox moth, regal fritillary, Karner blue butterfly (addressed on page 11)
- Other insects (not affected by Btk bacterial insecticides, but impacted by most other insecticides): Pecatonica river mayfly, red-tailed prairie leafhopper, flat-headed mayfly, *Attenuipyga vanduzeei* (a leafhopper), hairy-necked tiger beetle, giant carrion beetle, extra-striped snaketail (a dragonfly), Saint Croix snaketail (a dragonfly), Hine's emerald (a dragonfly), incurvate emerald (a dragonfly), spatterdock darner (a dragonfly), Knobels riffle beetle, Lake Huron locust, *Fitchiella robertsoni* (a planthopper), prairie leafhopper, rusty patched bumble bee
- Large birds: osprey, northern goshawk, red-shouldered hawk, peregrine falcon, great egret, colony-nesting birds
- Insectivorous Birds: Cerulean warbler, hooded warbler, worm-eating warbler, Kentucky warbler, Kirtland's warbler, Acadian flycatcher
- Bats: big brown bat, little brown bat, northern long-eared bat, eastern pipistrelle

The butterfly and moth species listed above are susceptible to bacterial insecticides as well as most other types of insecticide (but not "Gypchek"). Although only the legally protected butterfly and moth species are listed above, there are additional uncommon ("Special Concern") species on the Natural Heritage Working List for which voluntary conservation is encouraged.

The use of most insecticides is likely to affect many insect species, including those that are legally protected (as listed above), species of special concern, and other more abundant insects. Rare insectivorous birds and threatened bat species can be indirectly impacted by removing a large portion of their food source, particularly when a non-bacterial insecticide is used.

Ospreys, hawks, falcons and colony-nesting birds are sensitive to nest disturbance from low flying aircraft. If these nests/colonies are in or near the proposed spray area, contact the Bureau of Natural Heritage Conservation to evaluate case-by-case options that would avoid "take" of these species. Having an Endangered Resources Review done early in the planning process may alert spray coordinators to the presence of these nests/colonies and provide time to alter the spray project. More information about eagles can be found in section 2 on page 17.

Eastern prairie white-fringed orchid (*Platanthera leucophaea*) is a legally protected, rare plant that requires certain moths for its pollination. The orchid is state-listed as an endangered species (s. NR 27.03, Wis. Adm. Code) and federally-listed as a threatened species under the Endangered Species Act (16 U.S.C. Part 1531 et seq.)). Special care is warranted whenever spray treatments are being planned near its habitat (usually prairies).

Additional information on these and other species is available on the DNR Endangered Resources website.

**State Natural Areas**

The locations of State Natural Areas can be found online through the State Natural Areas Program website. Check to see if the spray area is adjacent to a State Natural Area. Alternatively, a check for nearby State Natural Areas will be done as part of the Endangered Resources Review process. Prior notification of the State Natural Areas Program is encouraged if spraying is adjacent to a State Natural Area.

**Conserving rare animals and plants when planning a spray area**

Avoiding certain habitats when designing spray blocks can help avoid impacts to many rare and uncommon species, especially butterflies and moths. These habitats include forest openings, barrens, prairies, rock outcroppings and wetlands. Planning an aerial spray near these habitats and State Natural Areas should be done carefully. Reporting of rare species locations is encouraged. Additional information on rare species is available on the DNR Endangered Resources website.

Spray drift, although not intentional, can be harmful to many of the species mentioned in this Appendix (and other species as well). Select a narrow-spectrum insecticide when possible, to minimize impacts to rare species. Use small-scale or individual treatments, if possible, to avoid unintented impacts to other habitat.

## Appendix B: Pest-specific information

## 1. Gypsy moth

Defoliation will be most severe and frequent on these favored species:

- oak
- aspen
- birch, except for yellow birch
- basswood and linden
- apple and crabapple
- willow
- tamarack
- witch hazel
- hazel shrub
- serviceberry

Figure 6. Gypsy moth egg masses on a maple.

Gypsy moth caterpillars that are 3/4" and larger can feed on tree and shrub species that smaller caterpillars typically cannot. The larger caterpillars may defoliate less-preferred hardwood species, and conifers such as white pine, red pine, spruce and hemlock. These other species are at risk if they are near preferred species that the caterpillars can feed on when small.

**Predictive surveys and using them to determine the area to be treated**

When gypsy moth populations increase over large areas, the intensity of the population varies considerably from site to site. Predictive sampling using egg masses (Figure 6) can focus aerial spraying on those areas likely to be damaged if the pest population is not reduced.

If planning to sample egg mass numbers, wait until mid-August in southern Wisconsin or Labor Day in northern Wisconsin. This will ensure that all of the egg masses have been produced for the year. Visit the Wisconsin gypsy moth website for an egg mass survey method that can be used to predict next year's defoliation intensity. Count only new egg masses that appear to be fresh and undamaged, and do not count older egg masses that appear faded and damaged.

Within the area being considered for treatment, take several egg mass samples in locations that are representative of the forest cover. If there are many egg masses on

one end of the area but few on the other, consider expanding the treatment area or moving spray boundaries to center on the area with the highest pest population. Be aware that large caterpillars can crawl up to 150 feet in search of food. If preferred tree species such as oak or aspen are close to a heavy gypsy moth infestation, the caterpillars will likely move into these favored trees and cause damage even if there are few egg masses there.

Heavy defoliation (over 50%) is predicted if the sampling indicates that there are more than 500 egg masses per acre in a residential area, or more than 1,000 egg masses per acre in a woodlot. However, the pest outbreak may be naturally declining if the egg masses are very small. Consult DNR Forest Health staff for technical assistance in this situation.

Figure 7. Small gypsy moth caterpillars, both about ½" in length, at a size where aerial spraying usually occurs.

**Timing of gypsy moth spraying**

When timing the spray application, consider both caterpillar development and leaf size.

Before the eggs hatch, the project coordinator or designee should identify 25 or more egg masses within the treatment area to monitor for hatching. Select new (firm) masses that are located on trees at eye level or lower, and are at least 6 inches from other masses. Choose masses from a variety of positions around the trees, and avoid masses on buildings or other outdoor objects.

In mid-April (southern Wisconsin) or late April (northern Wisconsin), start checking the egg masses every few days until the first small caterpillars are seen on them. When spring weather is very warm, hatch monitoring should begin about two weeks earlier. Once hatching has started, check every two days and count the total number of larvae on the masses selected for monitoring. Numbers can be estimated if there are likely more than 100 larvae on a mass. Hatching will start slowly, pick up and then decline.

Aerial spraying for gypsy moth usually occurs about 10 to 14 days after the peak egg hatching. However, do not plan to spray using only this rule-of-thumb because this timing will be affected by abnormal temperatures or other weather conditions.

Egg hatch should be finished before spraying occurs, and most caterpillars should be about 3/8" to 1/2" in length (Figure 7). Look for the small caterpillars on the underside of tree and shrub leaves of favored species. If needed, contact DNR Forest Health staff for

spray timing advice.

At the same time as egg hatch starts, monitor the oak leaf development in the area to be sprayed. Oaks will leaf out later than most species, but since oak is the gypsy moth's favorite tree species in most treatment areas, focus on its leaf expansion. Typically, spraying occurs when the oak leaves average 3" to 4" in length. Spraying too early results in too little leaf area to adequately intercept the spray, and spraying too late results in the outer leaves intercepting most of the spray.

When populations are high, expect to see some leaf feeding occur prior to the spraying. This amount of feeding should not affect the tree or spray effectiveness unless populations are extremely high.

## 2. Forest tent caterpillar

Forest tent caterpillar (Figure 8) is primarily a pest in northern Wisconsin, and periodic outbreaks occur over a large area. The most common tree species affected are aspen and oak. Growth loss is the major impact on trees, although defoliated trees can be weakened and become susceptible to mortality from other causes. Outbreaks and defoliation frequently occur for multiple years at a given site before the outbreak comes to an end. The presence of many large flies that often land on people is a sign that the outbreak is probably coming to an end. These flies attack the pupae of the forest tent caterpillar, leading to a decline in the caterpillar population.

Figure 8. Forest tent caterpillar (mature larva). Larvae are typically sprayed when smaller.

**Note:** Forest tent caterpillar may be misidentified as gypsy moth or eastern tent caterpillar. Make sure the pest species is correctly identified before proceeding to organize spraying.

### Determining the area to be treated

Forest tent caterpillar defoliation tends to be widespread and is less spotty in nature than gypsy moth defoliation. Landowners do not need to rely on local egg mass counts as much as they would with gypsy moth outbreaks. If landowners track outbreaks by staying in touch with DNR Forest Health staff, they should have a good idea what the local populations will be like.

| Predicting defoliation levels caused by forest tent caterpillars based on trends in local observations | | | | | |
|---|---|---|---|---|---|
| **Observations from last summer** | **FTC population levels** | | | | |
| | **Very low** | **Low** | **High** | **Peak** | **Collapsed** |
| **Severity of defoliation** What percentage of the leaves on oak, basswood, aspen and birch trees were eaten by FTC in late June? | Minimal < 25% | Moderate 25-50% | High 50-75% | Complete 75-100% | None 0% |
| **Caterpillars typically observed** During a short walk, how many caterpillars did you see? | 1 or 2 | Several | Hundreds | Thousands | None |
| **Cocoons typically observed** Were cocoons observed on buildings or in shrubbery during a short walk? | None | Few | Many | Dozens | None |
| **Friendly flies typically observed** During a short walk, how many friendly flies did you observe? | None | None | Dozens | Hundreds | Dozens |
| **Nuisance moths observed** How many dead moths did you sweep away on patios, sidewalks or driveways? | None | None | Few | Many | None |
| **Egg masses found near well-lit areas** Did you observe egg masses on trees or buildings? | None | 1 or 2 | Few | Several | None |
| **Predicted FTC defoliation levels for the upcoming summer** | **Trace to Light** | **Moderate to High** | **High to Complete** | **Complete 100%** | **None** |

Table 1. Forest tent caterpillar prediction guide developed by the Minnesota Department of Natural Resources.

The Minnesota Department of Natural Resources developed a guide (Table 1) that can be used to predict forest tent caterpillar population levels using local observations. In residential areas, a spray coordinator could also use other criteria such as nuisance caterpillars, increasing defoliation during the previous summer, or interest in treatment to determine the area to be sprayed.

**Monitoring hatch**

Figure 9. Forest tent caterpillar larvae hatching from an egg mass on a twig. Larvae are about 1/4” in length.

Forest tent caterpillar egg masses are silvery bands that wrap around a twig (Figure 9). Find several trees where there are about 25 new (firm) egg masses within 8 to 10 feet of the ground. In mid-April, begin monitoring these masses every day or two and record when the hatching begins on each mass. Egg hatch should roughly coincide with the emergence of tree leaves in the spring. Then, watch the development of the caterpillars, because the timing of spraying will be based on the size of the caterpillars and leaves. Monitor the size of the caterpillars on small trees, low-hanging branches and shrubs. The small larvae from an egg mass often cluster together on a group of small leaves.

If the area to be sprayed has a significant oak component (over 25%), monitor the development of the oak leaves. Oaks will leaf out later than the aspen in the area. If there is only a minor oak component, monitor the aspen leaves instead.

The optimal period for spraying occurs when the caterpillars are 3/8” to 1/2” in length, and the leaves are about half their normal length (when oaks are 3” to 4” and aspen are 1 1/2” to 2”). Normally this would be sometime in May in northern Wisconsin. If a second spray is planned, it should occur 3 to 5 days after the first.

When populations are very high, the small caterpillars may eat the foliage off as it appears. If this is the case, time the spraying only on the size of the caterpillars. Unfortunately, spray effectiveness will likely be reduced because of the reduced leaf area to intercept the pesticide. Alternative insecticides may be worth considering when planning the spray project.

## 3. Jack pine budworm and spruce budworm

Population sampling for Jack pine budworm (Figure 10) and spruce budworm is more complicated than for gypsy moth or forest tent caterpillar. It is recommended that landowners contact DNR Forest Health staff for technical assistance.

The hidden feeding habits of young budworm larvae make these species difficult targets for insecticidal control. The most common products used to control budworms are bacterial insecticides containing Btk. For both budworm species, the first life stage that

can be targeted by bacterial insecticides is the relatively open-feeding 4th instar caterpillar. This stage would occur from late May to mid-June in Wisconsin. Since this is relatively late in larval development for bacterial insecticide applications, a single high dose approach is advised. Applications should also be high volume in order to get the insecticide down to the base of the needles. This is necessary because the open-feeding larvae tend to eat at the base of needles.

Figure 10. Jack pine budworm (mature larva). Larvae are typically sprayed when smaller.

If a bacterial insecticide is used, jack pine budworms should be treated approximately two weeks after most of the male flowers stop shedding pollen. Spruce budworms should be sprayed about 7 to 10 days after all the bud caps have been shed from the new growth. If pollen cones are scarce, spray when the new needles are 1/2 to 3/4 expanded.

Bacterial insecticides are specific to caterpillars and will not kill the natural enemies of the budworms. Bacterial insecticides will not come close to a total kill of budworms, but should provide enough control to keep the trees green and alive.

A DNR Forest Health staff directory can be found online.

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# WISCONSIN DEPARTMENT OF NATURAL RESOURCES
# NOTICE OF FINAL GUIDANCE & CERTIFICATION

*Pursuant to ch. 227, Wis. Stats., the Wisconsin Department of Natural Resources has finalized and hereby certifies the following guidance document.*

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FA-20-0027

**DOCUMENT TITLE**

Organizing an Aerial Spray for Forest Pests: Recommendations and Regulations

**PROGRAM/BUREAU**

Forest Health, Applied Forestry Bureau

**STATUTORY AUTHORITY OR LEGAL CITATION**

S. 26.30, Wis. Stats. and others, including S. 29.604, Wis. Stats. (endangered and threatened species protected) and S. 94.607, Wis. Stats. *et seq*. (pesticides)

**DATE SENT TO LEGISLATIVE REFERENCE BUREAU (FOR PUBLIC COMMENTS)**

5/4/2020

**DATE FINALIZED**

7/6/2020

## DNR CERTIFICATION

*I have reviewed this guidance document or proposed guidance document and I certify that it complies with sections 227.10 and 227.11 of the Wisconsin Statutes. I further certify that the guidance document or proposed guidance document contains no standard, requirement, or threshold that is not explicitly required or explicitly permitted by a statute or a rule that has been lawfully promulgated. I further certify that the guidance document or proposed guidance document contains no standard, requirement, or threshold that is more restrictive than a standard, requirement, or threshold contained in the Wisconsin Statutes.*

Carmen Hardin 6/30/2020

Signature Date