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School IPM Fact Sheet

Pesticides, State Regulations, and IPM in Maine Schools

What is a pesticide?

- A pesticide is any natural or man-made chemical product that claims to kill, repel, or mitigate a living organism. Pesticides typically used on school properties include: ant cups, insect sprays, and dusts; weed control products; mouse poisons; and disinfectants applied to control mold or germs. Most, but not all, pesticides sold in Maine have an 'EPA Reg. No.' (EPA Registration Number) on the container label.

May pesticides be used in schools?

- Pesticides may only be legally applied in Maine schools by persons having a valid commercial pesticide applicators license in the proper category for the intended purpose. The exceptions to this regulation are the use of disinfectants used for routine cleaning, the use of insect repellents for personal protection, and emergency use of over-the-counter insecticides for control of stinging or biting insects that pose an immediate threat to human health.

What is required by the new regulation, *Standards for Pesticide Applications and Public Notifications in Schools*?

- All schools must adopt and implement an integrated pest management (IPM) policy.
- Superintendents or school boards must appoint an IPM coordinator.
- Within the first 2 weeks of school, parents, guardians, and school staff must be notified about the school's IPM policy and notification procedures for possible pesticide use during the year.
- Public and private schools must notify parents, guardians, and staff before pesticides are used in schools or on school grounds.

Does this new regulation apply to childcare programs and preschools, too?

- Yes, if the childcare program is in a school or shares facilities with any grades K through 12.

Do licensed school staff follow the same regulations as contracted pest management professionals?

- Yes. See *Certification and Licensing for Commercial Applicators* in this chapter.

Why did the Board of Pesticides Control adopt this regulation?

- The Board convened a diverse stakeholder committee representing school administrators and staff, pest management professionals, environmental organizations, and others who developed the regulation to address potential health risks posed by the use of pesticides in schools.

Must the school hire an outside contractor to do pest management?

- No. Many pest management solutions can be done by school staff. The most effective solutions include keeping facilities clean and well maintained, regularly inspecting buildings and grounds for evidence of pests and pest prevention needs, and using non-pesticide pest traps. Pesticides may not be needed.

Does the Board of Pesticides Control recommend any specific pest control companies or have any companies been contracted to help with compliance?

- No. The BPC does not recommend any specific pest control company and no company has been contracted to help with compliance with this rule. The Board can make available a list of licensed companies and recommends that schools use the contracting guidelines available at www.thinkfirstspraylast.org/schoolipm/ or by calling 207-287-7545.

What is required of the Integrated Pest Management Coordinator?

- The IPM coordinator is a *school employee, not a contractor*, who implements the school IPM policy. This person must be knowledgeable about IPM, but is NOT required to be licensed unless pesticide application is also part of their duties. However, many schools find that having a staff member become licensed is an asset whether contracting for IPM services or doing it in-house.
- Maintains the pest management and pesticide application records.
- Notifies parents, guardians, and staff and ensures that required signs are posted in advance of non-exempted pesticide applications (see below).
- Makes available to requesting parents, guardians or staff a copy of the *Standards for Pesticide Applications and Public Notifications in Schools*, pesticide application records, and information about pesticides used at the school.
- Makes the school's IPM policy available to anyone requesting it.
- Ensures all pesticide applications are performed in compliance with the school's IPM policy.

How must the initial notification be done?

- We recommend it be included in the school's handbook given out at the start of each year. The notice can also be sent home in backpacks, by e-mail, or any other way as long as the school is assured that all staff, parents, and guardians receive it**.** (See the Planning and Notification Templates chapter for sample notification letters.)

If the school does not use any pesticides, must the initial notice be given?

- Yes. The regulation requires that all schools adopt an IPM policy and that all schools notify staff, parents, and guardians about the policy, where it may be reviewed and how the school plans to notify parents and staff before a pesticide is applied.

How is specific pesticide application notification given?

- Schools must notify parents, guardians, and staff at least 5 days in advance of non-exempted pesticide applications, providing specific information about the pesticide.
- Schools can choose between providing universal notice to all staff, parents, or guardians before each non-exempted pesticide application or only to those requesting to be put on a notification registry.
- At least two working days prior to non-exempted pesticide applications schools must also post required signs at points of access and in a common area of the school. See *Standards for Pesticide Applications and Public Notifications in Schools* in this chapter for specifics.

How much will it cost to comply with this regulation?

- Unless a school chooses to send notices via U.S. mail, there should be minimal costs for printing the required notices and signs. Other infrequent costs include optional training sessions, optional licensing of school staff to apply pesticides and the resource materials associated with training and licensing. In the long term, integrated pest management programs usually cost less than traditional monthly pesticide applications. Cost of non-compliance could be much higher!

Standards for Pesticide Applications and Public Notifications in Schools

Department of Agriculture, Food & Rural Resources,
Board of Pesticides Control, Chapter 27

SUMMARY: These regulations establish procedures and standards for applying pesticides in school buildings and on school grounds. This chapter also sets forth the requirements for notifying school staff, students, visitors, and parents about pending pesticide applications. This rule becomes effective August 30, 2003.

Section 1. Definitions

A. Integrated Pest Management. For the purposes of this regulation, integrated pest management (IPM) means the selection, integration, and implementation of pest damage prevention and control based on predicted socioeconomic and ecological consequences, including:
   1. Understanding the system in which the pest exists.
   2. Establishing dynamic economic or aesthetic injury thresholds and determining whether the organism or organism complex warrants control.
   3. Monitoring pests and natural enemies.
   4. When needed, selecting the appropriate system of cultural, mechanical, genetic, including resistant cultivars, biological or chemical prevention techniques or controls for desired suppression.
   5. Systematically evaluating the pest management approaches utilized.

B. School. For the purposes of this regulation, School means any public or private elementary or secondary school, kindergarten, or nursery school that is part of an elementary or secondary school or a tribally funded school.

C. School Building. For the purposes of this regulation, School Building means any structure used or occupied by students or staff of any school.

D. School Grounds. For the purposes of this regulation, School Grounds means:
   1. Land associated with a school building including playgrounds, athletic fields and agricultural fields used by students or staff of a school.
   2. Any other outdoor area used by students or staff that is under the control of a school.

E. Integrated Pest Management Coordinator. The lead person in a school system or school who is knowledgeable about integrated pest management and is designated by each school to implement the school pest management policy.

Section 2. Integrated Pest Management Policy and Coordinator

A. All public and private schools in the State of Maine shall adopt and implement a written policy for the application of integrated pest management techniques in school buildings and outdoors on school grounds.

B. Each school shall appoint an IPM coordinator who shall maintain the school's integrated pest management policy. The IPM coordinator shall keep at least one copy of the policy on site in every school and make it available to the public upon request.

Section 3. Exemptions

A. The following pesticide uses are exempt from the requirements of Section 4 and 5 of this Chapter:
   1. Application of ready-to-use general use pesticides by hand or with non-powered equipment to control or repel stinging or biting insects when there is an urgent need to mitigate or eliminate a pest that threatens the health or safety of a student, staff member or other occupant.
   2. Application of general use antimicrobial products by hand or with non-powered equipment to interior or exterior surfaces and furnishings during the course of routine cleaning procedures.
   3. Application of paints, stains or wood preservatives that are classified as general use pesticides.

B. The following pesticide uses are exempt from the requirements of Section 4 of this Chapter:
   1. Non-volatile liquids injected into cracks, crevices or wall voids.
   2. Non-volatile baits, gels, pastes and granular materials placed in areas inaccessible to students.
   3. Indoor or outdoor applications performed when school is not in session and will not be in session until the re-entry or restricted entry interval specified on the pesticide label has elapsed.
   4. Indoor application of a pesticide with no re-entry or restricted entry interval specified on its label but entry to the treated area is restricted for at least 24 hours.

> The BPC has adopted the following statement until an amendment is added to define "non-volatile" in the Department of Agriculture, Food and Rural Resources Rule Chapters.
>
> **Non-volatile.** "Non-volatile" means a product with a vapor pressure of less than 10 Pascals (0.75 millimeters of mercury) at 25° Centigrade (77° Fahrenheit).

Section 4. Notification

A. Within the first two weeks of every school year, notice shall be given by all schools to all school staff and parents or legal guardians of students advising them that a school integrated pest management policy exists and where it may be reviewed, that pesticides may periodically be applied in school buildings and on school grounds and that applications will be noticed in accordance with Sections 4(B-D) hereof. This notice shall also state that a report of prior pesticide applications and information about the pesticides used and a copy of the Pesticides in Schools regulation (CMR 01-026 Chapter 27) are available for review.

B. Notices given as required by Section 4C shall state, as a minimum: (a) the trade name and EPA Registration number of the pesticide to be applied; (b) the approximate date and time of the application; (c) the location of the application; (d) the reasons for the application; and (e) the name and phone number of the person to whom further inquiry regarding the application may be made. These notices must be sent to school staff and parents or legal guardians of students at least five days prior to the planned application.

C. Schools shall provide notice of pesticide applications in accordance with either Section 4C(1) or 4C(2).

1. Notice may be given to all school staff and parents or legal guardians of students using a school whenever pesticide applications not exempted by Section 3 are performed inside a school building or on the school grounds, or
2. The school may establish a notification registry whereby persons wishing notification of each application performed inside a school building or on school grounds may make a written request to be put on the registry list to receive notice whenever pesticide applications not exempted by Section 3 are performed.

D. In addition to the notice provisions above, whenever pesticide applications not exempted by Section 3 are performed in a school building or on school grounds, a sign shall be posted at each point of access to the treated area and in a common area of the school at least two working days prior to the application and for at least forty-eight hours following the application. Posting of the notification signs as required by this Chapter satisfies the posting requirements of Chapter 28 of the Board's regulations.

1. The signs shall be:
   a. At least 8.5 inches wide by 11 inches tall for indoor applications.
   b. At least 5 inches wide by 4 inches tall for outdoor applications.
   c. Made of rigid, weather resistant material that will last at least ninety-six (96) hours when placed outdoors.
   d. Light colored (white, beige, yellow or pink) with dark, bold letters (black, blue, red, or green).
2. The signs for indoor applications must bear:
   a. The word CAUTION in 72 point type.
   b. The words PESTICIDE APPLICATION NOTICE in 30 point type or larger.
   c. Any reentry precautions from the pesticide labeling in at least 12 point type.
   d. The trade name and EPA Registration number(s) of the pesticide(s) to be applied in at least 12 point type.
   e. The approximate date and time of the application in at least 12 point type.
   f. The location of the application in at least 12 point type.
   g. The reason(s) for the application in at least 12 point type.
   h. The name and phone number in at least 12 point type of the person to whom further inquiry may be made regarding the application.
3. The signs for outdoor applications must bear:
   a. The word CAUTION in 72 point type.
   b. The words PESTICIDE APPLICATION in 30 point type or larger.
   c. The Board designated symbol.
   d. Any reentry precautions from the pesticide labeling in at least 12 point type
   e. The trade name and EPA Registration number(s) of the pesticide(s) to be applied in at least 12 point type.

Board Designated Symbol for Posting Outdoor Pesticide Applications to School Grounds

f. The approximate date and time of the application in at least 12 point type.
g. The location of the application in at least12 point type.
h. The reason(s) for the application in at least 12 point type.
i. The name and phone number of the person to whom further inquiry regarding the application may be made in at least 12 point type.

Section 5. Integrated Pest Management Techniques

A. All pest management activities should be conducted using appropriate elements of integrated pest management as described in the latest Cooperative Extension or Department of Agriculture training manuals for pest management in and/or on school property. In all cases, the application should be conducted in a manner to minimize human risk to the maximum extent practicable using currently available technology.

B. Prior to any pesticide application the following steps must be taken and recorded:

1. Monitor for pest presence or conditions conducive to a pest outbreak.
2. Identify the pest specifically.
3. Determine that the pest population exceeds acceptable safety, economic or aesthetic threshold levels established in the IPM policy.
4. Utilize non-pesticide control measures that have been demonstrated to be practicable, effective and affordable.

C. When a pesticide application is deemed necessary, the licensed applicator must take into account the toxicity of recommended products and choose lowest risk products based on efficacy, the potential for exposure, the signal word on the pesticide label, the material safety data sheet, other toxicology data and any other label language indicating special problems such as toxicity to wildlife or likelihood of contaminating surface or ground water.

D. Pesticide applications must not be conducted when people are in the immediate area to be treated. When space, spot, or fumigation applications are conducted the heating, ventilation, and air conditioning (HVAC) systems in the area must be shut off or the entire building must be evacuated. Applications should be planned to occur on weekends or vacations to allow maximum time for sprays to dry and vapors to dissipate.

E. Indoor pesticide use must be limited to placement of baits and wall void or crack and crevice treatments unless the pest threatens the health and safety of persons in the buildings as determined by the school's integrated pest management coordinator.

F. Outdoor applications must be conducted in accordance with all other applicable Board regulations designed for minimizing pesticide drift and posting of treated sites. Spot treatments should be considered in lieu of broadcast applications.

G. The integrated pest management coordinator must maintain records for a period of two years following all pesticide applications performed along with the labels and material safety data sheets for all products used in or on school property.

Certification and Licensing for Commercial Applicators in Maine

Maine Law requires a commercial pesticide applicator license to apply any pesticides in schools or on school grounds except for routine cleaning, emergency protection from stinging insects, or application of paints, stains, and wood preservatives.

Commercial certification

- Every commercial applicator must be one of the following:
  1. Licensed as a commercial applicator/master.
  2. Licensed as a commercial applicator/operator.
  3. Supervised on-site by either a licensed commercial applicator/master or a commercial applicator/operator who is physically present and directly overseeing the application. This supervision must include visual and voice contact. Visual contact must be continuous except when topography obstructs visual observation for less than five minutes. Video contact does not constitute visual observation. The voice contact requirement may be satisfied by real time radio or telephone contact.

- Each branch office of any company, agency, organization, or self-employed individual ("employing entity") required to have personnel licensed commercially under state pesticide law shall have in its employment at least one master applicator. This master must be licensed in all categories which the branch office of the company or agency performs applications and any operators must also be licensed in the categories in which they perform or supervise pesticide applications. This master applicator must actively supervise persons applying pesticides within such employing entity and have the ability to be on site to assist such persons within six (6) hours driving time. Whenever an out-of-state employing entity is conducting a major application project, they must have a master applicator within the state.

- Persons wishing to obtain a *commercial applicator/operator* license must be certified by passing written, closed book examinations (with a score of 80% or greater) covering general pesticide information (core exam) and categories that represent each type of application to be performed or supervised.

- Persons wishing to obtain a *commercial applicator/master* license must meet the commercial applicator/operator requirements and pass a written, closed book regulation examination (with a score of 80% or better) and an oral examination conducted by the BPC staff.

- Tests are scheduled by the BPC after receiving a completed application form and a $10 fee for the core exam and each category exam requested. Forms are available online at http://www.state.me.us/agriculture/pesticides/forms.htm. Tests are conducted at the BPC offices in Augusta and, with special arrangements, in Presque Isle. A $15 surcharge will be incurred whenever an examinee fails to notify the BPC staff at least 24-hours prior to canceling a scheduled exam.

- Commercial license examinees must pass both the core and at least one category or commodity exam within one year. If an applicant passes only one of the required exams within a year, he or she must retake even those previously passed before qualifying for certification.

- In order to maintain certification status, commercial applicators are required to accumulate 12 recertification credits over the six-year certification period. Each credit represents one hour of pest management training. Master applicators must accumulate 18 credits in six years. Of these credits, at least three must be in a category for which they are licensed and at least one credit hour must be in environmental science, ecology, or toxicology. The BPC assigns and records credit for certain pesticide applicator training sessions offered by Cooperative Extension, industry, and trade organizations. The BPC may assign credit to training sessions offered in other states after receiving a detailed agenda and proof of attendance.

- Certification lapses if insufficient credits are accumulated during the six year period. Renewal requires successful completion of all exams. In all other cases, recertification credits expire at the end of the certification period and are not carried over to the next certification period.

Commercial licensing

- A biennial $70 application fee is required to obtain a 2-year commercial applicator license at the master or operator level.

- Each school making its own applications must have at least one licensed commercial applicator/master. This master must directly supervise all other operator-licensed employees, and must be present at all application sites when unlicensed employees apply pesticides.

- All commercial applicators must keep records of all pesticide applications.

- Commercial applicators must submit an annual summary report to the BPC on or before January 15th. Failure to submit required reports will result in license suspension or refusal to renew licenses.

For more information

Maine Board of Pesticides Control
207-287-2731
pesticides@maine.gov
www.thinkfirstspraylast.org

School IPM Fact Sheet

Pestproofing

A straightforward pest control solution is simply to change the conditions that allowed the insect or animal to become a pest in the first place. One way to do this is to make physical or mechanical changes that will make the location less attractive to pests or that will keep them from entering buildings. Pestproofing can be as simple as repairing screens and caulking cracks or as sophisticated as landscaping with pest and disease-resistant plants. Some physical alterations can be expensive and time-consuming but they usually are permanent solutions. You may do some pestproofing yourself, and you may make pestproofing recommendations to school administrators, maintenance staff, or outside contractors.

Pestproofing Buildings

- Install weather stripping or door sweeps on doors. Inspect them regularly and replace as needed.
- Repair screens on windows and doors and make sure they fit tightly.
- Screen floor drains and outside vent openings.
- Install air curtains over loading docks and other open doorways.
- Seal cracks and crevices in interior and exterior walls.
- Caulk, stuff with steel or copper wool, or seal openings around pipes and conduits where they enter the building.
- Caulk crevices around doors, windows, vents, plumbing fixtures, equipment, cabinets, and counter tops.
- Repair grout around wall and floor tiles in restrooms, locker rooms, and other sites.
- Repair roof leaks that may attract carpenter ants and other moisture loving pests.
- Repair leaky plumbing in restrooms, kitchens, and laboratories.
- Install porcupine wire, pin and wire, or similar commercial products to keep birds from roosting on window ledges and other building surfaces.
- Use pest-proof storage boxes. Unpack and discard cardboard boxes. Deep clean buildings, especially where food and drinks are served, eaten, or stored. Rinse returnables and take them off-site at least weekly.

Pestproofing on the Grounds

- Install a concrete pad under the dumpster or garbage pickup area to make it easier to clean the site and to prevent rodents and other pests from burrowing or nesting underneath.
- Make sure all trash cans on the grounds have closing lids to discourage yellowjackets and flies.
- Pull organic mulch away from the building's walls. Wood mulch invites carpenter ants and moisture-loving pests like millipedes, sowbugs, and earwigs. Instead, install a 2-3 foot wide mulch-free band around the perimeter. Leave the area bare or fill it with pea gravel, crushed stone or shell.
- Thin or remove dense shrubbery and ground covers around the building's foundation. Dense vegetation provides good cover for rodents and makes it difficult to inspect and treat burrows.
- Trim tree branches within 6 feet of the building and remove vines on the building. Ants, squirrels, and roof rats especially, often follow branches or vines to enter a building.
- Remove dead trees and stumps from around buildings to keep carpenter ants and other pests from infesting the building.

- Remove plants that are hosts to specific invading pests and replace them with pest and disease-resistant varieties. For example, boxelder bugs feed on the female boxelder tree, often moving into buildings in the fall. Removing these trees from the area will eliminate problems with boxelder bugs. Keep ornamental plants and lawn healthy and pest-free through proper watering, fertilizing, and pruning.
- Fill or drain low spots to eliminate standing water that breeds mosquitoes and other flies. Align downspouts so that water drains away from the building.
- Remove piles of wood, stone, or other materials or stack them off the ground and away from building foundations.

School IPM Fact Sheet

Choosing the Proper Pesticide

Whether you contract for pesticide applications or do it yourself, there are important regulations and guidelines to follow. The health of school residents and prevention of pest problems must be the primary objectives that guide pest management in schools.

- Look for alternatives to pesticides first, like pest-proofing and sanitation practices, to prevent wasp, fly, and rodent problems and watering, mowing, and fertilization practices to reduce weed problems in lawns and athletic fields.
- If a pesticide application is still deemed necessary to adequately manage pests; follow these essential steps to ensure the pesticide is applied properly and effectively.

1. A commercial pesticide applicator license is required to apply pesticides on school grounds. This includes 'weed and feed' fertilizers, herbicides (weed-killers), rodenticides (mouse and rat baits), insecticides (insect-killers), fungicides (most mold and mildew treatments, plant disease treatments), etc. *Any product with an EPA Registration number on the label is a pesticide.* Verify that the person doing the application is licensed.

2. Choose least-toxic pesticides. Read the label and MSD sheets that come with the pesticide or call the Board of Pesticides Control to have them faxed to you (also available on line at the website listed below). Choose products with the signal word *Caution* if possible. Avoid those with the signal words *Warning* or *Danger*. Check the MSDS for other human health risks. Chronic toxicity and environmental impact are also important. Check the label and MSDS for mentions of these hazards, especially if wellheads, ponds or streams are nearby. Some newer, less-toxic pesticides appear more expensive than some older, more toxic ones. But the newer materials tend to be effective in smaller doses—one container goes a long way. The less-toxic pesticides are often the best buy in the long-run.

3. Choose an effective product. Identify the pest, then make sure the pesticide is labeled for use against your pest. Pesticidal soaps and oils can be effective against soft bodied insects and some weed seedlings and are less toxic to humans and beneficial insects such as lady bugs. Microbial pesticides containing *Bacillus thuringiensi*s (Bt) can be purchased for control of caterpillars or mosquito larvae.

4. Choose the best formulation. Carefully consider risks of human exposure, environmental impact, and effectiveness when determining which formulations (liquid, granular, dust, etc.) to use. For example, spot treatment with baits, granulars, or ready-to-use formulations present less exposure potential than broadcast applications.

5. Choose a product with less odor when possible. A product's effectiveness is not related to its odor, but odors can cause adverse reactions in persons with chemical sensitivities.

6. Follow the label's instructions carefully.

- Applicators are required by law to wear the safety equipment specified on the label. Make sure all necessary safety equipment and clothing are worn.
- Mix, apply, and store pesticides exactly as directed. Never apply at a higher rate than the label allows.
- Calibrate the application equipment to make sure pesticide is applied at the labeled rate.

7. Spot treat whenever possible. Direct the pesticide to the infested area rather than applying a broadcast treatment. This method reduces risks and pesticide costs while assuring effective pest control.

8. Timing is everything! It is critical to ensure children and other people do not enter the treated area too soon. Check the label for the Re-Entry Interval (REI) to determine how soon after the application it is legal to allow people to enter the area. In school settings, it's best to allow for as long an interval as possible. *Apply pesticides only when students and staff are not present and allow enough time before people are allowed to enter.*

9. Keep records. Record when, what, and where pesticides are applied, name of applicator, and rate used. Keep labels and MSD sheets on file.

10. Monitor for effectiveness. Check the pest population afterwards to see if treatment was effective. Keep checking to see how long it was effective.

11. Be prepared for chemical emergencies. Keep a list of whom to call for help and the kinds of first aid to be administered before help arrives. Place the list in an accessible area near a phone.

12. Dispose of pesticides properly. Do not pour them down the drain or into toilets! Contact the Maine Board of Pesticides Control if unsure about how to dispose of the pesticide.

13. Notification and posting. Outdoor areas treated with pesticides must be posted according to state regulations (Chapters 27 and 28) which require that 4"x 5" signs be placed around the treated area at points of entry. It is advisable to notify students, staff and parents of upcoming pesticide applications, paying particular attention to those individuals that may be of higher risk. You may also be required to notify neighbors when pesticides are applied if they request.

14. Ask, don't guess. Choosing pesticides is important and not necessarily simple; use the following resources for more help.

Resources

Pest control product manufacturers and dealers know their own products, so ask them about toxicity, effectiveness, formulations, and least-toxic (including traps and other non-toxic) products.

University of Maine Pest Management Office: tel. 800-287-0279 or 207-581-3880. Pest diagnoses, pesticide information, IPM, product recommendations.

Maine Forest Service: tel. 287-243l. Tree and forest pest diagnoses; tick, mosquito and browntail moth management; and product recommendations.

BPC: tel. 207-287-2731 or <*http:/www.thinkfirstspraylast.org*>. A good place to find out how toxic or leachable a product is, if it is labeled for specific sites, or if registered in Maine. Also product facts sheets and links to MSDS and pesticide labels.

ExToxNet: A web resource for comparing product toxicities. Compiled by Extension offices nationwide, it's found at <*http://ace.ace.orst.edu/info/extoxnet/*>.

U.S.EPA: One would think the folks who regulate the stuff ought to offer fact sheets and other product-specific information, they do: <*http://www.epa.gov/pesticides/factsheets/*>.

School IPM Fact Sheet

Mold and Moisture Problems

Modified from *Indoor Air Quality Tools for Schools* (IAQ TfS) *Action Kit*
EPA document number 402-K-05-001

Molds can be found almost anywhere; they can grow on virtually any substance where moisture is present. There are molds that can grow on and within wood, paper, carpet, and foods. When excessive moisture accumulates in buildings or on building materials mold growth will often occur, particularly if the moisture problem remains undiscovered or unaddressed. There is no practical way to eliminate all mold and mold spores in the indoor environment; the way to control indoor mold growth is to control moisture. Molds produce tiny spores to reproduce. Mold spores continually waft through the indoor and outdoor air continually. When mold spores land on a damp spot indoors, they may begin growing and digesting whatever they are growing on in order to survive.

There are many different kinds of mold. Molds can produce allergens, toxins, and/or irritants. Molds can cause discoloration and odor problems, deteriorate building materials, and lead to health problems such as asthma episodes and allergic reactions in susceptible individuals.

The key to mold control is moisture control. If mold is a problem, clean up the mold and get rid of excess water or moisture. Maintaining the relative humidity between 30%-60% will help control mold.

Condensation, Relative Humidity, and Vapor Pressure

Mold growth does not require the presence of standing water, leaks, or floods; mold can grow when the relative humidity of the air is high. Mold can also grow in damp areas such as unvented bathrooms and kitchens, crawl spaces, utility tunnels, gym areas and locker rooms, wet foundations, leaky roof areas, and damp basements. Relative humidity and the factors that govern it are often misunderstood. This section discusses relative humidity and describes common moisture problems and their solutions.

Water enters buildings both as a liquid and as a gas (water vapor). Water is introduced intentionally at bathrooms, gym areas, kitchens, and art and utility areas and accidentally by way of leaks and spills. Some of the water evaporates and joins the water vapor that is exhaled by building occupants. Water vapor also moves into the building through the ventilation system, through openings in the building shell, or directly through building materials.

The ability of air to hold water vapor decreases as the air temperature falls. If a unit of air contains half of the water vapor it can hold, it is said to be at least 50% relative humidity (RH). The RH increases as the air cools and approaches saturation. When air contains all of the water vapor it can hold, it is at least 100% RH, and the water vapor condenses, changing from a gas to a liquid. The temperature at which condensation occurs is the "dew point."

It is possible to reach 100% RH without changing the air temperature, by increasing the amount of water vapor in the air (the "absolute humidity" or "vapor pressure"). It is also possible to reach 100% RH without changing the amount of water vapor in the air, by lowering the air temperature to the "dew point."

The highest RH in a room is always next to the coldest surface. This is referred to as the "first condensing surface," as it will be the location where condensation happens first if the relative humidity of the air next to the surface reaches 100%. It is important to understand this when trying to understand why mold is growing on one patch of wall or only along the wall-ceiling joint. It is likely that the surface of the wall is cooler than the room air because there is a gap in the insulation or because the wind is blowing through cracks in the exterior of the building.

Mold and Health Effects

Molds are a major source of indoor allergens. Molds can also trigger asthma. Even when dead or unable to grow, mold can cause health effects such as allergic reactions. The types and severity of health effects associated with exposure to mold depend, in part, on the type of mold present and the extent of the occupants' exposure and existing sensitivities or allergies. Prompt and effective remediation of moisture problems is essential to minimize potential mold exposures and their potential health effects.

Taking Steps to Reduce Moisture and Mold

Moisture control is the key to mold control. Respond to water damage within 24-48 hours to prevent mold growth.

Mold growth can be reduced if relative humidity near surfaces can be maintained below the dew point. This can be done by: 1) reducing the moisture content (vapor pressure) of the air, 2) increasing air movement at the surface, or 3) increasing the air temperature (either the general space temperature or the temperature at building surfaces).

Either vapor pressure or surface temperature can be the dominant factor in a mold problem. A vapor pressure dominated mold problem may not respond well to increasing temperatures, whereas a surface temperature dominated mold problem may not respond very well to increasing ventilation. Understanding which factor dominates will help in selecting an effective control strategy.

If the relative humidity near the middle of a room is fairly high (e.g., 50% at 70°F), mold or mildew problems in the room are likely to be vapor pressure dominated. If the relative humidity near the middle of a room is fairly low (e.g. 30% at 70° F), mold or mildew problems in the room are likely to be surface temperature dominated.

Vapor Pressure Dominated Mold Growth

Vapor pressure dominated mold growth can be reduced by using one or more of the following strategies:

- Use source control (e.g., direct venting of moisture-generating activities such as showers to the exterior).
- Dilute moisture-laden indoor air with outdoor air at a lower absolute humidity.
- Dehumidify the indoor air.

Note that dilution is only useful as a control strategy during heating periods, when cold outdoor air contains little total moisture. During cooling periods, outdoor air often contains as much moisture as indoor air.

Surface Temperature Dominated Mold Growth

Surface temperature dominated mold growth can be reduced by increasing the surface temperature using one or more of the following approaches:

- Raise the temperature of the air near room surfaces.
- Raise the thermostat setting improve air circulation so that supply air is more effective at heating the room surfaces.
- Decrease the heat loss from room surfaces
- Add insulation close cracks in the exterior wall to prevent "wind washing" (air that enters a wall at one exterior location and exits another exterior location without penetrating into the building).

Consider an old, leaky, poorly insulated school in Maine that has mold and mildew in the coldest corners of one classroom. The indoor relative humidity is low (30%). It is winter and cold air cannot hold much water vapor. Therefore, outdoor air entering through leaks in the building lowers the airborne moisture levels indoors. This is an example of a surface temperature dominated mold problem. In this building, increasing the outdoor air ventilation rate is probably not an effective way to control interior mold and mildew. A better strategy would be to increase surface temperatures by insulating the exterior walls, thereby reducing relative humidity in the corners.

Consider a school locker room that has mold on the ceiling. The locker room exhaust fan is broken, and the relative humidity in the room is 60% at 70° F. This is an example of a vapor pressure dominated mold problem. In this case, increasing the surface temperature is probably not an effective way to correct the mold problem. A better strategy is to repair or replace the exhaust fan.

Mold Clean Up

The key to mold control is moisture control. It is essential to clean up the mold and get rid of excess water or moisture. If the excess water or moisture problem is not fixed, mold will most probably grow again, even if the area was completely cleaned. Clean hard surfaces with water and detergent and dry quickly and completely. A household mixture of 1 part bleach to 10 parts water works well as a final wash. (From: *A School's Guide to Dealing with Mold Using IPM. Wisconsin Department of Agriculture. Trade and Consumer Protection.*) Always wear gloves and eye protection and provide proper ventilation when using bleach and other chemical cleansers and disinfrectants. Absorbent materials such as ceiling tiles may have to be discarded.

Note that mold can cause health effects such as allergic reactions; remediators should avoid exposing themselves and others to mold.

Wear waterproof gloves during clean up; do not touch mold or moldy items with bare hands. Respiratory protection should be used in most remediation situations to prevent inhalation exposure to mold. Respiratory protection may not be necessary for small remediation jobs with little exposure potential. Refer to the end of this fact sheet and resource listing in the Appendix for sources of more information on mold remediation. When in doubt consult a professional, experienced remediator.

Identifying and Correcting Common Problems

Exterior Corners and Walls

The interior surfaces of exterior corners and behind furnishings such as chalk boards, file cabinets, and desks next to outside walls are common locations for mold growth in heating climates. They tend to be closer to the outdoor temperature than other parts of the building surface for one or more of the following reasons:

- Poor indoor air circulation.
- Wind washing.
- Low insulation levels.
- Greater surface area of heat loss.

Sometimes mold growth can be reduced by removing obstructions to airflow (e.g., rearranging furniture). Buildings with forced air heating systems and/or room ceiling fans tend to have fewer mold problems than buildings with less air movement.

Set-Back Thermostats

Set-back thermostats (programmable thermostats) are commonly used to reduce energy consumption during the heating season. Mold growth can occur when temperatures are lowered in buildings with high relative humidity. (Maintaining a room at too low a temperature can have the same effect as a set-back thermostat.) Mold can often be controlled in heating climates by increasing interior temperatures during heating periods. Unfortunately, this also increases energy consumption and reduces relative humidity in the breathing zone, which can create discomfort.

Air-Conditioned Spaces

Mold problems can be as extensive in cooling climates as in heating climates. The same principles apply: either surfaces are too cold, moisture levels are too high, or both.

One common example of mold growth in cooling climates can be found in rooms where conditioned "cold" air blows against the interior surface of an exterior wall. This condition, which may be due to poor duct design, diffuser location, or diffuser performances, creates a cold spot at the interior finish surfaces, possibly allowing moisture to condense.

Possible solutions for this problem include:

- Eliminate the cold spots (i.e., elevate the temperature of the surface) by adjusting the diffusers or deflecting the air away from the condensing surface.
- Increase the room temperature to avoid overcooling. NOTE: During the cooling season, increasing temperature decreases energy consumption, though it could cause comfort problems.

Mold problems can also occur within the wall cavity, when outdoor air comes in contact with the cavity side of the cooled interior surface. It is a particular problem in rooms decorated with low maintenance interior finishes (e.g., impermeable wall covering such as vinyl wallpaper) which can trap moisture between the interior finish and the gypsum board. Mold growth can be rampant when these interior finishes are coupled with cold spots and exterior moisture.

A possible solution for this problem is to ensure that vapor barriers, facing sealants, and insulation are properly specified, installed, and maintained.

Thermal Bridges

Localized cooling of surfaces commonly occurs as a result of "thermal bridges," elements of the building structure that are highly conductive of heat (e.g., steel studs in exterior frame walls, uninsulated window lintels, and the edges of concrete floor slabs). Dust particles sometimes mark the locations of thermal bridges, because dust tends to adhere to cold spots. The use of insulating sheathings significantly reduces the impact of thermal bridges in building envelopes.

Windows

In winter, windows are typically the coldest surfaces in a room. The interior surface of a window is often the first condensing surface in a room.

Condensation on window surfaces has historically been controlled by using storm windows or "insulated glass" (e.g., double-glazed windows or selective surface gas-filled windows) to raise interior surface temperatures. In older building enclosures with less advanced glazing systems, visible condensation on the windows often alerted occupants to the need for ventilation to flush out interior moisture, so they knew to open the windows.

The advent of higher performance glazing systems has led to a greater number of moisture problems in heating climate building enclosures, because the buildings can now be operated at higher interior vapor pressures (moisture levels) without visible surface condensation on windows.

Concealed Condensation

The use of thermal insulation in wall cavities increases interior surface temperatures in heating climates, reducing the likelihood of interior surface mold and condensation. However, the use of thermal insulation without a properly installed air barrier may increase moisture condensation within the wall cavity. The first condensing surface in a wall cavity in a heating climate is typically the inner surface of the exterior sheathing.

Concealed condensation can be controlled by either or both of the following strategies:

- Reduce the entry of moisture into the wall cavities (e.g., by controlling entry and/or exit of moisture-laden air).
- Raise the temperature of the first condensing surface in heating-climate locations.
- Install exterior insulation (assuming that no significant wind-washing is occurring) in cooling-climate locations.
- Install insulating sheathing to the interior of the wall framing and between the wall framing and the interior gypsum board.

Mold and Moisture References

A School's Guide to Dealing with Mold using Integrated Pest Management. Wisconsin Department of Agriculture, Trade, and Consumer Protection. <http://www.datcp.state.wi.us/arm/agriculture/pest-fert/pesticides/pdf/arm_pub_100.pdf>.

Indoor Air Quality Tools for Schools (IAQ TfS) Action Kit. Dec. 3, 2007. U.S. Environmental Protection Agency. <http://www.epa.gov/iaq/schools/actionkit.html>.

School IPM Fact Sheet

Head Lice

Modified from School Health Manual, Maine Department of Education

Pediculosis capitis refers to symptoms caused by human head lice infesting the head hair of a person. Head lice are not known to transmit infectious agents, nor do they discriminate among socio-economic groups. They are more commonly found on children of preschool and early elementary school age. Overall, about 1% of 5-12 year olds are infested. Girls are infested more often than boys, and parents and siblings sometimes acquire head lice. Lice and their eggs (called nits) are usually limited to the head hair.

Life Stages of Head Lice

Nit (louse egg) - Nits are laid onto the hair shaft, close to the scalp. They are oval in shape and may undergo several color changes as they develop. They take 8-12 days to develop and hatch. With magnification the developing nymph may be seen within the egg. Eggs that have died or hatched will remain firmly attached to the hair, but will never again produce another louse.

Nymph - The nymph is the immature stage of the louse. These look just like an adult louse, only smaller and are unable to reproduce yet. They mature into adults in about 9-12 days after hatching. Nymphs must feed on human blood to survive and grow.

Adult - Adults are about the size of a sesame seed, have six legs, are wingless, and may be tan to grayish-white or even have a reddish tinge. Adult females may live up to 30 days on the head of the infested person. As with nymphs, they feed once or more often each day. Lice are unable to survive longer than 1-2 days away from the human body and are unable to live on pets.

The adult head louse

A nit - an egg glued to a single strand of hair.

Signs, Symptoms, and Transmission

Students with head lice are usually asymptomatic, but some may experience itching from an allergic reaction to the bites or irritation from sores caused by bites. Transmission occurs from head to head contact with an infested person. The transmission from hats, combs, pillows, etc. is possible but much less likely.

Reasons for chronic infestations

- Misdiagnosis
- Non-compliance
- Resistance to treatment (Lice on children who are treated repeatedly are more likely to be resistant to treatment.)
- New infestations
- Ineffectiveness of treatment

Diagnosis

Head lice may be found anywhere on the head hair, but are often easiest to locate on the scalp behind the ears and near the neckline at the back of the neck. Adult female lice deposit nits on the hair about 1 mm from the scalp. Under good lighting and using a comb, search the head for viable nits and crawling lice. Live lice are sometimes difficult to see as they move quickly and there are usually less than 10 lice on a head. Tape the live louse on a white background and view with magnification to see it more clearly.

Treatment

Treatment is recommended only for individuals found with live lice or viable eggs. If nits are found further than about ¼ inch from the head, they are probably hatched and no longer viable.

- **Nit Combs.** Combing with a nit comb can sometimes be effective in removing viable nits and lice. Nits that are more than ¼ inch from the scalp are not likely to be viable and need not be removed. Comb daily until no live lice are discovered for two weeks. Recheck in 2-3 weeks after you think all lice are gone.
- **Over the counter lice shampoo**. As with all drugs, directions must be followed exactly. These products may be rinsed from the hair over a sink rather than shower or bath to limit exposure to the body. A second treatment may be required in about 10 days.
- **Prescription lice shampoo medications.** These products contain other insecticides that require greater care for treatments, and should be used only under a physician's care, and only if live lice persist following treatment with the over-the-counter products. Parents should be advised to discuss with their health care provider specific instructions for use of these products, potential risks and benefits, and other possible treatment recommendations.

Alternative treatments (petroleum jelly, mayonnaise, margarine, herbal oils, enzyme-based products and olive oil) should be avoided as there is no conclusive evidence that these treatments are effective or necessarily safe. Oils may facilitate the absorption of insecticides in shampoos.

Family members of a student with head lice should be encouraged to inspect themselves to see if lice are present. All individuals found with lice should be treated simultaneously. Inform family members that bedding, towels, nightclothes, and other clothing that was in contact with the head within a day of treatment should be washed and/or dried in the dryer at high heat (if appropriate). Combs, brushes, and hair accessories used by the student should be rinsed in hot water each day until lice are eliminated.

Do not treat the premises with pesticides! Treating rooms, carpets, desks, etc. is not recommemded. Vacuuming floors, especially carpets recently occupied by infested persons are recommended. Lice will soon die (generally within two days) once off the head for a day. Nits attached to hair that have fallen from an infected person will likely stop developing and will also die within a few days. Although it is not necessary to thoroughly clean school busses, vacuuming floors of classrooms or homes occupied by infected persons will help dispel concerns about lice or eggs that may have dropped from an infected person. Clothing, pillows, cloth toys, and other items that may have been used by infested children may be treated by heating in a clothes dryer on high heat or by sealing in a plastic bag for two weeks.

Recommendations for School Policy

- Routine head check of healthy students is not recommended.
- Check symptomatic students.
- When nits ¼ inch or closer to the scalp or live lice are discovered, do not exclude from school, but notify the parent that day and provide instructions on how to treat and eliminate.
- The school nurse may offer extra help to families with chronic infestations.

The American Academy of Pediatrics recommends that no healthy child be excluded from or allowed to miss school because of head lice, and discourages 'no nit' policies for return to school.

The National Association of School Nurses state that nit-free policies disrupt the education process and should not be viewed as an essential strategy in the management of head lice.

Health and Health Care in Schools. Children with nits do not pose an immediate threat to the health of others; therefore, excluding these children from school and requiring them to be treated with a pesticidal product is probably excessive.

Head Lice References

Lice Infestation. Centers for Disease Control and Prevention: <http://www.cdc.gov/ncidod/dpd/parasites/headlice/default.htm>.

Maine Coordinating School Health Programs: <http://www.mainecshp.com/>.

Pollack, R. J. **Head Lice Information and Frequently Asked Questions**. Harvard School of Public Health. <http://www.hsph.harvard.edu/headlice.html>.

Pediculosis - Head Lice. 2002. **Maine Department of Education School Health Manua**l. <http://www.maine.gov/education/sh/headlice06.rtf>.

Pediculosis in the School Community. 2004. National Association of School Nurses <http://www.nasn.org/Default.aspx?tabid=237>.

Scherer, C. & P. Koehler. **School IPM - Biology and Control of Head Lice**. <http://schoolipm.ifas.ufl.edu/tp2.htm>.

School IPM Fact Sheet

Cockroaches

Cockroaches can be common pests in schools. By contaminating human food with feces and saliva, cockroaches may vector food-borne illnesses like salmonella. Cockroaches are also known to trigger asthma attacks.

Cockroaches are flattened insects with long antennae. Their colors may vary but are usually brownish. Immatures (or nymphs) look like the adults but are smaller and have no wings. Nymphs and adults have similar habits and behaviors.

They are usually found in dark, warm, moist environments; in protected areas like cracks and crevices in walls; cluttered environments; and near drains and leaking pipes. They are active at night where food is found, often in kitchens. Cockroaches are seldom found throughout an entire building, but tend to concentrate themselves in areas where water and food resources are readily available.

Prevention

Sanitation and maintenance provide the only permanent solution to cockroach infestations.

- Inspect food shipments immediately upon delivery.
- If possible, unpack cardboard boxes at or near the delivery area (or loading dock) rather than in the kitchen. Take cardboard boxes offsite, or at least out of the kitchen and pantry.
- Remove water sources by repairing dripping pipes or leaky faucets.
- Seal holes, cracks, and crevices in areas where cockroaches are found.
- Store food in sealed containers (not cardboard boxes), off the floor, in clean dry areas.
- Always keep areas where food is handled clean. Regularly mop, vacuum, sweep, or scrub areas where food is handled and eaten.
- Remove all garbage promptly from inside the school.
- Rinse out returnables and store in designated lined, non-absorbant, washable (plastic or metal) bins. Take them off-site at least weekly. Clean bins weekly.
- Clean all recyclable materials and store outside the school if possible.
- Keep clutter to a minimum.
- Limit eating to designated areas of the building.
- When food is eaten and/or stored in classrooms (even small candies or pet food), rugs, and floors, cupboards, desks, and classroom cubbies should be cleaned daily.

American

German

Brown-banded

Cockroach

Monitoring

- Monitor areas where food, water, warmth, and protection are readily available: sinks, drains, vents, computers, leaky pipes, appliances, food-handling areas, air conditioning units, snack dispensers, dishwashing areas, trash receptacles, recycling and returnable bins, bathrooms, and storage areas.
- Monitor crawling insect activity (expecially cockroaches) by using sticky traps placed at regular intervals, about every 10 to 15 feet.
- Cockroaches normally use vertical surfaces as guides while they move from place to place, so place traps along baseboards, against the sides of freestanding objects, and in suspended ceilings. Traps must open parallel to walls, baseboards, etc. Traps set in the open away from walls or edges are unlikely to catch cockroaches.
- Avoid extremely dusty areas that decrease the stickiness of the trap.
- Number and date the traps and mark their position on a map of the school building.
- Check traps weekly. If a single cockroach is found, check traps daily until no more cockroaches are found in traps for about a week. Record the number of cockroaches caught in each trap in the IPM logbook. Remove or mark counted cockroaches or replace sticky cards at each count.

Management

In any area where cockroaches are detected, use increased sanitation and maintenance to eliminate sources of food, water, and shelter available to cockroaches. If this is not be enough to control an infestation chemical pesticides may be needed. Several least-toxic pesticides are available but pesticides may only be applied by persons with a commercial applicator license. *Discuss the following options with your licensed applicator.*

- Cockroach bait is the most common form of chemical management. Baits include a pesticide combined with a food source. Baits allow precise placement making them available to cockroaches with no interference to people.
- For optimum control, have a licensed applicator place baits as close as possible to an infestation. A small amount of bait in several strategic places is more effective than large amounts of bait in only a few places.
- Place baits along edges, in cracks and crevices, and between hiding places and foraging sites.
- To minimize the potential of pesticide exposure, use baits that are packaged in plastic stations.
- Map the location of all baits and check them regularly to make sure they are still present and are being eaten by cockroaches.
- Do not use other types of pesticides around the bait stations (e.g., sprays or dusts). The pesticides may act as a repellent, driving the cockroaches away from the bait.

Anyone making pesticide applications on school property must be licensed by the Board of Pesticides Control. See "Standards for Pesticide Applications and Public Notifications in Schools".

Cockroach References

Integrated Pest Management for Northeast Schools. 2002. Hollinsworth et al (eds.). Natural Resource, Agriculture, and Engineering Service. NRAES-33. p.28-33.

Daar, S., T. Drlik, H. Olkowski, & W. Olkowski. 1999. **Integrated Pest Management for Schools: A How-to Manual**. EPA Region 9. <http://www.epa.gov/pesticides/ipm/schoolipm/>.

School IPM Fact Sheet

Managing Ants

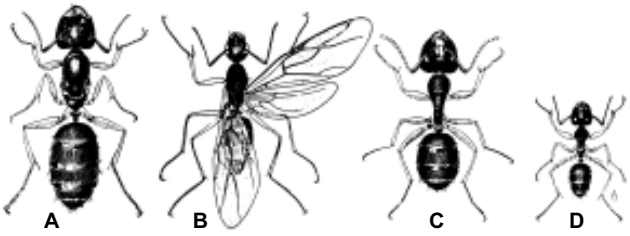
Ants are often considered pests in schools because they are unwelcome visitors inside buildings. Since most ants do not pose a serious threat to human health or property, take a common sense approach to managing them. Some schools have adopted a tolerance policy (except for carpenter ants) that emphasizes prevention and monitoring and relies primarily on mopping or vacuuming to remove the ants that invaribly find their way inside schools.

Indoor infestations are best treated or, better yet, prevented by practicing good sanitation and maintenance to keep ants from wandering indoors in search of food and water. It is usually not advisable nor effective to apply pesticides to floors or baseboards indoors or as a perimeter treatment outdoors. Preventative measures include the following.

- Clean up food and drink spills promptly.
- Keep pet and human food in pest-proof containers.
- Empty trash frequently.
- Rinse and store recyclable and returnable cans and bottles in pest-proof containers.
- Keep trees, shrubs, and mulch at least 12 inches away from buildings.
- Keep grass growing next to building mowed low.
- Repair leaks and condensation problems promptly.
- Seal cracks and keep screens, weather-stripping, door sweeps in good repair.
- Clean gutters.

Carpenter ants may cause considerable damage to wooden structures and should be eliminated when found in buildings. They are usually black and tend to be somewhat large (up to $^1/_2$" long). Carpenter ants are often encountered in trees, stumps, and rotting logs outdoors but will come into schools buildings in search of food, water, and nesting sites.

- Inspect trees and stumps near buildings at night for carpenter ant activity.
- Infested stumps and trees located near building should be removed.
- Nests in buildings are usually associated with moisture problems such as roof or plumbing leaks. Inspect attics, window sills and frames, porches, around sinks and dishwashers, and foundation and sills to detect and repair leaks or condensation problems. Small piles of wood particles and/or dead ants found near any of these areas are an indication of carpenter ant nesting activity.
- The key to eliminating carpenter ants is to locate and remove (or treat) the nest. This is usually a job for a professional exterminator.



Carpenter ants: A, queen (winged when young), B, male, C, major worker, D, minor worker.

Nuisance ants that can often be managed with sanitation and pest-proofing

Cornfield ants feed on flower nectar, insects—dead or alive, and honeydew secreted from aphids. These ants often collect and transport aphids. Nests are commonly found in fields, lawns, between bricks in walkways, beneath rocks, in pavement cracks, etc. Workers are about 1/10-1/4 inch long, light to dark brown, soft-bodied, and robust. When crushed, they emit a strong odor of formic acid. Numerous mounds can be common in turf where they ruin the surfaces of lawns, dull mower blades, and may suffocate the underlying turf.

Pavement ants may forage in buildings throughout the year, feeding on grease, meat, live and dead insects, honeydew, roots of plants, and planted seeds. These are very common ants usually found outdoors under stones, in pavement cracks, under slab foundations, along the curb edges, and in crevices of masonry and woodwork. Workers are sluggish, between 1/12 -1/4 inch long. They are hairy, light to dark brown or blackish, with pale legs and antennae. The head and thorax are furrowed with parallel grooves running top to bottom. In winter, nests are often moved indoors near a heat source.

Lawn ants are general scavengers. They may also tend aphids and collect nectar when available. They nest under walks or stones, in turf, and on trees. In well-drained, clay or gravelly soil they make the well-known small ant hills with a central entrance. Workers are about 1/4 inch long, yellowish, and occur in turf. The abdomen is light tan with brown bands. The head, thorax, and legs are slightly darker.

Little black ants feed on sweets, meats, vegetables, honeydew, and insects. They nest in woodwork, masonry, soil, and rotted wood. Nests in the ground have very small craters of fine soil surrounding the entrance. Workers are slow moving, about 1/8 inch long, slender, shiny black or sometimes dark brown.

All ants can bite when disturbed; therefore, ant nests sometimes present a hazard to children on playgrounds. For ant nests found on school grounds where children are at risk from bites, the following method can be used.

- Mix a solution of soapy water (3-4 tablespoons of liquid dish soap/gallon water) in 5-gallon plastic buckets.
- Standing a foot away from the nest (wear long pants or coveralls and tuck pant legs into socks to avoid ant bites), slowly pour soapy water into the nest. Have a partner poke holes in the nest with a stick and continue pouring water in. Continue using the stick to open the mound and pour more soapy water until no more live ants are seen.
- Excavate the nest with a shovel and pour more soapy water into depression.

European red ants (also called Eurpopean fire ants) are found in some mostly coastal areas including Mount Desert Island and Cape Elizabeth. They do not usually enter buildings but prefer moist soil in meadows, lawns, and gardens where they build wide, shallow nests often under bark mulch or wood chips. Workers are about 1/4 inch long, yellow to yellowish brown. This species can be aggressive and can inflict a painful sting that may cause allergic reactions.

Pesticide treatment by a licensed applicator can provide short term control, but can also result in resurgence of the problem. Effective alternative management strategies are under development for this pest. Contact the University of Maine Cooperative Extension's Pest Management Office for any control tactics (see box below).

Anyone making pesticide applications on school property must be licendes by the board of pesticides control. See "Standards for Pesticide Applications and Public Notifications in Schools".

Resources for Managing Ants

Groden, E., F. Drummond, & L. Stack. 2004. **European Fire Ant: A New Invasive Insect in Maine.** Bulletin #2550. University of Maine Cooperative Extension. <http://www.umext.maine.edu/onlinepubs/htmpubs/2550.htm>.

University of Maine Cooperative Extension Pest Management Office: Telephone: 207-581-3880; Web site: <http//:www.umext.maine.edu/topics/pest.htm>.

School IPM Fact Sheet

Managing Rodents

The most persistent rodent pests in schools are the house mouse, roof rat, and Norway rat. White-footed, deer mice, and voles (meadow mice) may also be troublesome. Rodents damage stored items, consume and contaminate food, and serve as reservoirs of several diseases. Most rodent problems can be prevented with landscape maintenance, good sanitation, pest-proofing, and monitoring with traps to catch them before they become an invasive pest. Rodenticides are not generally recommended except to reduce very high populations. Rodenticides may only be used in locked bait boxes serviced by a licensed applicator.

Monitoring, sanitation, and landscaping

- Inspect for evidence of rodents—droppings, gnawed food packages, greasy rub marks along walls.
- Use a flashlight to check behind and under equipment, furniture, sleeves, etc. especially where food is stored or eaten, including classrooms, teachers rooms, kitchens, cafeterias, and pantries.
- Inspect the grounds for food sources. Remove edible plants, fallen fruit and nuts, and animal feces.
- Use snap traps, glue boards, or other non-poisonous rodent traps to monitor rodent activity.
- Keep lids on trash cans and close dumpsters at night. Cover the drainage holes in dumpsters with wire mesh to keep rodents out. Locate dumpsters as far from buildings as possible.
- Remove debris, lumber piles, firewood, trash, and discarded items to reduce shelter for rodents.
- Trim vegetation at least 3 feet from buildings to decrease cover for runways and prevent hidden access.
- Break up long stretches of dense vegetation that allows rodents to travel long distances under cover.
- Keep grass and weeds mowed.
- Avoid planting ornamentals favored by rodents such as euonymus, nut and fruit bearing plants, etc. Contact Cooperative Extension for planting recommendations.

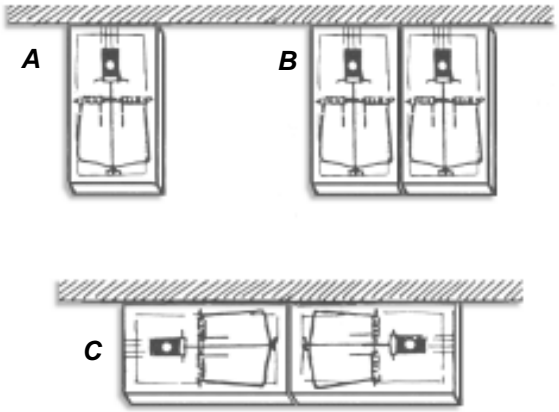
Rodent proofing

Rodent proofing involves tightening a structure to exclude rodents. A young rat can squeeze through an opening as small as 1/2 inch; 1/4 inch will admit a mouse. Inspect and seal doors, door sweeps, weather-stripping, cracks, gaps, and other openings where rodents may enter a building.

Traps

Traps are essential for monitoring rodent activity. School staff do not need a license to use mechanical traps for rodent control. Traps also avoid the odor problem from rodents that die in inaccessible places.

Rodents prefer to run along edges and they routinely follow the same runways. Identify runways by sprinkling a fine layer of flour or baby powder in suspected areas to observe tracks. Place traps along walls and runways, 6-10 feet apart. Take advantage of



Place snap traps in secure areas, along a wall or rodent runway. A) trap triggers should face a wall. B) two traps next to each other increases the chance of success. C) two traps may also be placed in line, the triggers to the outside.

fixtures that might guide them into the trap. Roof rats and Norway rats usually fear newly placed items and avoid them for several days. Keep all rat traps in place for at least 1 week before moving them. Traps should be checked daily. Traps and other surfaces contaminated with rodent urine or feces should be properly disinfected or disposed of.

Non-poisonous baits. The bait depends on the rodent. House mice and deer mice prefer peanut butter, gum drops stuck to the trigger, or rolled oats or bird seed sprinkled on the trap. When food is abundant, nesting material, such as a cotton ball tied to the trigger, can be effective. Roof rats prefer peanut butter, pieces of fruit, or shelled nuts. Norway rats prefer raw or cooked meat, fish (sardines are excellent), or peanut butter. Voles may be attracted using peanut butter, oatmeal, or apple slices.

Snap traps. Both the classic wooden trap and the newer pinch-designs kill trapped animals quickly. Traps should be placed in locked rooms or other areas not accessible to children or in locked, tamper-resistant containers securely attached to a surface so that the container cannot be moved.

Live traps. Several types of live traps are available. Some catch a single rodent, others reset themselves to capture several. The traps may be expensive and the live animals must be disposed of—living rodents should not be released into the wild. Regularly check live traps to avoid odor problems. Because rodents often die of dehydration in live traps, animal welfare experts consider snap traps more humane.

Glue boards are most effective against juvenile mice in dry, dust free areas. Captured rats can often pull themselves free. Fix glue boards to ledges, pipes, or rafters. Do not set them near open flames, above carpet, or where children and pets can contact them. Although they are not toxic, an encounter with a glue board can create a frustrating mess. Clean hands with room-temperature cooking oil. Clean hard surfaces with paint thinner or mineral spirits.

Chemical control

In situations where trapping and pest-proofing do not resolve rodent problems, anticoagulant poison baits are usually effective. Because rodenticides may be highly toxic to humans, they should only be used in secure locations and contained in tamper-resistant bait boxes. As with all pesticides, it is a violation of state law for unlicensed persons to use rodent poisons in schools. Be sure your pest control professional adheres to the following guidelines for using rodent poisons.

- Use rodent bait stations that are locked and firmly anchored.
- Place bait stations in areas inaccessible to children.
- Place rodenticides in the baffle-protected feeding chamber of the box. Never place bait in the runway.
- Monitor and service bait stations regularly; remove promptly when rodents are no longer using them.
- Ask your licensed applicator to provide a map showing locations of all traps and dates of service.

Anyone making pesticide applications on school property must be licensed by the Board of Pesticides Control. See "Standards for Pesticide Applications and Public Notifications in Schools".

House mice are the most common rodents found in schools. They are inquisitive, good climbers, and actively explore anything new. House mice are gray-brown with a lighter belly and small, black eyes. House mice feed primarily on seeds, grain products, and dried foods. They are nocturnal and secretive and tend to nibble on many small meals each night. They have a small home range, usually staying within 10-30 feet of their nest. Nests usually are built in structural voids, undisturbed storage or debris, or in outdoor burrows. The presence of mice is usually indicated by actual sightings, damage caused by gnawing into food containers, or the presence of droppings.

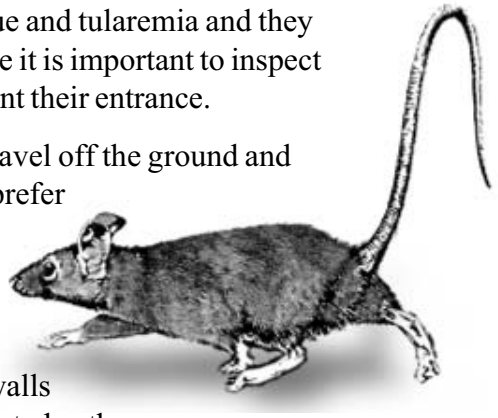
White-footed and deer mice have white feet, usually white undersides, and brownish upper surfaces. They have larger eyes and ears than house mice and most people find them more "attractive." These mice are seed eaters. They also consume fruits, insects, fungi, and possibly some green vegetation. They are uncommon in urban or suburban areas unless there is considerable open space nearby. They are mostly nocturnal with a home range of 1/3 to 4 acres. The signs they leave are similar to those of house mice, although white-footed and deer mice have a greater tendency to cache food supplies. They also lack the characteristic mousy odor of house mice. They will enter structures where they can cause considerable damage to materials that they use for nest building. White-footed mice may harbor hantavirus.

Voles, also called meadow mice or field mice, are compact rodents with stocky bodies, short legs, and short tails. They prefer wet meadows and grassland habitats and eat a wide variety of plants. Their home range is variable but usually 1/4 acre or less. Voles do not hibernate, they are active day and night, year round. Large population fluctuations generally peak every 2 to 5 years but the cycles are not predictable. During population eruptions, extremely high population densities may be reached.

Voles create an extensive system of surface runways 1-2 inches in width with numerous burrow openings. A single burrow system may contain several adults and young. Vegetation near well-traveled runways may be clipped close to the ground. Feces and small pieces of vegetation are found in the runways. During winter the only evidence of activity in and around buildings may be odors associated with droppings and urine in the walls. The droppings can be abundant and moist, unlike dry pellets produced by other rodents. They can also be quite active in greenhouses where they will eat plants.

Voles are capable of carrying disease organisms, such as plague and tularemia and they sometimes inhabit and defecate in the walls of buildings. Therefore it is important to inspect building perimeters in the fall and make necessary repairs to prevent their entrance.

Roof rats, or black rats, are excellent climbers. They like to travel off the ground and enter buildings from nearby trees or along power lines. Roof rats prefer fruit, but will eat any type of food. They have a large home range and may travel more than 50 yards to reach food or water. They often nest in attics, wall voids, and hollow trees. The presence of roof rats is determined by gnawing damage, droppings, sightings, sounds of scratching, squeaking, or gnawing in walls or ceilings, and characteristic dark, greasy rub marks along frequented paths along walls and rafters.



Norway rats are strong burrowers, good climbers, and excellent swimmers. They are more common in sewers and buildings than the roof rat. They strongly prefer meat and fish, but will do well on any type of human or pet food. Their home range may be more than 50 yards in radius. These rats usually dig burrows along building foundations and under debris piles. The Norway rat is very aggressive and may drive roof rats out of an area or they may share a building: Norway rats in the basement and roof rats in the attic. The signs they leave are similar to those of roof rats.

School IPM Fact Sheet

Yellowjackets, Hornets, and Bees

Stinging insects present a special hazard in schools due to the danger of allergic reactions in some people. Wasp stings are painful for most of us, but every year in the U.S. as many as 40 allergic individuals die from yellow jacket stings. Inspection, sanitation, exclusion, and the removal of small nests in early summer are the best methods for reducing wasp populations. Wasp colonies are killed by freezing temperatures in fall and winter and their nests are not reused the following season.

Inspection

From May to October, monitor for wasp nests every 2 weeks. Paper wasp nests are fairly easy to spot on the eaves of buildings or playground equipment. Yellowjacket nests are more difficult to locate especially if they are enclosed in wall voids or underground. These nests may remain hidden until they are quite large.

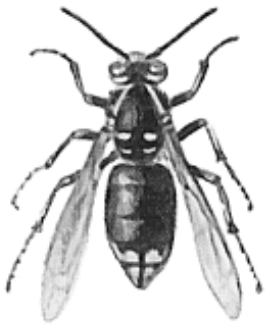
Yellowjackets will nest in the ground (often under shrubs, logs, or rock piles); in hollow trees; among branches of trees or shrubs; under eaves; in hollow fencing, playground structures, and meter boxes; and inside walls. Look for wasps entering and exiting from one of these locations.

Nests located where they can be avoided do not need to be treated. Rope off areas where nests are located, if possible, and instruct children not to disturb nests.

Outdoor sanitation

As summer wanes and natural food sources become scarce, dumpsters become very attractive to wasps. Practice good sanitation to keep foraging wasps away from food wastes.

- Make sure all trash containers have tight-fitting lids or spring loaded doors.
- Place all waste into sealed plastic bags before disposal.
- Empty trash frequently, especially during warm months.
- Wash dumpsters on a regular basis to eliminate spilled food and liquids.
- Limit food consumption outdoors. Clean up and dispose of trash promptly after outdoor events where food was served.
- Goldenrod is a major source of sugar for yellow jackets. If a nearby field of blooming goldenrod is mowed, expect an increase in the number foraging yellow jackets around school buildings and playgrounds.



Baldfaced Wasp

Yellowjacket

Paper Wasp

Exclusion

To prevent wasps from building nests, use quality sealant, steel wool, and insect screening to close openings in outside walls, playground structures, fences, pipes, hollow fence posts, meter boxes, wall voids, etc. Do not seal the entrance to an active nest until the colony is destroyed.

Removing nests

Nests should be removed if they are located in areas where disturbance is inevitable or where there is a persistent problem on athletic fields or around outdoor food-service areas. By managing wasps early in summer, schools can avoid larger, late-season nests that pose a real threat.

Knock down small paper wasp nests using a directed spray of water or a pole. Yellowjacket nests are often difficult to locate and remove. Nests found in shrubs should be bagged, then cut out. For ground nests, vacuuming the nest opening can work well, however digging a nest out of the ground is labor intensive and dangerous.

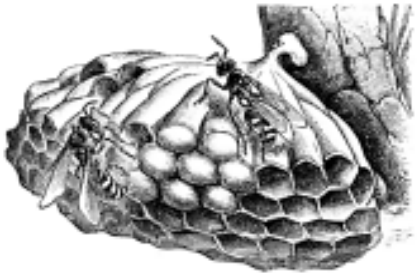
To avoid the risk of stings to students and staff, hire a professional to remove nests. Experienced professionals can vacuum nests located indoors or in sensitive areas where pesticides should not be used.

Using pesticides

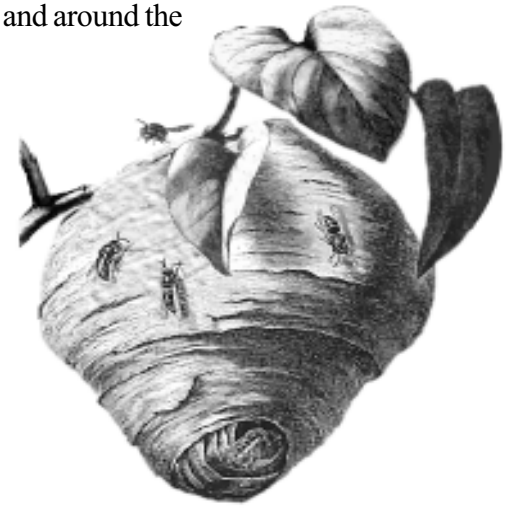
Large paper wasp nests and those in hard to reach locations require a low-toxic spray containing pyrethrin, mint oil, or eugenol. The pesticide treatment kills wasps at the nest as well as the foraging workers who will rebuild the nest on their return. Maine law permits a non-licensed school employee to apply ready-to-use general use pesticides by hand or with non-powered equipment to control stinging or biting insects for protection of school occupants. However, to avoid the risk of stings, you may wish to hire a professional to treat the nests. Treating the entire building exterior is not necessary or recommended. Use the following procedures to treat the nest with a registered insecticide:

Treating above-ground nests

- Wear protective clothing (coveralls with long sleeves tucked into gloves, pants, boots, a veil, and hat) to avoid stings.
- Treat at night when the entire colony is in the nest. Use an aerosol product—formulations designed to apply a 10-15' stream are effective.
- Approach the nest close enough to spray directly into and around the edges of the entrance hole.



Umbrella or paper wasp nest



Yellowjacket nest

Treating underground nests

- Wear protective clothing and veil to avoid stings.
- During the day, mark main entrance then check for and mark any additional entrances located within 40-50' of the main entrance.
- After dark, use a ½-second blast of aerosol spray to kill guard wasps at secondary entrance, stuff hole with paper, cover with soil. Apply some of the spray to the main entrance to kill guards, then use a bulb applicator to puff a dust formulation into the nest. Seal the entrance with moist soil.
- *Do not use gasoline or fuel oil for treatment.* It is illegal, ineffective, and pollutes the soil and ground water.

Treating nests in wall voids

- Wasp colonies can be eliminated using the same procedure for ground nests.
- After killing and removing the colony, seal the entry way to prevent reinfestation.

Yellowjacket traps

Trapping may catch hundreds or even thousands of individual wasps and still have little impact on the number of wasps around the school yard. However, the attractants in jar traps can draw wasps away from sensitive areas. Place traps out of children's reach near dumpsters or other food sources. Do not place traps on playgrounds or areas that are not normally attractive to wasps. Empty traps when full by placing them in the freezer or in a black plastic bag placed in the sun for a day to kill trapped yellowjackets. Wash traps in soapy water and refresh the bait.

Bees

Bees are generally mild mannered and pose a threat only if handled. They are often found on clover, wild flowers, and ornamental plantings. Because of their importance as pollinators, it is not advisable to apply pesticides to lawns, athletic fields or ornamental plantings where bees are active. To avoid stings, do not allow children to walk bare footed in these areas.

Occasionally, honeybees will swarm to seek a new site for the growing colony. Because there is no nest to defend, bee swarms are usually docile if left alone. It is common for a swarm to rest for several hours or an entire day before flying off to a new nest site. However, swarms that have clustered in an area for several days may become defensive. If swarming bees have moved into a wall void or other opening, they will defend themselves when disturbed.

Schools that experience swarming bees can call the Division of Plant Industry, 207-287-3891. The Division maintains a Swarm List of beekeepers who are willing to retrieve swarms. If the bees present an unacceptable threat, call the local fire department; they will exterminate the swarm.

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School IPM Fact Sheet

Managing Tree Squirrels

Tree squirrels are occasional pests in urban areas including school buildings. In Maine, there are two species of concern. **Gray squirrels** are gray on the top with a white underside. They measure 16 to 20 inches long; nearly half this length is the tail. **Red squirrels** are smaller but more agile, alert, and noisy than the grays. They are rusty-brown on top, turning grayer during winter, and off-white below. Red squirrels measure about 12 inches from nose to tail. They are strongly territorial and defend their food sources and den trees against intruders.

Tree squirrels feed on a variety of material including nuts, fruit, seeds, berries, insects, and bark. They nest in tree cavities, old woodpecker holes, attics, etc. If these sites are unavailable they may construct leafy nests in the branches of trees.

Damage

Squirrels typically gain entrance to attics and other structures from the roof, usually where tree limbs overhang the roofline. They may enter through damaged or unscreened vents although they sometimes gnaw their way into an attic. The sound of running or gnawing in walls or the ceiling during the day often indicates the presence of squirrels. Similar sounds at night usually indicate the presence of rats or mice. Squirrels can cause extensive damage to the insulation in the attic or walls, and may gnaw and damage wiring creating the risk of electrical fires. During winter, tree squirrels may damage trees and other ornamental plants by eating the bark off the limbs.

Management Methods

- Trim all tree limbs back at least 8 to 10 feet from roofs. If this is not possible, discourage climbing by fastening a 2-foot band of sheet metal around the trunk 6 to 8 feet above ground.
- All openings attics, vents, overhanging eaves, and siding must be sealed to exclude squirrels.
- Sheet metal, hardware cloth, and steel wool are effective materials for sealing the openings.
- Openings should not be repaired until the squirrels are out of the building. Usually a one-way door is used to allow squirrels to leave the building and not re-enter.
- Seal openings where utility cables or pipes enter buildings.
- Install chimney caps on all chimneys and check for gaps in the flashing at the chimney base.
- Live traps can be used to reduce local squirrel populations or to remove individual squirrels from a building interior. Effective baits include fruit, peanut butter, nuts, seeds and vanilla extract.

For more information, contact your local Animal Damage Control Office or one of the following Regional Warden Service Offices:

Ashland	**800-624-2512 or 207-435-3231**	**Greenville**	**800-624-2538 or 207-695-3756**
Bangor	**800-624-2498 or 207-941-4440**	**Sidney**	**800-292-7436 or 207-547-4145**
Gray	**800-295-2435 or 207-657-2345**		

School IPM Fact Sheet

Managing Flies

Filth flies

House flies, blue and green bottle flies, and flesh flies breed in garbage and/or animal feces and are generally referred to as filth flies. They pass through four distinct stages in their life cycle: egg, larva (maggot), pupa, and adult. These flies can detect odors across long distances. Smells of souring milk from hundreds of containers thrown in dumpsters can attract thousands of flies from the surrounding neighborhood. Sanitation is the key to preventing fly problems.

House flies. House flies are the most common fly in and around schools. The adults are 1/8-1/4 inch long, and dull gray. Females lay eggs in organic material, such as garbage or decaying vegetation that has sufficient food for developing maggots. After emerging as adults, flies range 1-2 miles; some may travel as far as 20 miles. Their behaviors make them annoying—they enter buildings, hover around people, and crawl on food. They also leave fecal spots, or "specks," where they have walked, and may transfer human and animal diseases.

Blow flies—greenbottle and bluebottle flies. These flies are similar in size to house flies, but are metallic blue or green. Adults make a loud, droning buzz. They breed in dead animals, feces, and garbage. They are stronger fliers than the house fly; flight range is 3-10 miles. If a large number of these flies is found indoors, there is probably a dead animal nearby. Green bottle flies are commonly seen on animal feces outdoors.

Flesh flies. Flesh flies are 2-3 times larger than house flies (over 1/3-inch long), gray with 3 dark stripes on the body, a gray and black checkerboard pattern on the abdomen, and red eyes. Most species of flesh flies are scavengers and breed in garbage, manure, or animal carcasses. A few species are parasites of caterpillars and considered beneficial insects. Flesh flies are common in populated areas but seldom enter buildings in large numbers.

Managing filth flies

Permanent or long-term control involves locating and eliminating larval breeding sites through improved maintenance and sanitation.

Sanitation and maintenance

- Keep doors and unscreened windows closed. Install air curtain over doors that must remain open for extended periods of time.
- Make sure window and door screens are in good repair.
- Promptly fix drains or electric garbage disposal units that leak, or drains that allow food waste to accumulate under sinks or floors. Leaky drains can attract many species of flies. Remove any food waste that has accumulated under sinks or floors; or in crawl spaces or basements at the site of a broken drain, and then clean the area thoroughly.
- All food waste from the kitchen, cafeteria, and other areas should be separated from other garbage, drained so that it will be as dry as possible, and then stored in sealed plastic bags before disposal.
- Seal containers with small amounts of food waste, such as milk or yogurt cartons, in plastic bags before disposal.
- Staff should be trained to place, not toss, bags of garbage into dumpsters to avoid breaking the bags open and spilling garage into and around the dumpster.
- In food preparation areas, rinse all cans, bottles, and plastic containers before recycling or discarding.
- Inform students, teachers, and staff about the importance of placing garbage inside the proper containers. Garbage should never be left lying on the ground.
- Promptly remove animal waste or dead animals found on school ground.
- To avoid attracting flies into the building, place dumpsters and recycling containers upwind from the outside doors of the school, particularly doors to the kitchen or cafeteria.
- Garbage cans on the school grounds should have removable domed tops with self-closing, spring-loaded swinging doors. Line cans with plastic bags that can be tightly sealed and removed daily.
- Make sure garbage can and dumpster lids close tightly and remain closed when not in use. Repair or replace dumpsters and garbage cans that have holes or lids that do not close tightly.
- Inspect dumpsters and other outdoor trash receptacles daily and remove any wastes lying on the ground.
- Wastes should be collected and moved off-site at least once a week. Since flies breed faster in warm weather, garbage removal twice a week may significantly reduce fly problems.
- Regularly clean garbage cans and dumpsters to prevent the buildup of food waste. If possible, dumpsters should be fitted with drains so that they can be hosed or scrubbed out as needed. Use a high-pressure stream of water or a brush and soapy water. A solution of borax and water will eliminate odors that attract flies. Some pest management companies will power-wash dumpster and dumpster areas as part of their service. You may need to require your sanitation company to clean the dumpster or replace it with a clean one more frequently.
- Flies can develop in soil that was soaked with water used to clean garbage cans and dumpsters. Check these areas regularly. If you see maggots, scrape them up along with the soil and dispose of everything in a tightly sealed plastic bag.
- Manage compost bins properly to avoid fly problems.

Fly traps

Adult flies can be captured with attractant fly traps or sticky fly tape. Traps can monitor the effectiveness of management programs and give moderate control in small, closed areas where fly populations are low. Electrocution type traps should not be used because these can disperse bacteria into the environment.

Commercially available indoor light traps that attract adult flies are often used in restaurants, grocery delis, and food processing plants. They should be placed on the wall 3-6 feet from the floor, away from windows and doors. These traps may be useful in school kitchens or cafeterias where an extra measure of control is needed, such as schools located adjacent to animal farms. Only use light traps with replaceable glue boards.

Attractant traps need to be serviced regularly, and repaired or replaced when damaged. Sticky traps should be hung where people do not inadvertently contact them. For some examples of commercially available fly traps see http://schoolipm.ifas.ufl.edu/tech_np.htm#3.

Fly traps are available in several designs. Traps need to be serviced regularly, and repaired or replaced when damaged.

Chemical control

Except for odor-eliminating chemicals (such as borax) and baits (placed only inside dumpsters), pesticides are not recommended for fly management.

Low concentrations of borax in water can be used to eliminate fly odors. This solution is particularly effective for removing fly specks from walls and eaves, and for rinsing out garbage cans and dumpsters. These solutions should not be used near ponds, streams, lakes, or other bodies of water, and should not be poured onto plants.

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Fruit flies

These flies are commonly seen flying around ripe fruit, especially bananas. They are about 1/8 inch long. They lay their eggs near the surface of fermenting fruits and vegetables and other moist organic materials (including damp mops and cleaning rags, as well as residues in bottles, cans, garbage disposals, and drains). Their complete life cycle takes little more than a week, so the number of flies produced by a single piece of fruit is enormous. These flies are most often a problem in late summer and early fall; careful storage of fruit and vegetables is necessary at these times of the year.

Management

Fruit flies are most active from early summer through early fall. Problems with these flies can be avoided by ripening fruit in paper bags. Seal the bags by folding the top over several times and closing them with paper clips or clothespins. Once fruit is ripe, store it in the refrigerator.

If an infestation is discovered, find and remove the material that is breeding the flies. Begin with obvious sources, such as ripe fruit and vegetables; look at water seeping from refrigerators, humidifiers, or sink drains that may be fermenting; spoiled animal food; even damp, sour mops or rags. To check if the breeding source is located in a garbage disposal or drain, tape a clear plastic bag over the drain overnight. Emerging adults will be captured in the bag. Areas outside the building near windows and doors should be checked for rotting vegetable matter. All breeding sources should be removed and disposed of in a sealed plastic bag. Make sure that screens and windows near food preparation areas are in good repair.

Fruit fly trap

To make a simple trap for adult fruit flies, combine 1 cup of vinegar, 2 cups of water, and 1 tablespoon of honey in a 2-liter soda bottle. Replace the cap, shake the mixture well, and punch holes through the side of the bottle above the liquid so the flies can get in. String the bottle about 5 feet above the ground. Discard and replace the liquid as needed.

Cluster flies

Cluster flies are larger and darker than the common house fly. These flies parasitize earthworms during the summer months. Rich soil with many earthworms can support a large population of these flies. In the fall, the adults cluster on the sun-light south and west sides of buildings. As the weather gets cooler, these flies begin looking for sheltered places to spend the winter and often enter buildings through cracks and crevices.

Management

Cluster flies are not as strong fliers as house flies and can easily be killed with a fly swatter or removed with a vacuum. During warm winter periods, cluster flies in buildings become active and are attracted to windows. Opening the window and allowing them to exit is an easy control tactic for smaller infestations. Commercially available window traps can be helpful in capturing flies indoors.

Try to seal the building exterior before they find their way inside during fall. Common entryways include unscreened doors and windows, openings under siding and around roofs, unscreened ventilating spaces, cracks around windows, and holes where wires penetrate the walls of the building.

Phorid flies (humpbacked flies)

Common phorid flies are small, 1/16 - 1/8 inch long, with a yellowish-brown body and li brown wings. The adults seem reluctant to fly as they run around on walls, windows, and tables with a characteristic quick, jerky motion. The females are strongly attracted to odor and lay their eggs on or next to decaying material including decomposing fruit, vegetables, and meat; open wounds in animals or people; and human and animal feces. The life cycle from egg to adult takes from 14-37 days.

Management

Although it may be difficult, it is important to find the breeding site. Once found, it must be thoroughly scraped, cleaned, and dried. Large infestations of these flies are often the result of broken drains or garbage disposals that allow organic matter to accumulate in out-of-the-way places such as wall voids, under floors, in basements, or in the soil of crawl spaces.

Moth flies (drain flies)

Moth flies are dark or grayish and fuzzy, about 1/16 - 1/4 inch long. Their body and wings are densely covered with hairs. Wings, appearing too large for the body, are held roof-like over the body at rest, giving this fly a mothlike appearance. During the day, adults often rest in shaded areas or on walls near plumbing fixtures and on the sides of showers and sinks. During the evening, these flies can be seen walking about drains and sinks. The maggotts can live in drain scum.

They may breed in large numbers at sewage filter plants and can be carried by prevailing winds to nearby buildings up to a mile away. Adults are small enough to pass through ordinary window screening.

Management

Moth flies do not bite humans but large numbers may become a nuisance. Infestations in drains often can be eliminated by flushing these areas with sink cleansers and very hot water. The most effective management tool is prevention. Regularly clean problem areas to remove the gelatinous, rotting organic matter that fly larvae feed on, including drains, sinks, wash basins, showers, dirty garbage containers, standing water in air conditioners, and other pools of stagnant water. Enzymatic cleaners and a long-handled brush are recommended for cleaning drains.

To monitor moth flies, place a glue board over a drain, sticky side down, on a collar made of cardboard. Leave in place overnight or for a few days to capture adult flies.

School IPM Fact Sheet

Mosquitoes

Although there are 45 identified species of mosquitoes in Maine, only about half of them are considered biting pests of humans and even fewer are sufficiently abundant to be considered important pests. Female mosquitoes feed on blood to acquire the extra protein they need to produce and lay eggs. In this process they can carry disease organisms and parasites from one animal to another. Eastern Equine Encephalitis and West Nile Virus are serious human diseases vectored by mosquitoes.

Habitats and life cycles

All mosquitoes breed in standing water. The majority of biting species live in the temporary spring pools formed by melting snow. Some species live in fresh water swamps, ponds, salt marshes, grassy ditches, culverts, and natural or artificial containers, such as tree holes, hollow stumps, rock holes, tires, swimming pools, and cans.

Eggs are deposited by females either individually or in groups on the surface of water or on soil where flooding will produce pools or ponds. In southern Maine, mosquitoes begin hatching in early to late March and continue until late April or early May, each species having a particular temperature range favorable for egg hatch. In central and western Maine, hatching occurs about 2 weeks later. At the Canadian border, mosquito eggs do not hatch until the last week of April. The larvae are called wrigglers because of their thrashing motion in the water. They breathe through a straw-like tube held at the water surface. The length of this life cycle varies by species from 4–30 days.

Adults begin emerging in late April. As long as water is available in their habitats, mosquitoes tend to gradually increase in abundance throughout the summer. Their numbers generally depend on the amount of rainfall. During wet summers, mosquitoes will be abundant; in dry summers, numbers will be low and individuals short-lived. Peak annoyance to humans usually occurs during the month of June.

Management

Eliminate breeding sites

Locate breeding sites before the adults emerge (late April). Drain or remove all stagnant water in unused buckets, pools, old tires, tin cans, and other discarded containers. Be sure gutters and downspouts are cleaned. Keep dumpsters and trash receptacles covered to prevent water accumulation. Drill holes in playground tires, if necessary, to prevent water accumulation.

Eliminate adult resting sites

Cut back or remove dense brush and other vegetation from around buildings. Keep grassy areas mowed. Manage landscapes to allow air movement to reduce mosquito problems.

Protect natural predators

Predators such as dragonflies provide some natural control of mosquitoes, especially in and around small ponds and salt marsh pools. However, importing dragonflies is not recommended. Bats and birds, often cited as important natural controls for mosquito populations. Consider putting up bat and bird houses.

Avoidance

- Avoid outdoor activity when mosquitoes are most active—at daybreak and dusk and on cloudy, warm days.
- Avoid areas where mosquitoes tend to concentrate—in tall grass, margins of wooded areas, or in heavily wooded areas in dense vegetation.
- Avoid wearing dark colors. Mosquitoes and other biting flies are attracted to dark greens, browns and black. They are less attracted to light colored clothing, especially whites, and yellows.
- Wear long sleeves and pants.
- Make sure window and door screens are in good repair.

Repellants

Schools may wish to adopt a policy for use of repellants. Some schools require parents to sign a consent for school staff to assist younger students in applying repellants provided by parents.

Repellants are pesticides, and although they are exempt from many pesticide regulations, care should be taken to avoid over-exposure. Insect repellents can repel mosquitoes for 2 or more hours depending on the ambient temperature, amount of perspiration, exposure to water, abrasive removal, etc. The CDC recommends the use of repellents containing the EPA registered active ingredients DEET, Picaradin, oil of lemon eucalyptus PMD), or IR3535. "Pure" oil of lemon eucalyptus (e.g. essential oil) is not registered and, therefore, not recommended. Oil of lemon eucalyptus should not be used on children under the age of three years. Concentrations containing 50% or more of any active ingredient do not significantly increase protection time.

Do not allow children to handle the product. Adults should first apply to own hands and then wipe it sparingly on the child, avoiding the child's hands. Apply repellants only to exposed skin and/or clothing (as directed on the product label). Do not apply to eyes, mouth, cuts, wounds, or irritated skin. When using sprays, spray first on the hands and then apply to the face, sparingly around ears. After returning indoors, thoroughly wash treated skin with soap. If use of repellent results in a rash or other bad reaction, immediately wash the repellent off and contact the local poison control center.

Questionable control methods

"Bug zappers" are commonly sold for mosquito control. Using an electrified grid and an ultraviolet light, they attract and kill any insect entering the trap. Unfortunately, the lights are not especially attractive to female mosquitoes who are more attracted to host odor. These devices generally kill more beneficial insects than pests. Light traps and carbon dioxide traps used by mosquito control programs are for monitoring purposes and are not effective in reducing mosquito numbers.

There have been several ultrasonic "mosquito repellers" on the market. The sound emitted by these devices is supposed to confuse mosquitoes and prevent biting. Tests under carefully controlled conditions have shown that these devices are totally useless for repelling mosquitoes.

Chemical control

There are several chemicals and formulations specialized for mosquito control. Chemical control is only a temporary solution to mosquito problems. Overuse of chemical pesticides can adversely affect nontarget organisms and can lead to pesticide resistant mosquito populations that are more difficult to control. However, if there are extensive mosquito breeding areas on school property, consider having a licensed operator apply a carefully chosen insecticide to the breeding areas to kill mosquito larvae. This method eliminates mosquitoes before they disperse and gives more effective, longer lasting control than applications that target adult mosquitoes. The population should be monitored to determine proper treatment timing. Larviciding should be used when mosquito egg hatch is complete, but before the larvae transform into pupae. Larvicides

will not affect eggs or pupae.

Use the least toxic materials to minimize contamination of aquatic environments and adverse effects to other organisms in the area. Note that any treatment of the surface waters of Maine requires a special permit issued by the Department of Environmental Protection.

Insecticide applications that target adults are the most expensive and least effective method of mosquito control and are not recommended for controlling mosquitoes on school grounds. This method will rapidly reduce mosquitoes in a local area, but the effect does not last long and applications must be repeated several times to keep mosquito populations low.

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Resources for Managing Mosquitoes

Updated Information Regarding Insect Repellents. May 8, 2008. Center for Disease Control. http://www.cdc.gov/ncidod/dvbid/westnile/

School IPM Fact Sheet

Spiders

The general appearance of spiders is familiar to most. They are closely related to insects but spiders have eight legs; insects have only six. Spiders belong to a group of animals known as arachnids, which also includes mites, ticks, and harvestmen (daddy longlegs). Few organisms create as much hysteria as spiders; this fear is largely unwarranted. In fact, spiders are beneficial to humans because they help to control a wide variety of indoor and outdoor pests.

In the U. S., four types of spiders are considered dangerous: the black widow, brown recluse (or violin) spider, the aggressive house (or hobo) spider, and the tarantula. Bites from these spiders can be painful, but they bite only when provoked or under certain circumstances. Poisonous spiders are rarely, if ever, found in Maine.

Children may be especially sensitive to spider bites, but many bites blamed on spiders are more likely from fleas, bedbugs, mosquitoes, ticks, or mites. Most spiders are too small to have a dangerous amount of venom, or a bite that can penetrate skin, or too weak to harm humans.

Wolf spiders hunt, day and night, and are often observed running on the ground.

The common house spider hangs upside-down in their tangled web. Several egg sacs are often present.

Often found at windows, jumping spiders stalk their prey during the day. Their eyes accurately follow objects up to a foot away.

Management

Unwanted spiders, and their webs, can usually be removed simply by sweeping or vacuuming. In most cases this is sufficient. If more action is necessary, study the situation to locate the spider's source of prey. Are spiders thriving on night-flying insects that are attracted to security lights? Are insects being attracted by poor sanitation habits? Eliminating the food source for the insects will reduce the food source for the spiders.

Maintenance to reduce spiders includes:

- Moderate the use of exterior lighting. Use sodium vapor lights where possible.
- Position lights away from buildings rather than mounting them directly on the exterior.
- Vacuum adult spiders, webs, and egg sacs. Immediately empty bag to prevent their escape.
- Remove litter and clutter from the sides of buildings, keep all areas free of unneeded, unwanted items.
- Seal openings in outdoor structures, playground equipment, bleachers, fencing, outdoor furniture.
- Repair screens and fill cracks and crevices around windows, doors, and foundations.
- Use weather stripping around windows and doors.
- Eliminate moisture from crawl spaces.
- Prune plants 6 feet away from buildings.

Chemical control

Chemical control of spiders is rarely, if ever, needed, often ineffective, and is not recommended.

School IPM Fact Sheet

Ticks

Ticks are sometimes of concern on school properties, especially those species that can transmit serious diseases to humans such as Rocky Mountain spotted fever, Lyme disease, babesiosis, ehrlichiosis, and Powassan encephalitis. Approximately 12 species are considered to be of major public health or veterinary concern. Management practices unclude: a) personal protective measures (such as wearing appropriate clothing, avoiding habitats associated with ticks, and judicious use of insect repellents), b) landscape modifications, and c) if necessary, limited use of pesticides as a targeted barrier treatment.

Ticks are blood-feeding arthropods related to spiders and mites. The adult tick has eight legs compared to insects which have six legs. Ticks can feed on a variety of animals including birds, amphibians, reptiles, and mammals (including people). The primary habitats for ticks are wooded areas and the open or grassy areas at the edges of wooded areas. On school properties, ticks are most often found on playgrounds, athletic fields, cross-country trails, paths, and school yards located in and adjacent to wooded areas, especially where deer and other wildlife hosts are abundant.

As ticks go through their life stages (egg, larva, nymph, and adult), they usually change hosts. Young ticks will attach to small animals and be dispersed by them. Nymphs and adults will climb onto grasses, herbaceous plants, and shrubs which enables them to latch onto larger hosts. Adult ticks can perch on plants for months waiting for a host to come by.

On humans, ticks migrate around the hairline, the area behind the ears, or in the armpits. It takes five to six hours for a tick to become firmly attached and up to ten days for it to become fully engorged with blood. The female needs a bloodmeal in order to lay her eggs. Ticks have been known to survive for one year without a bloodmeal.

The deer tick (*Ixodes scapularis*), also known as the "black-legged tick", is a small tick found almost statewide, especially central and southern Maine. It is the principal vector of *Borrelia burgdorferi,* the Lyme disease spirochete (bacterium) in the northeastern United States. Ticks must remain attached to the host for at least 24 hours in order to infect the host. The early signs of the disease usually show up as a rash at the bite site followed by flu-like symptoms. Untreated cases may lead to arthritic conditions and possible neurological problems. Medical care should be sought when a person is bitten by a deer tick or exhibits Lyme disease symptoms.

For more information on deer ticks and Lyme disease, contact the Maine Center for Disease Control and Prevention (207 287-7267) or visit http://www.maine.gov/dhhs/boh/ddc/lyme_disease.htm.

The American dog tick (*Dermacenter variabilis*), also called the wood tick, is larger than a deer tick and the unengorged female has a whitish shield on its back. This tick readily attaches itself to humans and is one of the most commonly encountered ticks in Maine. Some dog ticks outside of Maine may carry the organsim that causes Rocky Mountain spotted fever, a serious disease that can be transmitted to humans. Symptoms of this disease are headache, fever, and aching muscles two to 14 days after

an encounter with a tick. Two to three days after the fever starts, a rash develops on the wrists and ankles, spreading to the palms, soles, and trunk of the body. There have been no known diseases transmitted by dog ticks in Maine.

Dog ticks are most likely to be found in open areas with tall grass or brush. Adults are first noticed in late April and remain abundant through June. Although numbers seem to decline sharply after that, ticks are present all summer.

Managing School Properties to Reduce Tick Problems

Landscape management practices designed to make the landscape more inhospitable to primary tick hosts may reduce a tick population. However, these practices alone will not eliminate all ticks and the risk of associated diseases. Therefore, other tick control practices must be integrated with the overall program to reduce the risk of disease. It is impractical and expensive to institute tick control measures and landscape management practices in all areas of the school grounds. Efforts should be focused on frequently used areas (playground, ball fields, area immediately surrounding the school building, etc.).

- Cut back vegetation and remove vegetative debris to reduce shade and moisture. Keep grass, weeds, and brush mowed short. Remove leaf litter and plant debris around buildings, edges of lawns, playgrounds, and ball fields. Compost or bag and remove leaf litter. Avoid use of ground cover vegetation in frequently used areas.
- Reduce cover for mice. Prune trees and shrubs. Clean up storage areas.
- Use hardscapes (pavement, stones, etc), mulches, and water-conserving landscape techniques.
- Maintain a three-foot wide or broader walkway of wood mulch or crushed stone to serve as a barrier between woods and lawns.
- Keep out stray dogs.
- Reduce deer habitat and install fencing as necessary.
- Move swing sets and playground area out and away from the woodland edge.

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Monitoring for Ticks

Tick populations can be monitored by dragging or flagging since ticks are usually found within 18" of the ground. A tick drag, made with a 3" x 3" white cloth stapled to a dowel and weighted with a second dowel, is dragged over dry grass and brush and inspected at fixed intervals for ticks. Flagging involves brushing higher vegetation with a cloth attached to one end of a pole. Such areas include the understory in wooded areas and brush and shrubs in open areas, along edge habitats, and along property borders.

Prevention

Limiting exposure to ticks is presently the most effective method of prevention. Other prevention methods include the following.

- Wear light-colored clothing. This will allow ticks to be detected more easily.
- Wear long sleeves and long pants that are tight around the wrist, ankle, and neck. Tuck pants into socks to prevent ticks from crawling up the inside of pants' legs.
- Walk in the center of paths and avoid vegetation along path edges.
- Treat exposed areas of skin with repellents to discourage tick attachment. Repellents containing DEET (n, n-diethyl- m-toluamide) can be applied to the skin, but will last only a few hours before reapplication is necessary. Use DEET (supplied by parents and only with parental permission) with caution on children because adverse reactions have been reported. Refer to Mosquito fact sheet for more information on the use of repellents. Repellents should not be applied under clothing and should be washed off when indoors.

- Adults and students should check themselves immediately after visiting a potentially tick-infested area. Pay close attention to hair, armpits, shoulders, waist, and inner thighs. Remove any tick found on the body.

Removal of Ticks

- Use fine-tipped tweezers to remove attached ticks. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with tweezers or consult the school nurse.
- Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms.
- Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin.
- Apply rubbing alcohol to the bite and wash hands with soap and water.

The tick may be saved for future identification should disease symptoms develop within 2-3 weeks. Place the tick in a small vial containing rubbing alcohol. Write the date of the bite on a piece of paper with a pencil and place it in the vial.

Note: *Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting a tick-borne disease. These methods of tick removal should be avoided. Also, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.*

Chemical Control

Restrict application of pesticides to high-risk tick habitat such as edges of lawn and woodlands. Spraying open fields and lawns is not necessary. The product must be labeled for area-wide tick control. Pesticides may only be applied on school grounds by a licensed commercial applicator.

Anyone making pesticide applications on school property must be licensed by the Board of Pesticides Control. See "Standards for Pesticide Applications and Notifications in Schools".

Tick References

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School IPM Fact Sheet

Ten Practices That Prevent or Minimize Ornamental Plant Problems

Many plant problems can be prevented through good landscape management practices. Other problems can be minor or serious, depending on how early you detect and manage them. Some practices cause long-term problems that weaken plants, which then fall victim to problems that should be minor. Here are ten practices, with specific examples, that can help you prevent some problems, minimize others, and improve the overall quality of your landscape.

1. Design landscapes to support good horticultural practices and minimize damage to plants.
   - Consider long-term maintenance when making every decision, from concept to design to installa tion to maintenance.
   - Design adequate walkways; compacted lawns at sidewalk edges are invaded by weeds like purslane and knotweed.
   - Mulch widely around trees and shrubs, to reduce competition from lawns and prevent string trimmer/mower damage.
   - Design shrub borders, flower beds, fences and other features in a way that makes mowing around them easy and safe.

2. Inspect all materials before you bring them into the landscape.
   - Mulches, compost and soil can contain weeds, weed seeds, disease propagules, road salt and chemical residues.
   - Plant root balls can contain weeds, weed seeds, disease propagules and insects such as European red ant.

3. Choose plants that have the ability to thrive in the site's conditions.
   - Choose plants suited to the site's wind, temperature, soil characteristics, and water availability.
   - Choose plants that will support users' activities: foot traffic, school activities, vehicle exhaust, and urban pollution.
   - Consider the long-term cost of pruning, mulching, weeding, irrigating, fertilizing, mowing, edging, and raking leaves.
   - Avoid plants prone to local problems. Many viburnums are vulnerable to viburnum leaf beetles. True lilies are eaten by lily leaf beetles. Roses are popular with Japanese beetles and many plants are favored by deer.

4. Choose plants that have the potential to do what you expect them to do.
   - Trees can provide shade, form a windbreak, produce seasonal color, and control erosion … but no one tree does it all.
   - Of turfgrasses, bluegrass is the best for sports, fescue does well in shade, ryegrass grows fast… but no one does it all.
   - When selecting any plant, think about its function first, and other features (beauty, price, etc.) second.

5. Choose plants whose growth potential fit your spaces.
   - Spacing plants too closely encourages disease development and discourages plant vigor.
   - Trees that are too large for a space can conflict with power lines and may lead to power company pruning.
   - Trees in tight spaces may not develop good root systems and can become a danger to buildings and people.
   - Trees in tree pits do not develop normal root systems and often die from what should be minor problems.
   - Trees planted too close to buildings can cause foundation problems.
   - Plants planted under the building overhangs receive low water and light and are prone to winter ice damage.
   - Plants in and adjacent to parking lots are prone to snowplow damage, salt damage, and auto impact.
   - Plants planted next to playgrounds may be damaged by bicycle chains or may be otherwise vandalized.
   - Siting shrubs according to their mature size nearly eliminates the need for pruning.
   - Siting plantings away from play areas and other high-pedestrian traffic areas reduces problems of soil compaction.

6. Purchase only the highest quality plants, plant them correctly, and get them off to a good start.
   - Establish a trust-based relationship with a knowledgeable local nursery/garden center/landscape professional.
   - Buy early in the season for the best choice of plant materials; buy healthy plants with excellent shoots and roots.
   - Dig wide planting holes as deep as the plants' root systems, so that you set plants on firm native ground.
   - Tease soil away from the base of trees and shrubs, locate the crown, and site it at ground level when planting.
   - Remove containers from plants, even if the containers are fiber pots or burlap.
   - Amend soil minimally, only if needed, and never more than 25% by volume (3 parts soil : 1 part organic matter).
   - Handle trees and shrubs by their root balls, not by their stems.
   - Position a tree or shrub in its planting hole, backfill half-way, tamp with shovel, water to settle; repeat to fill hole.
   - Mulch the root zone of plantings with 2-3" of bark mulch, pulling it back 6" from stems; never volcano-mulch!
   - Newly planted plants must develop roots before they can take up fertilizer; start fertilizing the year after planting.
   - Water thoroughly after planting. Repeat the next day. Irrigate to prevent water stress during the establishment time.
   - The establishment time for a mature tree may be three or more years.
   - To water thoroughly, irrigate the equivalent of 1" to 1.5" water over the area of the plant's root zone per week.
   - The root zone of an established tree can reach 2-3 times the width of the canopy.
   - Water early in the day so that excess water evaporates; watering in the evening promotes disease development.

- Use water-conservative irrigation systems like drip irrigation, which delivers water directly to the roots.
- Avoid overhead sprinklers; they waste water, and improve conditions for disease development by wetting leaves.
- Do not overfertilize. Plants vary in nutrient needs; always fertilize according to a soil test recommendation.

7. Learn the pest/problem complex of the plants you choose, and monitor appropriately for them.
   - Many problems can be avoided through good plant choice; examples include crabapples resistant to multiple diseases and phlox cultivars that are resistant to powdery mildew.
   - Check for problems that you anticipate at the times of year when you'd expect to see them.
   - If using chemicals to manage problems, use appropriate chemicals at times when they are most likely to be effective.

8. Spot-treat problems as they develop with IPM, cost, and labor in mind.
   - Many problems can be controlled by pruning, or spot-treating very localized outbreaks.
   - Problems left unchecked can develop into serious threats to plant survival.
   - Spot-treating takes less time, less product, and less money than larger scale problems.
   - Some pests can easily be managed nonchemically: prune out viburnum twigs containing eggs in late fall, handpick tent caterpillar egg masses in winter, prune or hand-remove fall webworm nests in late summer, etc.
   - Follow specific protocol on pesticide labels. Use personal protective gear. Follow state and federal application laws.

9. Educate the users of the landscape about how to interact with the space appropriately and respectfully.
   - Communicate in a variety of ways: conversations, memos, emails, announcements, and signs all have their place.
   - Good landscape design helps people use spaces appropriately: curbs stop vehicles, fences create boundaries, etc.
   - Help frequent users of the landscape develop a sense of ownership; they'll help you educate others to respect it.
   - When people misuse the landscape, evaluate the situation and consider how a better design might mitigate the problem.
   - Establish a protocol for "gift" and "memorial" plants, considering site conditions, function, design, and maintenance.

10. Learn from others … attend classes and workshops … consult experts … read … and educate others.
    - You can learn what problems are active in an area by communicating with other local landscape managers.
    - New problems develop over time; knowledge can help you stay one step ahead of some of those problems.
    - Check these websites (just a sample; develop a longer list specific to your landscape needs):
      - Pest management information for New England: <http://pronewengland.org/>.
      - Cornell's turf management guidelines: <http://ipmguidelines.org/turfgrass/>.
      - Weed photos: <http://www.umassgreeninfo.org/fact_sheets/weed_herbarium/common_name_list.htm>.

- List of Maine native plants for landscape use: <http://www.umext.maine.edu/onlinepubs/htmpubs/2500.htm>.
- Yardscaping: <http://www.yardscaping.org/http://www.yardscaping.org/>.
- Plant database with keys, selectors, etc.: <http://www.hort.uconn.edu/Plants/index.html>.
- Maine Board of Pesticides Control: <http://www.maine.gov/agriculture/pesticides/about/index.htm>.
- University of Maine Cooperative Extension: <http://www.umext.maine.edu>.

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School IPM Fact Sheet

Eastern Tent Caterpillar

Webs of the eastern tent caterpillar are a common sight in spring, especially where wild cherry, their favorite food, is abundant. During the day caterpillars feed on leaves; the webs protect them at night. After they strip one tree of leaves they crawl to others to continue feeding. During outbreaks tent caterpillars may attack cherry, apple, hawthorne, peach, plum, witch hazel, rose, beech, birch, willow and poplar. Defoliated trees are weakened but the damage often occurs early enough so that trees can replace their leaves.

Life cycle

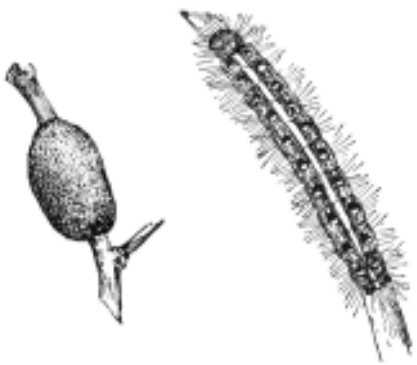
Tent caterpillars spend the winter as dark, collar shaped egg masses about 1 inch long on branches and twigs. Each egg mass contains 150-300 eggs. Eggs hatch in spring, when tree buds begin to open. Young caterpillars construct tent-like silken masses near the trunk in branch crotches. They feed for 6-8 weeks before tranforming into adults. Adults emerge in July and live less than a week—just long enough to mate. There is a single generation each year.

Monitoring

- After autumn leaf fall, look for egg masses on susceptible trees; record locations and quantities.
- In May, when buds begin to develop, look for webs in susceptible trees.

Management

- Remove wild cherry trees from hedgerows and fields near susceptible ornamentals.
- Remove egg masses or prune twigs containing egg masses and destroy them by crushing and then coating them with a 50-50 mix of laundry detergent and water.
- Remove webs when they appear in early spring. Crush them on pavement or drop them into a 50-50 detergent/water mix. Do this in the evening when larvae have returned to the web; wear gloves to avoid skin irritation.
- Biological control using of *Bactillus thuringiensis* (Bt) can be very effective in eastern tent caterpillar control. Make applications to foliage when the larvae are small (less than $^1/_2$ inch).
- Chemical control is usually unnecessary if all of the above methods are used. If populations still exist, judicious chemical controls may be used. Chemical controls are most effective against young larvae; web size should be no more than three inches in diameter. Applications should be made in late morning when larvae congregate near the nest surface to warm in the sun.



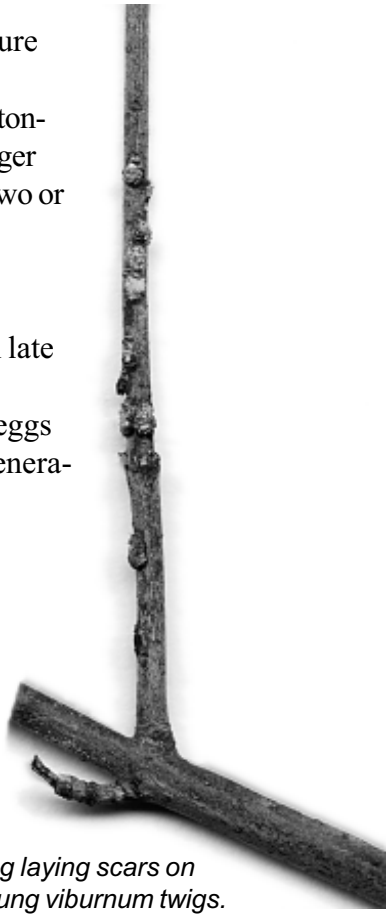
Anyone making pesticide applications on school property must be licensed by the Board of Pesticides Control. See Standards for Pesticide Applications and Public Notifications in Schools.

School IPM Fact Sheet

Viburnum Leaf Beetle

Adults and larval viburnum leaf beetles feed exclusively on plants belonging to the genus *Viburnum*, sometimes killing the plant. This species is native to Europe but is now established in Maine.

Adults are about 3/8 of an inch long and yellowish to light brown. Mature larvae are larger than the adults (about 1/4 inch), shiny, greenish-yellow to white, and covered with dark dots. The first sign of infestation is young, skeletonized leaves. Both larvae and adults feed on foliage between the midrib and larger veins, usually on the lower leaf surface. Plants that have been defoliated for two or three consecutive years may die.



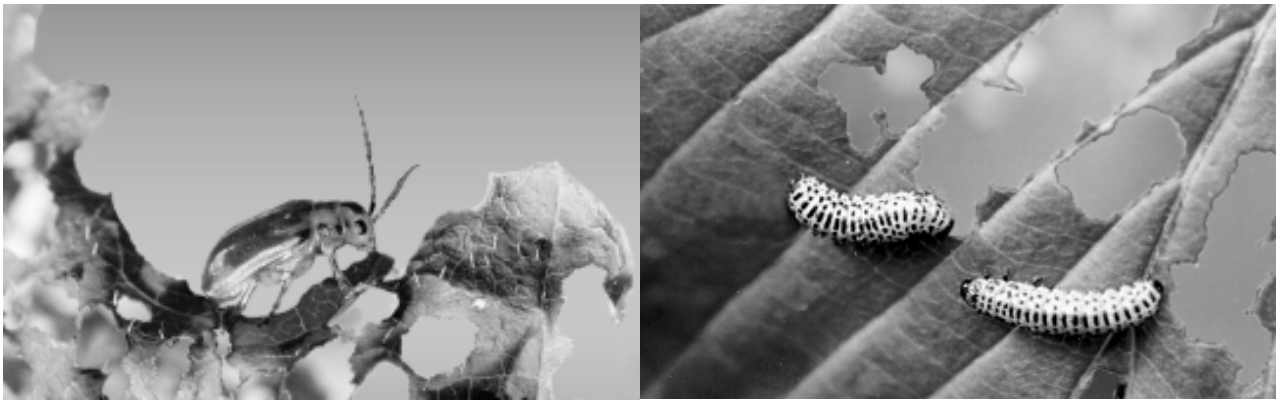
Egg laying scars on young viburnum twigs.

Life Cycle

Viburnam leaf beetles overwinter as eggs on host twigs. Eggs hatch in late May or June. Larvae feed on viburnum leaves and eventually drop to the ground to pupate. Adults usually emerge in July. Females deposit several eggs on the tips of the branches from late summer into fall. There is only one generation per year.

Management

- Prune and destroy infested twigs after egg laying has ceased in the fall—anytime from October to May. Look for egg sites that seem to swell and peel as the temperatures warm.
- Monitor the lower leaf surface for the presence of larvae in late spring. Hand-pick larvae and destroy.
- Plant less susceptible species of viburnums.



Adult viburnum leaf beetles (left) and larvae (right) feed exclusively on viburnum leaves.

School IPM Fact Sheet

White Pine Weevil

The white pine weevil is the most serious insect pest of white pine in Maine. The weevil also attacks Norway spruce, Colorado blue spruce, jack pine, red pine, Scotch pine, mugho pine, and native spruces. Feeding damage kills the tops of conifers leaving unsightly dead leaders (the top-most branch of the tree) and distorted growth.

Adults are active in early spring laying eggs in the bark of the highest stems on the tree. After hatching, the weevil grubs tunnel under the bark and girdle the branch. Dripping resin is commonly observed from damaged stems. Typically, the top $1^1/_2$-2 feet of the main stem is killed. Adult weevils emerge in July, feed on new growth in the crown of infested trees, and eventually burrow into the ground litter, often at the base of host trees, to over-winter.

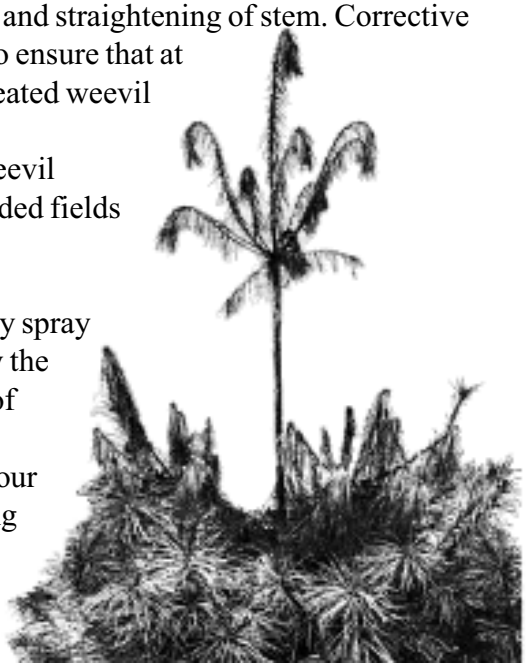
Management

At low infestation levels, prompt removal of infested leaders can limit population increases. Prune wilting leaders by mid-July before the adults emerge. Cut the stem below the grubs by including at least some green bark at the base of injury. Immediately burn the cuttings to destroy the larvae and pupae. Pruning infested leaders early in the season encourages the growth of a new leading stem and keeps the natural form of the tree.

Corrective pruning of injured tops should remove all but a single shoot at the topmost healthy whorl. This promotes healing, resumption of vertical growth, and straightening of stem. Corrective pruning may be postponed until the year after weevil injury to ensure that at least one lateral branch survives ice and snow damage or repeated weevil attacks the following year.

Avoid planting white pine or spruce in areas with high weevil populations. Locations with heavy clay soils and densely sodded fields may increase the chance of weevil attack.

Chemical Control. If pesticides are necessary, thoroughly spray the top half of all leading stems before the buds open (usually the first week in May). An extended spray rod that reaches tops of taller trees may be required for complete coverage. In severe cases, fall treatments can reduce adult populations. Contact your Cooperative Extension office for more information concerning chemical control for white pine weevil.



Leaders damaged by white pine weevil bend into a characteristic "shepherd's crook." WIthout corrective pruning the tree trunk may become forked or crooked.

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School IPM Fact Sheet

White Grubs

Some of the most prevalent turfgrass pests are white grubs. These are the C-shaped larvae of a large group of beetles known as scarabs. Many scarabs attack turfgrasses and cause considerable damage. The three important species in Maine are the Japanese beetle, May or June beetle, and the European chafer.

White grubs in turf share similar life cycles. They develop in the soil and feed on grass roots. In the summer, adults emerge from the soil and feed on foliage and/or flowers before mating and depositing their eggs in turf. The eggs hatch in August and larvae feed on grass roots until October. As soil temperatures cool, the grubs move deeper into the soil to overwinter. The following April or May, they return to the surface and begin feeding again before emerging as adults.

Damage

White grubs eat organic matter including the roots of plants. Heavily infested turf is water stressed—off color, gray-green, and wilts rapidly in the hot sun. Fine and tall fescues are not as severely attacked as Kentucky bluegrass and perennial ryegrass. Continued feeding kills turf in large irregular patches.

Dense grub populations can reduce the playability of athletic fields. The tunneling of the larvae gives turf a spongy feel; large patches can often be rolled back like loose carpet. Animals, such as crows, skunks, or raccoons, are attracted to these areas to feed on grubs, causing considerable damage as they dig. While these animals help keep grubs under control, too much of this damage may be unacceptable on athletic fields.

Japanese beetle

The Japanese beetle was introduced into southern Maine during the early 1960s. Adults are dark metallic green beetles about $^{1}/_{2}$-inch long. Adults are voracious plant feeders and may become serious pests of ornamental landscape plants and trees including maple, birch, mountain ash, linden, grape, blueberry, rose, apple, cherry, peach, and plum. Japanese beetle adults emerge from late June to mid-July, often in large numbers. They aggregate in dense populations inflicting heavy damage to ornamental leaves and flowers.

May or June beetle

May/June beetles are native and found throughout Maine. They are shiny, robust, reddish-brown beetles nearly 1-inch long. Adults emerge in May or June and are active at night. They are highly

White grub

Japanese beetle

May/June beetle

European chafer

attracted to lights, frequently fly into windows and screen doors, especially during hours of peak activity—7:00 to 9:00pm. Egg laying may be concentrated near exterior lighting. May/June beetles have a three-year life cycle. The grubs are most damaging in their second year when they feed heavily from May through September.

European chafer

The European chafer has recently been introduced to the southern and coastal areas of Maine. It is expanding its range inland. The adult is light-brown and $^{5}/_{8}$-inch long. European chafers tend to remain in the root zone later in the fall and return to the root zone earlier in spring than other white grubs.

Adults emerge from the soil in June and July. At dusk they congregate in conspicuous mating flights, usually at a tall object on the skyline, such as a tree 20-30 feet high. Swarms may number in the thousands and may look and sound like a swarm of bees. Larval damage is later concentrated in the turf around these swarms.

Monitoring

Monitoring for white grubs involves sampling several locations across an area of turf. It is important to use a uniform method to accurately assess the population. Walk in a zigzag pattern across the field, taking samples at 10-20 foot intervals from at least 10 locations. Begin sampling in August when grubs are easily seen and actively feeding, but before signs of injury are visible.

Take square foot samples using a small shovel to cut through the turf and thatch on three sides of a square. Peel back the turf and inspect the thatch and upper 2-3 inches of soil. To find the grubs, shake the sample, and probe through the soil and roots with a pocket knife or screwdriver. Count the number and species of grubs found at each sampling site and record these on a map of the area. Replace the sod after sampling and irrigate thoroughly. A quicker method is to use a golf course cup cutter. This cuts a round core of about $^{1}/_{10}$ square foot. Multiply the average grubs per core by 10 to get the approximate number of grubs per square foot.

White grubs are distributed in patches. Be sure to sample in the most likely turfgrass habitats. Japanese beetles and European chafers prefer grass in sunny areas, and high quality turf near the adult's favorite food plants. May/June beetles often lay large numbers of eggs under or near exterior lights. If white grubs are not detected but damage is present, examine the turf for other causes of injury such as disease, excessive thatch, moisture stress, heat damage, or other insect pests.

Action thresholds

Japanese beetle and European chafer. Irrigated turf has a tremendous ability to recover from injury. Even so, irrigated turf with more than 20 grubs per square foot will likely suffer from water stress. In un-watered turf, 5-10 grubs per square foot may result in brown patches.

May/June beetle. Large grubs can cause more damage. Turf injury is likely if more than 10 grubs per square foot are found on irrigated turf, or if more than 3-5 per square foot are found on low maintenance turf.

Prevention

Do not plant roses, grapes, or lindens around high maintenance turf areas.

Water management

White grubs usually need moist soil for eggs to hatch. The young larvae are also very susceptible to dry conditions. In areas where turf can stand some moisture stress, do not water in July and early-August when white grub eggs and young larvae are present. Use water management cautiously; dry soil will accentuate any existing white grub damage.

Traps

Adult Japanese beetles are highly attracted to traps baited with floral and pheromone lures. The traps are useful for monitoring the presence of adult populations, but they are not useful for controlling turf damage. Traps may have some utility for managing Japanese beetles on ornamentals, although plants near traps can sustain increased damage. These traps are recommended only as a means of drawing beetles far away from very susceptible landscape plants. Place them as far away as possible from valued ornamentals and high-maintenance turf.

Biological control

Certain nematodes (microscopic wormlike animals that can cause disease in insects) have shown some promise for controlling white grubs in turf. *Steinernema glaseri* works consistently but may be difficult to find; *Heterorhabditis bacteriophora* and *H. heliothidis* provide moderate white grub control. Other species, including *S. riobravis*, *H. megidis*, and *H. zealandica* have provided good white grub control in research trials.

Nematodes are very sensitive to drying and must be used carefully. They should be watered in as soon as they are applied to turf, either by applying them during rain, or by irrigating immediately after application. Do not apply nematodes during the hottest parts of the day. When preparing them for use, keep them cool and out of the sun; store them in a cooler if the day is hot. An excellent resource on the use of nematodes for grub management is: www.oardc.ohio-state.edu/nematodes.

The naturally occurring soil fungus *Beauveria bassiana* is commercially available and may be effective against white grubs. *B. bassiana* requires high humidity to infect insects. Research has shown promising results, but only when the fungus is used during a wet summer.

Chemical control

White grubs are most susceptible to chemical control when they are very small. The degree of control is highly variable from site to site and year to year, but insecticides may provide 50-80% control of white grubs. If irrigation is available, liquid insecticide applications can be effective if applied with proper timing (usually late summer). Granular insecticides are often more effective where irrigation is not possible.

Apply spot treatments in late August and early September. Early morning or evening is the preferred time for insecticide treatments. If soil moisture is unusually low at the time of application, consider irrigating the area a day or two before the intended application to draw the grubs up into the upper root zone. Irrigate after application to wash the treatment into the soil. Three weeks after treatment, evaluate the treatment by sampling for grubs where the original samples were taken. Be sure to record the results for future reference. Keep in mind that no insecticide will eliminate an entire grub population, but the numbers can be reduced below the action threshold.

Research indicates that most of the pesticide applied for grub control ends up in the thatch. Irrigating before or after an application does affect this binding. If the thatch layer is an inch thick or more, grubs probably will not contact an effective dose of any applied insecticide.

Anyone making pesticide applications on school property must be licensed by the Board of Pesticides Control. See "Standards for Pesticide Applications and Public Notifications".

School IPM Factsheet

Weed Management

Weeds in parking lots, walkways, under fences and similar areas

Weeds are often defined as plants growing in places where they're not wanted. In some cases, the designation of a "weed" can be quite subjective such as dandelions in a lawn which affects the aesthetics. In other cases, weeds are unwanted because they are harmful to people such as poison ivy or thorny plants. Finally, weeds can be unwanted because they grow in areas intended to be free of vegetation such as parking lots, walkways, fence lines, or infields.

Cultural practices for weed management

- Proper design and construction reduces the need for weed management. For example, placement of concrete or asphalt mow strips under fencing or backstops provides long term weed management. Most landscape areas can be designed for either long term weed exclusion or mechanical weed management with mowers or string trimmers.
- Install posts 8-12 inches inside the edge of the pavement, when fences surround paved playing surfaces such as basketball or tennis courts.
- Use landscaping fabric in plant beds and under stone or brick walkways.
- Retrofit existing cyclone fence lines by pouring a 16-inch concrete or asphalt strip to cover the soil under and beside the fence. Retrofits can be done in stages over several years as budgets permit.
- Mulches inhibit weed growth by blocking sunlight. Apply mulches immediately after the ground is disturbed or plants are installed. Mulches should to be 3-4 inches thick. Reapply mulch periodically.
- Suppress weeds on baseball infields, running tracks, and other bare soil areas using periodic shallow cultivation with a tractor mounted rotary harrow, also called a rotary hoe or power rake.
- Use hand weeding, string trimmers, and mowers wherever possible.
- Plant groundcovers with rapid, spreading growth habits between shrubs.
- Plant fast growing annual flowers such as sweet alyssum, farewell to spring, and scarlet flax in bare areas between bedding plants or shrubs.
- Seal cracks on asphalt surfaces. If weeds are present, control them with flamers before sealing.

Chemical weed management

- Chemical control of weeds should only be considered when cultural controls have been exhausted or are unrealistic.
- In Maine, herbicides can only be applied at schools by a licensed pesticide applicator and should be applied when school is not in session (weekend or summer). Be sure the treated areas are posted to prevent accidental exposure.
- Selective herbicides (broadleaf or grass killers) and non-selective herbicides are available.
- Discuss herbicide choices with your licensed applicator. Select least toxic, effective materials.

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School IPM Fact Sheet

Turf Establishment

The foundation of Integrated Pest Management requires steps to ensure turf gets a good start when lawns and fields are first established. Turf can be established from seed or sod. Soil preparation is the same for either method and is the foundation for growing quality turf. Below are guidelines for establishing turf. For more information about turf management see **Outdoor Pest Management for Maine Schools** at http://www.maine.gov:8080/agriculture/pesticides/schoolipm/pdf/outdooripm.pdf.

Turf establishment requires a specific sequence of actions

- Soil test.
- Lime to adjust pH based on soil test.
- Apply starter fertilizer at the rate of 1.0 lb. Phosphorous/1000 sq. feet.
- Roto-till amendments into the top 4" of the soil mix.
- Finish grade.
- Firm soil and finish rake.
- Apply a complete fertilizer at the rate of 1.0 lb. Nitrogen/1000 sq. feet.
- Seed or sod.

Sod establishment

- Select top quality sod from a reputable sod grower.
- When root mix is sandy material, request sod grown on sandy soil; if not available, purchase washed sod.
- Sod should be laid quickly, rolled, and then irrigated with sufficient water so as to wet the soil beneath.
- Maintain moist soil beneath the sod by irrigating on a daily basis or as needed for the first three weeks.
- Restrict use until sod is well established (minimum of 4-6 weeks).

Seed establishment

- Select a mix of top quality seed varieties from a reputable seed dealer.
- Seed at half rate in one direction and at half rate in a perpendicular direction.
- Seed ideally in late August - early September or when unavoidable, seed in May - June.
- Lightly rake seed into the top $^1/_8$-$^1/_4$ inches of the soil.
- Roll to firm seed in contact with soil.
- Mulch with straw, compost, or other weed and seed free organic material or row cover fabric for spot areas.
- Irrigate lightly and frequently (maintain moist seedbed) until seed germinates.
- As turf develops, increase amount of irrigation and interval between irrigation.
- Irrigation will be critical to proper establishment over the first two months.
- Restrict use until turf is well established, usually 2-4 months.
- Athletic fields require a full year to mature before use.

School IPM Fact Sheet

Turfgrass Species Selection

Turf Integrated Pest Management begins with growing the grass species most likely to succeed. Choose the best adapted species for the site conditions and the intended use of the area. The wrong species in the wrong place will led to increased need for water, fertilizer, and pesticides. Use these guidelines for choosing turf grass species when establishing, renovating, or overseeding athletic fields and lawns.

- Grass species well adapted for use in Maine as athletic fields or general lawns include Kentucky Bluegrass, Creeping Red Fescue, Chewings Fescue, Hard Fescue, Perennial Ryegrass, and Tall Fescue. Mixtures including Kentucky Bluegrass, Fescue, and Perennial Ryegrass are best.
  - Level A athletic fields: 80% Kentucky Bluegrass (2-3 varieties) and 20% Perennial Ryegrass (2 varieties) or 60%-80% Tall Fescue and 20%-40% Kentucky Bluegrass
  - Level B athletic fields: 60% Kentucky Bluegrass (2-3 varieties), 20% Creeping Red Fescue, and 20% Perennial Ryegrass, or 80 % Tall Fescue, 10% Perennial Ryegrass, and 10% Kentucky Bluegrass
  - General Lawns: 40% Kentucky Bluegrass (2 varieties), 20% Chewings Fescue, 20% Hard Fescue, 20% Perennial Ryegrass
  - Low impact lawns: 40%-60% Creeping Red Fescue or Tall Fescue, 10%-20% Chewings Fescue, 10%-20% Hard Fescue, 10%-20% Kentucky Bluegrass, 0%-5% Dutch white clover
- Certain varieties of fescue and perennial ryegrass have Endophytes, a beneficial fungi, that controls surface feeding insects. Choose to use these if available.
- Improved varieties of each species exist and should be considered for use. New varieties are continually being developed and information is available at The National Turfgrass Evaluation Program (www.ntep.org/). National testing has shown the following have good general characteristics.
  - Kentucky Bluegrass: Liberator, Champagne, Bordeaux, Cabernet, Award, Midnight, Nuglade, North Star, Baronie, Odyssey
  - Perennial Ryegrass: Affirmed, Citation III, Linn, Stardance, Pennfine, Advantage, Palmer III, Secretariat, Brightstar II, Calypso, Premier II, Pennant II, Exacta, Churchill, Charismatic
  - Chewings Fescue: Shadow II, Banner III, Brittany, Tiffany, Bridgeport
  - Hard Fescue: Discovery, Reliant II, SR 3100, Osprey, Defiant, Nordic
  - Creeping Red Fescue: Florentine, Shademaster II, Jasper
  - Tall Fescue: Masterpiece, Rembrandt, Picasso, Davinci, Endeavor

School IPM Fact Sheet

Soil Tests

A routine soil test is a quick and inexpensive way to check the level of nutrients that are available for plant growth. Soil tests save money and prevent water pollution by indicating:

- The soil pH.
- Levels of potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg).
- Level of organic matter.
- The presence of lead contamination.
- How much lime and fertilizer (organic or chemical) to add.
- Management tips for growing healthy plants.

Test your soil at least once every three years. Test more often in problem areas, or where abundant nutrients have been added. Record test results to track changes. Note that there are no reliable tests for measuring nitrogen levels in soil. Test results come with recommendations for the next growing season, so sample the soil in early spring, after the frost is out of the soil, or in the fall, before the ground freezes (wait several weeks after your last fertilizer application before sampling). Fall sampling will give the same test results as spring sampling. A soil test usually takes two to three weeks to complete. Several companies offer soil testing. The following procedure is recommended by UMaine's Soil Testing Service (*<http://anlab.umesci.maine.edu/>)*.

Taking a good soil sample

1. Get a Maine Soil Testing Service kit from your County Extension Office or from the Maine Soil Testing Lab, 207-581-3591 (or http://anlab.umesci.maine.edu). Some garden centers may carry them as well.

2. Using a clean tool, take several samples from different spots to fully represent the sample site. Sample in the root zone (usually at 6-8 inches depth for gardens and 3-4 inches depth for turf).

3. Combine all samples in a clean container, mix thoroughly, and fill the sample box.

4. Label the container with your name, address, and sample identification.

5. Fill out the information form, available online at <http://anlab.umesci.maine.edu/forms/forms.htm>. Keep a copy for your records.

6. Deliver to your County Extension office or mail to the Soil Testing Lab. A standard soil test costs $10.

School IPM Fact Sheet

Turf Fertilizer

Fertilizer analysis

The fertilizer analysis is listed on the label as a series of three numbers. For example, consider a 50 lb. bag of fertilizer with an analysis of 10-6-4. The first number lists the percentage of nitrogen. In this example 10% of the bag is Nitrogen (abbreviated as N). The second number is the percentage of Phosphorus (P_2O_5). In this example 6% of the bag is Phosphate. The third number is the percentage of Potassium (K_2O). In this example, 4% of the bag is Potash. Thus, our 50 lb. bag of 10-6-4 fertilizer actually contains:

10% x 50 lb. = 5.0 lb. of Nitrogen
6% x 50 lb. = 3.0 lb. of Phosphate
4% x 50 lb. = 2.0 lb. of Potash

Determining application amounts

Rates of application are usually stated as pounds of nitrogen (abbreviated as N) per 1000 square feet. A thousand square feet is a common measure of area used by turf managers (abbreviated as M). Thus, an application rate of 0.5 lb. nitrogen per 1000 square feet is written as 0.5 lb. N/M.

To determine pounds of fertilizer to use for a particular application rate:

$$\frac{\textbf{Application rate}}{\textbf{\% N}} = \textbf{Pounds of fertilizer product to use}$$

For example:

Using fertilizer with a 10-6-4 analysis (10% N), the amount needed to apply 0.5 lb. N/M is

$$\frac{0.5 \text{ lb.}}{10\%} = \frac{0.5}{0.10} = 5.0 \text{ lb. of fertilizer product}$$

Using the same product, the amount needed to apply 1.5 lb. of nitrogen/M is

$$\frac{1.5 \text{ lb.}}{10\%} = \frac{1.5}{0.10} = 15.0 \text{ lb. of fertilizer product}$$

School IPM Fact Sheet

Turf Irrigation

The amount of water needed for healthy and productive turf varies according to the amount and type of field use. High-use athletic fields need 1 inch of water per week during the growing season from either rainfall or irrigation. Less water is needed in spring and fall and sometimes slightly more is needed in summer, depending on turf condition and use. For more information about turf management see **Outdoor Pest Management for Maine Schools** at http://www.maine.gov:8080/agriculture/pesticides/schoolipm/pdf/outdooripm.pdf. Below are some irrigation guidelines.

- All athletic fields used for fall sports benefit from late summer irrigation during a drought period. This irrigation reduces the need for pesticides and fertilizers.
- Many factors influence the exact amount needed per week.
    - Kentucky Bluegrass needs more water than Fescues.
    - Clay soils hold more moisture and hold it longer than sandy soils.
    - Turf with southern exposure uses more water than that with a northern exposure.
    - Areas with full sun use more water than areas with partial shade conditions.
    - Low humidity, high temperatures, and sunshine lead to greater water use.

Turf irrigation techniques

- Calibrate irrigation system output.
- Match irrigation rate to the infiltration rate of the soil.
- Irrigate infrequently and deeply (2 - 3 times per week).
- For best efficiency and to reduce disease potential, irrigate in the early morning hours.

Pitfalls of excess irrigation

- Wet turf is weaker and more easily damaged by traffic or play.
- Wet soil compacts and reduces potential for optimum growth.
- Water and air must be balanced in the soil; excess water suffocates roots.
- Excess water leaches nutrients out of the root zone and contaminates groundwater.
- Wet turf is more susceptible to fungal diseases.

School IPM Factsheet

Athletic Field Turf Management

Athletic fields require maintenance and performance according to the amount and type of use they get. Schools generally have **High Maintenance** game fields and **Low Maintenance** practice and recreation fields. Both types require proper design and construction including surface and sub-surface drainage, good root mix, adapted turfgrass species, and proper establishment techniques. For more information about turf management see **Outdoor Pest Management for Maine Schools** at http://www.maine.gov:8080/agriculture/pesticides/schoolipm/pdf/outdooripm.pdf.

High Maintenance Fields

- Irrigate to supplement rainfall. Provide 1.0 inch of moisture per week with early morning applications.
- Mow at 2.0-3.0 inches, frequently enough to remove 1/3 of the leaf blade or less. This also eliminates clipping build up.
- Mow with sharp mowers, when turf is dry and soil is not excessively moist.
- Soil test and adjust pH as needed.
- Fertilize with 50%-100% WIN material. Use rate of 0.5-0.75 lb. N/1000 sq. feet around May 15, June 15, Sept. 1, and Oct. 15.
- Phosphorus and potassium fertilization amounts should be based on a soil test.
- Aerify once or twice per year either in the spring or fall.
- Overseed thin areas of field in May - June or September.
- Limit games or practices when field is wet; particularly when soil is moist. Traffic on wet turf or excessively wet soil is particularly damaging.
- Scout for weed, insect, or disease problems.

Low Maintenance Fields

- Irrigate in late summer if turf is dormant and field will be used for fall sports.
- Mow at 2.5-3.0 inches, frequently enough to remove 1/3 of the leaf blade or less. This also eliminates clipping build up.
- Mow with sharp mowers, when turf is dry and soil is not excessively moist.
- Soil Test and adjust pH as needed.
- Fertilize with 50%-100% WIN material. Use rate of 0.5-1.0 lb. N/1000 sq. feet around May 15, and Sept. 1.
- Phosphorus and potassium fertilization amounts should be based on a soil test.
- Aerify once per year either in the spring or fall.
- Overseed thin areas of field in May - June or September.
- Limit games or practices when field is wet; particularly when soil is moist. Traffic on wet turf or excessively wet soil is particularly damaging.
- Scout for weed, insect or disease problems.

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