Department of Pesticide Regulation

CURRICULUM FOR STRUCTURAL IPM—OUTLINE
Pest management for buildings

Time required: 3–4 hours
Number of sessions: One session per year
Suggested class size: Up to 20 participants

Purpose

This curriculum is intended to help trainers teach school staff about integrated pest management (IPM). We use a hands-on approach to encourage learning through experience. The curriculum is ideal for a train-the-trainer approach, and an entire session should take no more than 3 or 4 hours. We suggest you tailor the curriculum according to your site, and omit rarely encountered pests from the lesson plan.

Objectives

- To discuss the preventive emphasis of IPM in and around school buildings.
- To demonstrate where and how to inspect buildings for pests and monitor pests. This includes demonstration of inspection tools and how to keep records.
- To learn how to evaluate pest problems. This includes identifying the pest, understanding its biology, figuring out how it entered school buildings, assessing damage, and establishing a threshold or action level.
- To discuss pest-prevention strategies including exclusion, sanitation, and moisture management.
- To evaluate different chemical options and recognize which ones may lead to exposure problems of students and staff.

Lesson Plan

A. Introduction to Structural IPM, pages 8–13

1. The Big Picture—Why Do Pests Go to School?

a. What's a pest?

b. The surrounding environment

c. Likely pests from beyond

d. A continuously available food supply

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2. IPM Basics
   a. What's IPM? In 15 words or less
   b. What pests need
   c. How to prevent infestations
      (1) Remove sources of food and water
      (2) Limit access and harborage
3. Components of an IPM Program
   a. Inspect (the school) for pests
      (1) The cast of characters—who are the major structural pests?
      (2) Look for conditions that encourage pests—food, water, access, harborage
      (3) Look for the pest—find evidence of the pest, pest damage, or see the pest itself
   b. Identify the pest species
      (1) Don't assume…Or the importance of correct identification
      (2) How to preserve specimens for identification
      (3) Where to get specimens identified
      (4) Helpful identification resources
   c. Monitor for pests
      (1) What's monitoring?
      (2) Monitoring tools
      (3) Monitoring vs. trapping
      (4) What's an action level or threshold?
   d. Use preventive practices
      (1) Facility design
      (2) Maintenance
         (a) Exclusion
         (b) Sanitation
         (c) Moisture management
   e. What you can do when prevention isn't enough
      (1) Physical and mechanical management
      (2) Chemical management—the last resort
   f. Recordkeeping and evaluation
      (1) What's the difference between recordkeeping required by the Healthy Schools Act and recordkeeping for an IPM program?
      (2) What should records show?
      (3) Is your program working?

B. School Tour, pages 13–23
1. Classroom Preparation for the Tour, pages 13–14
   a. Advance preparation (start a few weeks before)
      (1) Develop a slide show pointing out important features to note on the tour

(2) Obtain specimens you'll need for displays
(3) Print labels and captions for displays

b. The day of the tour

(1) Set up the room for training
(2) Present slide show
(3) Review *Exterior IPM Checklist* with participants, pages 24–25
(4) Review *Interior IPM Checklist* with participants, pages 26–27
(5) Just before leaving on the tour… (participants may help with these activities)
(a) Prepare clipboard with checklists and other forms
(b) Assemble inspection tools: flashlight, telescoping mirror, hand lens

2. Tour of Building Exteriors and Perimeters, pages 15–18

a. Perimeter (ground level)

b. Exterior walls, siding, soffit or eaves

c. Roof with its supporting structures and attic vents

d. Outdoor eating areas

e. Outdoor refuse and recycling areas

f. Receiving areas

BOX: Conditions that invite termites

3. Tour of Building Interiors, pages 18–23

a. Food preparation and serving areas

(1) The kitchen
(2) Pantry or food-storage area
(3) Cafeteria and dining room
(4) Snack area and teachers' lounge

b. Classrooms

c. Rooms with extensive plumbing: restrooms, rooms with sinks, locker rooms

d. Hallways, including lockers

e. Auditorium, multi-purpose room, and gymnasium

f. Offices and office-storage areas

C. Exercises, pages 24–27

1. Exercise 1. Exterior IPM Checklist
2. Exercise 2. Interior IPM Checklist

D. Inspection and Monitoring Forms, pages 28–36

1. Roach Trap Monitoring Form—blank
2. Roach Trap Monitoring Form—example

3. Pest Proofing—Repairs and Cleanup Needed Inside
3. Pest Inspection—Sanitation Report
4. Pest Control Trouble Call Log/Extra: Various Items Useful for Monitoring and Management

E. Pest Summaries: Information About Specific Pests, pages 38–47

Pest	pages	Species in California
Ants	38	Argentine ants, California fire ants
Cockroaches	39–40	German, brownbanded, oriental, smokybrown, American, and Turkestan cockroaches
Rats & mice	41	Roof and Norway rats; house mice, deer mice
Birds	42–43	Pigeons, seagulls, starlings and swallows
Termites	44	Dampwood, drywood, and subterranean termites
Tree squirrels	45	Western grey squirrel, Eastern or red fox squirrel, Eastern grey squirrel. Ground squirrels are covered in a separate curriculum.
Black widow spiders	45	Note that there are no brown recluse spiders in California.
Paper wasps	46	Also known as umbrella wasps. Yellowjackets are covered in a separate curriculum.
Bats	46	Mexican free-tailed bat, California myotis
Feral cats	47	*Felis domesticus*

References

O'Connor–Marer. P. 2001. Residential, Industrial, and Institutional Pest Control. UC IPM Pest Management Guidelines. UC DANR. (Pub. 3334). Oakland, Calif. 214 pp. *A 2nd edition will soon be issued.*

Olkowski, W., S. Daar, & H. Olkowski. 1991. Common-sense Pest Control. The Taunton Press. Newtown, Conn. 716 pp. *Thorough, easy to follow. Out of print, but can be obtained through used-book web sites.*

UC IPM Pest Notes. *Detailed information on common indoor and outdoor pests. Not specifically written with schools in mind, but offers good descriptions of pest biology and management options. See below for suggested topics.*

General indoor & outdoor pests	Ants, cockroaches, fleas, flies, house mice, silverfish and firebrats, rats, spiders
Food-service pests	Ants, cockroaches, flies, food-storage pests, moth flies (see fungus gnats), house mice, pantry pests, rats
Office pests	Ants, fleas, delusory parasitosis, fungus gnats
Wood-destroying pests	Carpenter ants, carpenter bees, termites, drywood termites

http://www.ipm.ucdavis.edu/PMG/selectnewpest.home.html

UC IPM Quick Tips. *One-page management guides. They discuss ways to limit food, water, shelter, and access; non-chemical management strategies and chemical control.*

Topics include ants, cockroaches, fleas, rats, spiders, termites

http://www.ipm.ucdavis.edu/QT/

Materials

Books and Pamphlets (see references above)

- *Residential, Industrial, and Institutional Pest Control*.
- UC IPM Pest Notes
- UC IPM Quick Tips

Visual Aids

- Photos or drawings showing problem-prone areas, indoors and outdoors
- Photos or drawings showing damage from structural pests
- Identification posters for insects, rats & mice (You can download images and create your own teaching aids.)

Electronic Resources

- UC IPM. 2004. Key to Identifying Common Household Ants. *Interactive; online*
http://www.ipm.ucdavis.edu/TOOLS/ANTKEY/index.html
- UC IPM. 2004. Pest management for ants. *Interactive DVD*. Visit www.schoolipm.info for ordering information.
- UC IPM. 2004. Pest Notes. *Online; also see list above*
- DPR School IPM Web site, www.schoolipm.info

Table Display—Tools & Equipment for All Pests

Arrange the following items on tables. Group them by pest or type or, when feasible, display duplicates in more than one category. For example, snip copper wool apart and place some with rats & mice and another clump with bats. We suggest several categories below, but it is doubtful that you'll use all of them for your training purposes. See page 14 for suggested furniture arrangement.

Inspection and Monitoring Tools

- Clipboard & pencil
- Flashlight
- Ice pick and spatula
- Dissecting microscope
- Telescoping mirror
- Sticky traps
- Hand lens
- Disposable plastic gloves
- Measuring tape and ruler
- Stickers (e.g., colored dots)
- Talcum powder

Exclusion Tools

- Caulking guns
- Caulking and sealing materials
- Weather stripping
- Doorsweep (= pest brush)
- Copper wool
- Hardware cloth
- Pruning shears and tree trimmer
- Masking, electrical, and duct tape

Sanitation Tools

- Vacuum cleaner—cheap, light
- Webster (= spider brush)
- Vacuum cleaner—expensive with triple filter

Tools for Chemical Management

- Bait gun
- Variety of baits and bait stations for insects and rodents
- Tanglefoot
- Pesticides exempt from registration (in other words, no posting or notification)

Tools That Don't Work

- Owl decoy with photo that shows the decoy's ineffectiveness
- Ultrasonic devices

Note on obtaining specimens

For insects and spiders, collect your own or borrow specimens from UC Cooperative Extension or a County Agricultural Commissioner. For vertebrates, use photos unless you have a local natural history museum or science center willing to lend stuffed specimens.

Table Display—Tools & Equipment for Specific Pests

You probably don't have all of the pests we list here. The listed items are suggestions. Focus on the pests that are problematic in your area.

Ants

- Specimens of Argentine ant, carpenter ant & subterranean termite
- Specimens of other ant species
- Liquid soap in spray bottle + recipe
- Petroleum jelly
- Variety of baits
- Bait stations

Cockroaches

- Specimens of German, field, brownbanded, smokybrown, American, oriental, and Turkestan cockroaches
- Bellows duster (Pest Pistol)
- Electric duster
- Vacuum cleaner
- Bait stations
- Variety of baits
- Sticky traps for cockroach monitoring
- Caulking gun
- Caulks
- Gel gun applicator
- Roach trap monitoring form

Birds

- Specimens of gulls, pigeons, sparrows, starlings and swallows; photos; drawings
- Photos or drawings of nests
- Variety of anti-roosting devices: netting, metal projectors & spikes
- Electrical shocking devices
- Owl decoy with photo that emphasizes the decoy's ineffectiveness
- Photos of architectural designs that discourage roosting and nesting

Rats & mice

- Specimens of house mice, deer mice, roof and Norway rats, and their droppings
- Variety of mouse and rat snap traps
- Mouse and rat bait stations (tamper resistant)
- Rat zapper
- Copper wool
- Hercules putty to hold down traps
- Tie-down stakes for bait boxes
- Doorsweep (= pest brush)
- Baits—peanut butter, extract oils
- Rodenticides
- Rat trap (tin cat)
- Pruning shears and tree trimmer
- Twigs or other debris to check for rat activity

Spiders

- Photos or specimens of common local species
- Vacuum cleaner
- Webster (= spider brush)

Paper wasps (= umbrella wasps)

- Specimen of a nest and wasps
- Exclusion materials: screen & caulk
- Vacuum cleaner
- Reduced-risk aerosols (preferably products that are exempt from registration)

Wood-destroying pests

- Specimens of white rot, brown rot, powderpost beetles, drywood and subterranean termites, carpenter ants, carpenter bees
- Decay-proofing materials
- Graphics showing structural areas likely to have problems
- Desiccants

Bats

- Specimens or photos of local bat species
- Netting
- Copper wool

Feral cats

- Photos—showing overt invitations to cats
  - Access & harborage: openings under portables
  - Food: food and water dishes left out
- Live trap
- Bait (e.g., jack mackerel)

Indianmeal moth (and other stored-product pests)

- Photos—moth and beetle pests
- Infested food (look through your cupboards)
- Sticky pheromone traps (available over the counter)

Curriculum for Structural IPM—Lesson Plan

A. Introduction to Structural IPM

1. The Big Picture—Why Do Pests Go to School?

a. What's a pest?

Pests are plants or animals in the wrong place. Pests usually have lots of offspring, disperse rapidly, and find food easily. They do more harm than good. Most plant or animal pests that have evolved around people thrive in marginal areas—along roadsides or among garbage.

b. The surrounding environment

Discuss California's diverse habitats—deserts, coastal areas, mountains, urban, suburban, rural. Schools are often built next to open fields or new construction, and may provide a more attractive habitat for certain plants and animals than the neighboring areas. Result: An oasis that lures pests because it provides food, water and shelter. Expect sporadic visits from harmless critters such as lizards, box elder bugs, or small, predaceous ground beetles from open fields. Rats from adjacent building sites and mice from orchards may also show up. Plants and animals do not recognize property boundaries, and are likely to wander into the school from the field next door.

c. Likely pests from beyond

Yellowjackets—Adjacent undeveloped terrain, backyards

Nuisance flies—Nearby livestock or horse stable

Rats—Construction sites, adjacent backyards with fruit trees or pet food

Mice—Open fields, orchards

Mosquitoes—Water bodies or standing water; adjacent residential areas or parking lots

Birds—Pigeons and seagulls from local and distant locations

d. A continuously available food supply

Most of the pests listed above easily find food. In Southern California, roof rats subsist on fruit that grows in many yards, and make their homes at the top of date palms. Argentine ants feast on honeydew from aphids and scale insects that cover lush vegetation in residential areas. The ants easily spread to schools.

2. IPM Basics

a. What's integrated pest management or IPM? in 15 words or less

Integrated pest management (IPM) is a decision-making strategy that focuses on **long-term prevention** of pests.

b. What pests need

(1) **Food**—Easily found in classrooms and lockers; includes food for class pets

(2) **Water**—Found wherever there's plumbing, especially if pipes leak

(3) **Access**—Pests enter under doors, through improperly sealed exterior electrical, telephone, or gas lines, through cracks and holes in walls.

(4) **Harborage**—Pests live in cracks and crevices; behind posters, bulletin boards; in appliances; inside closets, cabinet bases, suspended ceiling spaces

c. How to prevent infestations

(1) **Remove sources of food and water.** See the specific information in the school tour section, pages 15–23. You can avoid pest infestations by keeping the school clean: empty garbage regularly, vacuum carpeted areas regularly, don't leave food out, and repair leaks.

(2) **Limit access and harborage.** Again, you'll find specifics in the school tour section. You can avoid pest infestations by paying attention to campus maintenance needs: sealing holes and cracks, repairing leaks, and installing doorsweeps.

3. Components of an IPM Program

IPM has its roots in agriculture. In the 1950s, a few entomologists realized that newly introduced organochlorine pesticides such as DDT were upsetting the natural enemy complex within each crop. The natural enemies—mostly predaceous and parasitic insects—usually kept pest numbers in balance; without them, new pests suddenly appeared, requiring even stronger and more frequent pesticide applications. The situation worsened until the 1970s, when some entomologists suggested that farmers abandon calendar sprays in favor of monitoring, cultural and biological control, and when necessary, carefully timed applications of pesticides. They referred to these steps as *integrated control*. Eventually the term *integrated pest management* or IPM became more widely accepted. Entomologists also applied IPM principles to urban and forest settings, so IPM for schools is not a new concept.

Unless disrupted by excessive pesticide use, natural enemies keep many agricultural pests in balance. Biological control is not as applicable to school environments. Most urban insect pests have hitchhiked to North America from elsewhere, leaving their natural enemies far behind. One exception to note is that parasitic wasps sometimes attack brownbanded cockroaches. Some school districts have had success with biological control of rodents by contructing and installing owl boxes.

a. Inspect (the school) for pests

(1) **The cast of characters—who are the major structural pests?**

Pest	Species in California
Ants	Argentine, odorous house, and California fire ants
Cockroaches	German, brownbanded, oriental, smokybrown, American, and Turkestan cockroaches
Birds	Seagulls, pigeons, sparrows, starlings and swallows
Rats & mice	Roof & Norway rats; house mice, deer mice
Spiders	Cellar spiders, black widows
Paper wasps	Also known as umbrella wasps. Yellowjackets are covered in a separate curriculum.
Wood-destroying pests	Termites, white rot, brown rot, powderpost beetles, carpenter ants, and carpenter bees
Bats	Mexican free-tailed bat and California myotis
Feral cats	*Felis domesticus*
Stored-product pests	Indian meal moths, flour and cigarette beetles

(2) **Look for conditions that encourage pests—food, water, access, harborage.** Throughout the school tour (pages 15–23), you'll notice that the conditions that help pests thrive are not always obvious. A few crumbs lodged in the cracks of a kitchen counter can feed dozens of roaches. A dripping pipe will sustain thousands of ants. A pile of used paper awaiting recycling is a dream house for a family of mice. And the mice can enter rooms and storage areas through ¼-inch spaces under doors.

(3) **Look for the pest—find evidence of the pest or damage it causes; or see the pest itself.** You may not see mice, but you know they're around. Their droppings will tell you they're in the neighborhood, and the damage they cause will also alert you—gnawed food and nests built of shredded math exercises. And then there's the mysterious, distracting thumping in the false ceiling during class, and the excitement produced by a mouse streaking through the classroom. In all probability, you would find out about invading mice from a teacher or staff member. You would then inspect the school using a flashlight and mirror.

b. Identify the pest species

(1) **Don't assume…Or the importance of correct identification.** It's essential to identify the potential pest, or you may launch a futile pest management program. And likewise, you need to know the correct species or you may use the wrong management strategy. Field cockroaches are often confused with German cockroaches. Field cockroaches normally live and reproduce outdoors, but may come inside buildings during the fall. Installing weather stripping around doors and vacuuming is probably sufficient, but putting out baits for field cockroaches would be unnecessary.

(2) **How to preserve specimens for identification.** If the specimen is hard bodied (e.g., bees, wasps, flies, beetles, moths) carefully place it in a small pill vial and cushion with crumpled tissue paper. (If your specimen isn't yet dead, put it in a jar and place in a freezer overnight.) If you wrap specimens in tissue and seal them in plastic bags, chances are you'll end up with smashed bug parts. Place soft-bodied specimens (e.g., spiders, ants) in a jar filled with rubbing alcohol. Include written information such as habitat, location, and date captured. Note color and texture, too.

(3) **Where to get specimens identified.** Take specimens to your local county agricultural commissioner or UC Cooperative Extension office. Phone numbers and locations of both are in the county pages of your telephone directory.

(4) **Helpful identification resources.** If you're familiar with the pest you're identifying, use Pest Notes or books produced by UC IPM. To narrow your search, see the list on the *Pests of Landscapes, Gardens, and Turf* page at http://www.ipm.ucdavis.edu/PMG/selectnewpest.landscape.html. You'll find the ant identification page at http://www.ipm.ucdavis.edu/TOOLS/ANTKEY/index.html, and illustrations of cockroaches at http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pni7467-2.html.

Make sure that you haven't misidentified a beneficial insect as a pest. See the *Natural Enemy Gallery*, http://www.ipm.ucdavis.edu/PMG/NE/index.html.

c. Monitor for pests

(1) **What's monitoring?** Monitoring is the process of keeping track of pests. There are different levels of monitoring that range from casual observation to careful data collection using quantitative methods. See the next paragraph for some examples.

(2) **Monitoring tools.** These include sticky traps for cockroaches and stored-product pests. You don't always need a tool or device to monitor—your eyes come in handy to help track down pest infestations. Visual inspection of an area is an important first step before monitoring (see *Look for the pest*, page 10). For example, if you're looking for mice in a classroom, you could leave food overnight in specific locations (note these on your monitoring form) and check them the next morning. Mice usually leave droppings close to their dining spot, and you can look for mouse droppings around the nibbled food. Mice often urinate immediately after eating—you can use a black light to see the urine, another way to monitor mouse activity.

(3) **Monitoring vs. trapping.** When a pest population is low and the pests are not invading from elsewhere, trapping may limit the infestation. You can use a sticky pheromone trap in the pantry to monitor for Indianmeal moths. If the pantry is overrun with moths, you won't be able to trap them all. But if only a few have snuck in as pupae glued to a box of raisins, you'll catch them when they emerge as moths.

(4) **What's an action level or threshold?** Agricultural scientists developed thresholds for pests on different crops to determine when to take some type of management action. In agriculture, treatment thresholds are based on economics, but those of urban pest management are usually tied to aesthetics (appearance) and public health standards. (The aesthetic component of agriculture relates to economics. For example, when thrips feed on the rind of an orange, the fruit itself will taste fine, but the scarred orange cannot be sold as premium quality. Although the damage is aesthetic, the impact is economic.) In a school, exceeding a threshold for dandelions on a lawn is aesthetic, not economic. Public health thresholds would include the number of cockroaches in a cafeteria or the number of yellowjackets buzzing around the lunch area.

d. Use preventive practices

When a school building is constructed or modernized, architects, engineers, plumbers, and electricians have an opportunity to pest-proof the building, which will prevent the conditions that attract and support pests—food, water, access, and harborage. The typical design of most school buildings unintentionally provides ideal entry points and harborage for pest insects, rodents, and other unwelcome wildlife. During the school tour (pages 15–23), notice the importance of good design and maintenance to IPM.

(1) **Facility design.** Pest management should be a part of the early planning stage of facility design, but many building codes skimp on pest-proofing, which may lead to pest problems throughout the life of the building. Buildings should be constructed to keep out pests, eliminate pest harborage, and make easy cleaning possible.

Pests usually enter buildings, both permanent and portable, through doorways and windows, but they also come in through heating and air conditioning ducts, plumbing, electrical service, fire sprinklers, water and gas lines, and communication cables. Once inside cavities of walls and ceilings and the space beneath floors, pests can enter the rest of a building through utilities, overhead suspended ceilings, and air conditioning ducts.

(2) **Maintenance—exclusion, sanitation, and moisture management.** Simple practices such as installing doorsweeps, sealing gaps, cracks, and crevices will limit access by pests. Once pests get into a building, good sanitation will help discourage establishment.

Custodians are charged with keeping schools clean, but they shouldn't have to do all the work. Food service staff, teachers, and students also should play an active role. The food service staff must keep the kitchen and dining areas clean, not to mention the receiving and storage areas, and trash receptacles. Some suggestions covered in the School Tour include inspecting incoming goods for pest infestations, removing goods from cardboard boxes, and steam-cleaning trash receptacles. Teachers should make sure that all classroom garbage is collected at the end of the day. If they stay late, they should take the garbage to a drop-off trash receptacle. Students should learn that desks, cubbies, and lockers are not cupboards for stored food. *Learn* is the key word—there is an educational component for each one of these groups. Teaching students the importance of keeping the school clean helps them take pride in the school and feel as though they can make a difference.

While good sanitation removes food available to pests, eliminating excess moisture will prevent wood decay and discourage ants, cockroaches, and termites.

e. What you can do when prevention isn't enough

(1) **Physical and mechanical management.** When spiders and their webs collect in entryways and windows, you can sweep them away with a spider brush or suck them up with a vacuum cleaner. You can also use vacuum cleaners as a first step to deal with infestations of ants and cockroaches. Physical barriers such as hardware cloth and copper wool prevent access by a number of pests. When birds cannot be excluded, physical management using anti-roosting devices may be the only option. Some of the devices available for mechanical management such as bug zappers and ultrasonic devices either don't work, or kill innocent bugs. Check UC IPM Pest Notes, www.ipm.ucdavis.edu, to read objective evaluations by UC researchers about various devices.

(2) **Chemical management—the last resort.** If you've exhausted all possibilities and must use a chemical treatment, use only products that pose the least possible risk. Frequently, we hear about least-toxic options, but toxicity is not the only criterion. Exposure is the other part of the risk equation. People can be exposed to chemicals by inhalation or through their skin, mouth, or eyes. Exposure is intensified when a chemical volatilizes (evaporates), which is why most reported pesticide mishaps in schools result from applications of aerosols or liquids. The volatilizing pesticide doesn't have to be toxic to cause an allergic reaction or asthma—even some botanical products can cause problems if used in a closed area. When used in cracks and crevices, baits in the form of gels or pastes are the safest bet when chemical treatment is necessary.

When you use any pesticide be sure to follow label directions. The label provides information on how to use the product correctly, safely, and legally. Do not concoct your own remedies such as tobacco tea, or use seemingly harmless repellents such as ant chalk (also known as Chinese chalk), which is actually illegal and contains pyrethroids.

f. Recordkeeping and Evaluation

(1) **What's the difference between recordkeeping required by the Healthy Schools Act and recordkeeping for an IPM program?** The Healthy Schools Act requires school districts to keep records of pesticide use for four years. Records kept at each school must include the pesticide product name, manufacturer's name, U.S. EPA registration number, actual date and areas of application, reason for application, and amount of pesticide used. Records must be available to the public upon request. As a simple way to keep records, schools may keep a copy of the posted warning sign, making sure to add the pesticide quantity applied.

Other types of recordkeeping are not required, but an IPM program is only as useful as its recordkeeping system. It's best to keep written records because they're more accurate and detailed than human memory. By using written records you can avoid mistakes when evaluating effects of treatment on the pest problem. Monitoring records can help you decide which areas are most in need of attention or observation. When you keep records, you can easily pass information from one employee to another without losing anything if someone leaves or retires. As your district transitions to an IPM program, noting IPM practices in your records will show that an effort to change is in progress, especially to parents who request the records.

(2) **What should monitoring records show?** You should include the following:

- What is being monitored—name of the pest (common name and scientific name, if possible), stage of the pest (immature, adult).
- Where monitoring is done—a map is always useful.
- When monitoring occurs—date and time.
- Who's doing the monitoring.

It's also important to standardize the format and the process by which the records are kept to maintain continuity from season to season and person to person. Design forms with boxes to be checked off so less writing is necessary.

(3) **Is your program working?** It helps to evaluate changes in pest management practices from year to year. Consider whether you started with a serious pest problem, whether the actions you took were necessary, or would the problem have resolved itself? Did the treatments used solve the problem? What would work better the next time?

B. School Tour

1. Classroom Preparation for the Tour

a. Advance preparation (start a few weeks before)

1) Develop a slide show pointing out important features to note on the tour. You don't have to be an expert to develop an instructive slide show. Digital cameras are ideally suited for this activity because you'll instantly know how your photo turned out and can directly download it to a computer. You can also use other camera types—just develop the photos on a CD. You can then assemble a slide show with an application such as PowerPoint. Be sure to emphasize the photos, not text, although descriptive captions will focus the presentation. In PowerPoint (and perhaps other applications) you can highlight details of each photo by using the cropping feature.

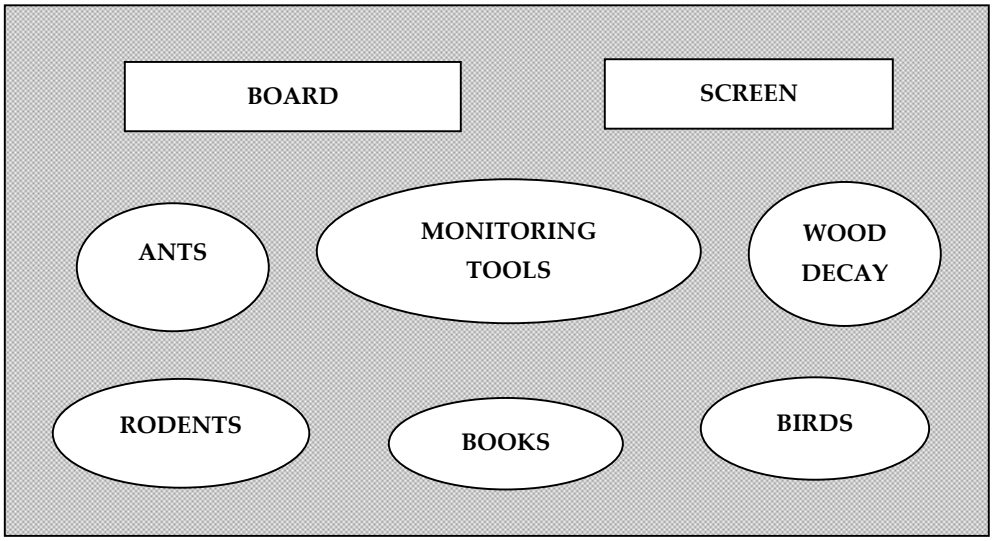
2) Obtain specimens you'll need for displays. For insects and spiders, collect your own or borrow specimens from UC Cooperative Extension or County Agricultural Commissioner—for contact information, look under the County pages in the white pages of your local phone directory. If neither office has stuffed vertebrate specimens to lend, use photos unless you have a local natural history museum or science center willing to lend specimens.

3) Print labels and captions for displays. They should be descriptive but succinct.

b. The day of the tour: if you have access to the room beforehand, set up everything a day or two in advance

1) Set up the room for training. Hands-on workshops are best set up for comfort, clear lines of site, and straightforward interaction between the participants and trainer. Each trainer may have different needs or interests, and will have to modify the room accordingly. Easy access to tools and exhibits makes the session come alive.

- Arrange tables so that all participants can view a centrally located board or easel while seated on one side of the table.
- Set up each table with an exhibit of key pests and the tools used to manage that pest.
- Set up separate tables in the middle of the room with books and monitoring tools that can be used for more than one pest.
- Leave room between tables for participants and trainers to move freely.



2) **Present the slide show.** Don't go overboard with the number of slides. This portion is meant to be a dress rehearsal for the actual tour. Once the participants have a preview, they'll be more inclined to pay attention during the tour.

3) **Review *Exterior IPM Checklist* with participants**, page 24–25

4) **Review *Interior IPM Checklist* with participants**, page 26–27

5) **Just before leaving on the tour** …(participants may help with these activities)

a) Prepare clipboard with exterior and interior checklists and other forms

b) Assemble inspection tools: flashlight, telescoping mirror, hand lens

2. Tour of Building Exteriors and Perimeters, pages 15–18

On this portion of the tour, we'll examine the perimeter at ground level that surrounds the building, look at exterior walls, and then up at the roof and supporting structures. Notice structural design features and problems that may interfere with exclusion, sanitation, or moisture management.

a. Look down at the structure's perimeter (ground level)

Potential pests	Specific features to note
Ants Other insects Rats & mice	Are there plants next to the structure? Insects can move from the plants into structures. Measure the plant-free zone around buildings—the distance should be about 12 inches. If rodent burrowing is a problem, there should be a 2-foot pea gravel strip barrier. Prune or remove ivy and other vines.
Mold (wood decay) Mosquitoes	Is there potential for basement flooding? If possible, grade areas surrounding the building so water flows away. Is the area under structures damp? Check for proper drainage leading away from the structure. Is shrubbery blocking foundation vents? Are drains clean so water flow is unimpeded? Check for standing water—you don't want to start a mosquito hatchery, attract termites, or promote dry rot.
Mice	What about doors? Are they closed tightly? Doors should be equipped with self-closures and door sweeps.

b. Examine the exterior walls, siding, soffit or eaves

Potential pests	Specific features to note
Ants, roaches, mice	Look at walls at about eye level. Are there holes or cracks and crevices that need sealing? Eliminate hiding places and access. Do you see plumbing and electrical service openings that need sealing? Use a high-quality sealant or copper wool. (Steel wool will rust and degrade.)
Paper wasps, ants, roaches, flies	Do weep holes in window frames allow access by paper wasps? Do windows prevent harborage and access for other pests with no clear passageways to inside? They should be designed to prevent access, but still allow the wall to drain and ventilate. Stuff with screen, mesh or baffle.
Rats, skunks, possums, cats, dogs	Look under decks, porches, and stairways. Are these potential harborage areas screened or is animal access limited? Do people feed feral dogs and stray domestic cats on campus? If feral animals are being fed (look for food dishes) the do-gooders need to be educated about potential dangers and nuisances connected to this activity.
Rats, skunks	Are there digging pests such as rats and skunks? Limit their access by sealing porches, stairways, and ramps to the building foundation with ¼-inch hardware cloth. This screen must extend 12 inches into the ground and have a right-angled, 6-inches-wide, outward-extending shelf to prevent burrowing.

Potential pests	Specific features to note
Birds, rodents, cats	Are gable vents screened with ¼-inch hardware cloth to exclude birds, rodents, and cats? The screen will still allow air to penetrate, but will block vertebrates from entering.
Mold (wood decay)	Are there places where sprinklers hit stucco or wooden siding? Look for swollen wood or mold growth. Do downspouts open toward the building or away?

c. Look up at the roof with its supporting structures and attic vents

Potential pests	Specific features to note
Birds!	Are there obvious places for birds to roost or nest around campus? Are decorative lattices located over entrances to food services facilities? Are exterior light fixtures attractive as bird roosts? Supporting columns with flattened areas? It may be necessary to modify structural features. If you could go back in time and redesign buildings to be more bird proof, what changes would you make? Are bird-proof barriers installed? These will vary depending on the bird species. Are there obvious sources of food for birds? This, too, will depend on the bird species. Look for nearby fruit trees, weeds that are sources of seeds, and eating areas.
Birds & bats, bees, wasps	Are eave roof tiles fitted with bird stops? Bird stops or eave closures prevent birds from making a home in the small nooks under curved Spanish tiles. They also exclude bats, bees and wasps.
Birds & squirrels	Do people feed birds and squirrels on campus? They may also be attracting rats. Are there broken panes in windows or skylights? Birds and squirrels will have easy access.
Squirrels & rats	Are tree limbs and branches at least six feet away from building exteriors? If tree squirrels are a problem, keep limbs and branches ten feet away.
Moths, spiders	Notice where lights are located on or near buildings. These may attract night-flying insects. Use of yellow-colored bulbs will reduce the number of insects attracted to the light.
Mold (wood decay) Mosquitoes	Are flat roofs inspected periodically to check for standing water or flooding? Where problems recur, inspect frequently. Use a push broom to disperse water to avoid rooftop mosquito-breeding puddles.

d. Outdoor eating areas—pavilions and patios; adjacent to playgrounds

Potential pests	Specific features to note
Birds, rats & mice, ants, yellowjackets, flies	Are there designated eating areas, or are food and beverages allowed throughout campus? It helps to centralize eating areas so that custodians can regularly sweep and steam clean. Are garbage cans emptied soon after lunch? Also remove food debris on the ground. Lingering lunch food attracts a number of pests. Are outdoor garbage containers equipped with tight-fitting, spring-loaded lids to exclude pests? Yellowjackets rarely find their way into the containers. Also, place a plastic liner in each container to keep food and sticky liquids from fouling the container's sides. Is there litter strewn around the campus? Collect litter from the entire school at least once weekly.

e. Outdoor refuse and recycling areas

Avoid keeping recyclables and garbage near the receiving area because pests attracted to outgoing garbage may discover the incoming goods.

Potential pests	Specific features to note
Birds, rats & mice, ants, cockroaches, yellowjackets, flies	Are outdoor garbage containers emptied frequently? You may not be able to tell as you walk around on a tour, but note any garbage receptacles near doorways and how much garbage accumulates. How are trash or recyclables stored? The storage area should be closed off from building interiors. Are recyclables collected at least once weekly? This is important since even rinsed cans and bottles may attract some pests, and paper and cardboard create a perfect hiding place for roaches. Are outdoor garbage containers, Dumpsters, and compactors placed on hard, cleanable surfaces and far away from building entrances? Design the site with properly graded concrete or asphalt pads to help prevent rats from establishing burrows beneath them. Are garbage cans and Dumpsters cleaned regularly? Wash outdoor garbage containers on at least a monthly basis, including spills around containers.

f. Receiving areas—Docks where goods are received usually lead directly indoors to a storage area (see next page for pantry or food-storage area).

Potential pests	Specific features to note
Cockroaches, flies, mice	Are dock doors closed when not in use? Is the the area beneath dock levelers clean? Pests will find food and harborage in this area, and enter the storage area.
Cockroaches, stored-product pests	Is there an inspection procedure for all receivables? When a carrier shows up with infested goods, there should be a procedure for rejecting delivery.
Cockroaches	Are goods stacked against walls in receiving areas? If supplies are uncased in the receiving area, are the empty boxes taken to the recycling area immediately? Roaches will find hiding places in boxes, and will easily access goods stored against walls.

Look for Conditions That Invite Termite Infestations

(See page 44 for termite prevention details.)

Can you find any soil-to-wood contact? Stucco siding should not reach the ground.

Is there wood mulch, other wooden debris or cellulose around structures? Look for and remove tree stumps, stored lumber, untreated fence posts, and buried scrap wood near the structure.

Is anything stored next to the structures? Store on elevated racks at least 12 inches off the ground.

If there has been recent landscape renovation, is the soil level raised against the building? Don't let soil mound up next to structures.

3. Tour of Building Interiors

Inside school buildings, you'll visit the kitchen, food-storage area, cafeteria, dining room, snack area and teachers' lounge. You'll also see classrooms, hallways, and more—these are all rooms that serve different purposes. As you tour these rooms, think about sources of food and water, how pests access the rooms, and where they hide. You'll also want to consider how each area could have been designed or constructed to be more pest proof, and if cleanliness is a problem.

a. Food preparation and serving areas

(1) The kitchen. As you enter the kitchen area notice the layout of appliances, equipment, cupboards, and work surfaces. How clean is the kitchen to the naked eye? Are there crumbs around? Grease? Are there recurring pests in the kitchen you've been told about? Is there enough space to allow adequate ventilation, cleaning, and visibility for inspection? Use a flashlight and mirror to look into narrow spaces between appliances, floor, and walls.

Potential pests	Specific features to note
Cockroaches	Are kitchen appliances, equipment, and fixtures designed to be pest-resistant? They should lack hiding places for roaches, preferably be freestanding, and rest on casters for easy, thorough cleaning. There should also be space under and around them that allows ventilation and effortless (steam) cleaning.

Potential pests	Specific features to note
Cockroaches	Are permanently installed furnishings sealed at points of attachment, under counter tops, and inside to prevent harborage of pests in the gaps? Seal all built-in cabinets, closets and millwork.
Cockroaches	Is coving used at floor-to-wall junctures to minimize build-up of debris and allow thorough cleaning? Floors should slope toward drains so that water doesn't puddle after cleaning.
Cockroaches Drain flies	Are drain covers and drains coated with scum? Clean weekly with a bacterial-based enzymatic solution. For drains under refrigeration units, clean monthly.
Cockroaches	Is pegboard attached to walls? Bulletin boards? What about flyers or notices taped to walls? Does pipe insulation have a smooth surface with no gaps between pieces? These are favorite hiding places for roaches.

(2) Pantry or food-storage area. This is one of the most vulnerable areas because pests have plenty of food and deluxe accommodations. Many pests such as mice need very little water, and others can find water in the nearby kitchen. Some pests will arrive with ordered goods, which is why inspection at delivery time is so important. Beware of stored-product pests in dry goods—these include Indianmeal moth and various small beetles. Pheromone traps will help detect infestations, but they won't attract every single moth or beetle.

Potential pests	Specific features to note
Rodents, roaches	Is the door to the outside (e.g., receiving dock) self-closing with doorsweeps? These are inexpensive additions and easy to install.
Roaches, ants	Are products kept on pallets or open shelving? Is there at least an 18-inch gap between pallets and the wall? If not, this creates a perfect diving-off point for roaches. Can you see around products to see if anything is broken or exposed? A puddle of spilled applesauce will feed thousands of ants.
Roaches, ants, rodents	Extra points if shelving is metal rather than wood—metal shelving is easier to clean and doesn't absorb spilled materials. Are shelves and ledges kept clean and uncluttered? Mop up any leaks or spills before pests arrive. Check supporting posts of shelving or on overhead beams for signs of insects or rodents.
Roaches, ants, rodents, stored-product pests	Do you notice contaminated or infested merchandise that should be promptly removed? Are products kept in cardboard boxes? Store food products (except those to be used immediately) in refrigerators or in pest-proof containers, not in cardboard boxes.
Stored-product pests	Are stored products rotated on a first-in, first-out basis? This will reduce pest harborage and reproduction. Are pantry pest pheromone traps distributed around the storage area? If so, are they checked regularly? If pests are found in the traps, are you witnessing a random visit or a full-blown infestation? Replace traps once they're clogged with pests or no longer sticky.

Potential pests	Specific features to note
Stored-product pests, rodents	Is food stored in containers that are inaccessible to pests? Containers must have tight lids and be made of plastic, glass, or metal.
Ants and roaches	Is food waste sealed in plastic bags before removal? Waste should be removed at the end of each day.
Roaches	Are mops hung upside down and buckets emptied? Don't provide water for thirsty roaches.

(3) Cafeteria and dining room. Although this area is cleaned regularly, the sheer expanse of surface area and frequency of foot traffic prevents total sterility.

Potential pests	Specific features to note
Roaches	Are tables and chairs movable for cleaning? Do chairs, benches, or tables have cavities or recessed areas perfect for errant crumbs and food debris? Use a knife to clean out these areas and if possible, seal them.
Ants, roaches	Are floors washed and carpets vacuumed on a regular basis? Make sure that food residue is removed from edges where it often settles and can be discovered by scavenging roaches.

(4) Snack areas and teachers' lounge. Food left behind by hurried students and teachers attract pests. Often custodians do not clean these areas as thoroughly as larger dining areas. In the teachers' lounge, spills from sugary drinks combined with crumbs that disappear under sofa cushions can feed roaches and ants indefinitely.

Potential pests	Specific features to note
Cockroaches	Are vending machines kept clean inside and out? Roaches thrive amid the warmth of the refrigeration or heating units combined with food debris.
Cockroaches, ants, dust mites	Are furniture and floors vacuumed on a regular basis? In the teachers' lounge, are counters washed and crumbs cleaned out of toasters? Is food such as cereal or crackers left on shelves? Are microwave ovens and refrigerators kept clean? Vacuum underneath chair and sofa cushions regularly, and every few months, move furniture away from the walls and vacuum along the edges.
Cockroaches, ants, flies	Is garbage kept in lined, covered containers and emptied daily? Make sure teachers know the importance of removing garbage at the end of each day.

b. Classrooms—Food is often plentiful in classrooms because students and teachers munch on snacks. Classroom pets may also attract pests if their food is left out in the open. If a classroom has specific problems, the teacher and M&O staff should work together on solutions such as taking home pets and eating snacks outdoors until the pest infestation is resolved.

Potential pests	Specific features to note
Cockroaches, ants, dust mites	Is it possible to vacuum underneath all furniture, even fixed desks and shelves? When purchasing new built-in classroom furniture (e.g., staff desks, bookcases, filing cabinets), consider whether complete cleaning under and around the furniture is possible at least annually. Can the furniture be moved for cleaning purposes? Vacuum furniture and floors on a regular basis, and move furniture away from walls for vacuuming.
Mice, cockroaches	Are exterior doors throughout the building closed when not in use? Install weather stripping and door sweeps under doors to exclude pests.
Cockroaches, ants, dust mites	Do bulletin boards, mirrors and other wall fixtures have gaps underneath where roaches can enter? Prevent roach harborage by caulking any gaps. Are out-of-date paper notices cluttering walls and bulletin boards? Vacuum dust and cobwebs from walls and windows. Never attach food-based art to walls (e.g., candy collages).
Stored-product pests, cockroaches	Look around for unlikely sources of food. Store potential pest food items used in classrooms (e.g., beans, plant seeds, pet food and bedding, decorative corn, gourds) in refrigerator or in glass or metal containers with pest-proof lids. (Exception: if there isn't an active infestation, it's okay to have unprotected educational displays out such as insect collections.)
Cockroaches, ants	Are teachers and students aware that they can help prevent pest infestations by removing food or food wrappers from desks and cubbies on a daily basis? Empty desks and thoroughly clean them at least twice yearly (e.g., winter break and at the end of each school year). Remove any leftover food items from classrooms (e.g., snack food in kindergartens) or store in sealed containers. Allow food and beverages only in designated areas. Teachers and M&O staff should work together if eating in class is a necessity.
Cockroaches, ants	Is food for classroom pets left out in the open? Store food in pest-proof containers. Are wastes from pets removed from the classroom every day? If ants or roaches become a problem, it's best to take classroom pets home until the problem is resolved so the pet's living quarters don't provide food and water to unwanted visitors.
Cockroaches, mice	Are classroom storage areas cluttered with paper and supplies? Remove accumulated debris along wall–floor junctures and on top of equipment.
Cockroaches, ants, mice	Collect and remove waste materials or recyclables in all rooms within the school building to a Dumpster, compactor or designated pickup location daily. Have a system in place where after-hours garbage is taken to a drop-off trash receptacle.

c. Rooms with extensive plumbing: restrooms, rooms with sinks, locker rooms, science laboratories—The main concern in these areas is leaky pipes and accumulated moisture. Pests gain access through openings around pipes, conduits, and heating ducts.

Potential pests	Specific features to note
Cockroaches, ants, mice and rats	Are there leaky pipes or other plumbing? Inspect these routinely. Encourage teachers and other staff to report leaks immediately. Moisture attracts insects and rodents. Are openings sealed around electrical conduits, heating ducts, and plumbing pipes? These can serve as potential insect and rodent runways.
Drain flies, cockroaches	Are drains screened? Are floor drains, strainers, and grates cleaned on a regular basis? Maintain clean sink and floor drains and use a bacterial-based enzymatic solution at least monthly.
Rats	Are unused drains or drain pipes open? Close these off and seal pipe chases. Are sewer and water lines in good repair? Broken sewer lines may attract rats.
Mold (wood decay)	Do these rooms trap moisture? Is there adequate ventilation? Keep areas as dry as possible by removing standing water and water-damaged or wet materials. Use desiccants and ventilate areas where condensation forms frequently. Repair plumbing, roof leaks, and dripping air conditioners. Wrap sweating pipes with insulating tape.

d. Hallways, including lockers—These areas are ideal bed and breakfast inns for pests. Lockers are often stuffed with food, and crumbs accumulate along hallway edges as students eating on the run hurry to classes.

Potential pests	Specific features to note
Cockroaches, rodents	Are crumbs and debris cleaned up along edges? Hallways should be vacuumed or swept at the end of each day.
Cockroaches, ants	Are lockers emptied and thoroughly cleaned at least twice yearly (e.g., winter break and at the end of each school year)? If not, spilled sugary messes will attract pests.
Cockroaches, dust mites	Are permanent bulletin boards and other wall fixtures caulked? Are out-of-date charts or paper notices removed from walls? Are walls and windows free of dust and cobwebs? Remove any potential harborage.

e. Auditorium, multi-purpose room, and gymnasium—Although eating may not be allowed in the auditorium or gym, count on stealth munchers.

Potential pests	Specific features to note
Cockroaches, ants, rodents	Are carpeted areas vacuumed frequently? Inspect the floor beneath fixed chairs to make sure ants haven't found a dropped muffin.
Cockroaches, rats	Are the inside of vents and ducts inspected at least every three years and cleaned when needed by a certified contractor? This is a good idea for vents and ductwork throughout the school.
Cockroaches, dust mites	Are walls and windows free of dust and cobwebs? Vacuum walls and windows, and remove out-of-date charts or notices from walls monthly.

f. Offices and office storage areas—The office staff will waste no time complaining about pest problems; be sure to inspect and monitor to verify these.

Potential pests	Specific features to note
Cockroaches, mice	Are bags, boxes, and pallets promptly and properly disposed of or recycled? Take office products out of shipping boxes and store on open shelving.
Cockroaches, mice, silverfish, earwigs	Are paper products or cardboard boxes stored away from moist areas and away from the floor or walls? Is the storeroom cluttered? Remove boxes and supplies along wall–floor junctures and on top of equipment. Don't tempt mice to nest amid office supplies.
Cockroaches, ants, mice	Are supplies stored with food, trash, or recylables? When stored together, these materials put food and shelter together, favoring pests.
Cockroaches, ants, mice	Does the office staff understand that they play an active role in pest management? They should remove food or food wrappers from desks on a daily basis, and be aware that they should report any pest infestations. They should *not* bring their own pesticides to work.

C. Exercises

Use these two checklists to practice finding damage and evidence of pests. The actual forms used for inspection and monitoring begin on page 28.

Exercise 1. Checklist—Inspection for Exterior Pests

Check the appropriate boxes, make comments and mark the number on a sketched map of the building. This checklist is designed to address insects (ants, termites), rodents (mice, rats) and wood decay. Emphasize what's right as well as what's wrong!

Pay attention to:	
Foundations or footings	Exterior walls
Gutters and downspouts	Debris
Vents and vent screens	

" 1. Insects—wings, frass, trail, other

_____

" 2. Rodents—hole, tracks, droppings, chewings, other

_____

" 3. Wood decay—punkiness, discoloration, fungal mycelium, other

_____

" 4. Earth—wood or stucco contact

_____

" 5. Soil graded incorrectly (toward structure)

_____

" 6. Exterior plumbing leak

_____

" 7. Wet soil

_____

" 8. Infested tree stumps, soil, or other plant

" 9. Planter boxes or planting beds

" 10. Gutters

" 11. Downspouts opening toward structure

" 12. Ventilation screen damaged

" 13. Trash, birdseed, mulch or other debris near foundation

" 14. Garbage cans or compost bins near door

" 15. Openings for pipes, cables or wires not sealed

Exercise 2. Checklist—Inspection for Interior Pests

Check the appropriate boxes, make comments and mark the number on a sketched map of the building. This checklist is designed to address insects (ants, cockroaches, termites), rodents (mice, rats) and wood decay. Emphasize what's right as well as what's wrong!

Pay attention to:	
Doors and door framing	Faucets & sinks
Windows & window framing	Floor quality
Perimeter walls	Garbage cans

" 1. Insects (wings, frass, trail, other)

_____

" 2. Rodents (holes, tracks, droppings, chewings, other)

_____

" 3. Wood decay (punkiness, discoloration, fungal mycelium, other)

_____

" 4. Doors (trouble closing, warped, big gap underneath, other)

_____

" 5. Door frame (discolored, sawdust, cracked, other)

_____

" 6. Weather stripping (lacking or in disrepair)

_____

" 7. Windows (trouble opening or closing, mold, condensed moisture, other)

_____

" 8. Window framing (discolored, sawdust, cracked, other)

_____

" 9. Screens (condition, presence/absence, torn, other)

_____

" 10. Perimeter walls (gaps, cracking, discolored, droppings, other)

_____

" 11. Openings for pipes, cables or wires not sealed

_____

" 12. Faucets and sinks (dripping water, discoloration musty smell, other)

_____

" 13. Floor quality (uneven, cracked, discolored, other)

_____

" 14. Garbage cans or compost bins near door

_____

" 15. Cleanliness (comment)

_____

D. Inspection & Monitoring Forms

The forms that follow were developed specifically for inspecting and monitoring schools. Some of the forms overlap with each other and you may find that one or more works best for your situation. Since no two schools are identical, you may want to customize or combine the forms as you become more familiar with local pest problems and maintenance solutions. Filling out the forms should not be a tedious, laborious process.

1. Roach Trap Monitoring Form—blank
2. Roach Trap Monitoring Form—example
3. Pest Proofing—Repairs Needed Outside
4. Pest Proofing—Repairs Needed Inside
5. Pest Inspection—Sanitation
6. Pest Control Trouble Call Log

What sticky monitoring traps can show you

The obvious

- Traps can indicate the presence of mice, cockroaches, and sometimes rats.
- Other trapped critters include ants, beetles, moths, and other insects that have accidently wandered inside. It's not unusual to catch stray lizards or house centipedes. Monitoring traps can tell you if you have a persistent problem or an infrequent visitor. Should you immediately throw out a trap once roaches are caught in it? Roach-studded traps are more attractive to other cockroaches, so depending on your monitoring program, you may want to keep the trap around until its stickiness has worn off.

More subtle things to notice

- Look for footprints of mice, rats, or other pests.
- Pieces of insects, such as legs or heads could mean that a mouse or rat ate the rest. This not only indicates that a rodent is present, but it's aware of the dangers of the sticky trap and will be difficult to trap in this manner.
- Pieces of debris on the trap may mean a rodent put them there intentionally and will need to be trapped in another manner—check around for other signs of rodents or use talcum powder to catch paw prints.
- Droppings on a trap indicate the type of animal in the area. Remember large cockroaches have droppings similar to those of mice, so look closely.
- Hairs on the trap indicate that a mouse or a rat probably got one or more of its guard hairs trapped on the sticky surface. (Again, a rodent is around and probably trap shy.)
- The direction the cockroaches are facing when caught indicate that they came from the opposite direction. If you find only a few adult roaches, you may not have a full-blown infestation (unless you know otherwise). Young roaches as well as adults indicate that the adults are reproducing nearby. You can tell how long ago the roaches were caught if they're alive or dead, break apart when touched, or still have some elasticity.

Roach Trap Monitoring Form

Building _____

Room or area _____ Name of person monitoring _____

Trap #	Room # or name	Date trap was		Trap missing	Location description	Roaches		
		Set	Read			Adults	Nymphs	Total

_____ Total number traps _____ Average # roaches per trap Total # roaches _____

(Total # of roaches divided by total # of traps)

Roach Trap Monitoring Form (Example)

Building Number 3

Room or area Cafeteria Name of person monitoring _____

Trap #	Room # or name	Date trap was		Trap missing	Location description	Roaches		
		Set	Read			Adults	Nymphs	Total
1	Kitchen	3/5	3/15		SE drain, under gate	0	0	0
2	Kitchen	3/5	3/15		S sink under electric box	1	1	2
3	Dishroom	3/5	3/15	yes	S under conveyor belt	—	—	—
4	Dishroom	3/5	3/15		N under conveyor belt	0	0	0
5	Storage	3/5	3/15		Left side of door	0	0	0
6	Dining	3/5	3/15		W serving counter	0	2	2

6 Total number traps 0.67 Average # roaches per trap Total # roaches 4

(Total # of roaches divided by total # of traps)

Pest Proofing—Cleanup and Repair Needed Outside

Date _____ School _____

Building#/Location _____

Inspector _____

For each repair, specify location and action needed. State priority for each work item.

_____

- ❑ Cut vegetation back from building walls at least 12″
- ❑ Prune or remove ivy and other vines from sides of buildings or nearby trees
- ❑ Eliminate standing water
- ❑ Improve drainage
- ❑ Screen drains

Doors ❑ Repair ❑ Replace ❑ Weatherstrip ❑ Screen

❑ Other_____

- ❑ Seal holes in wall around pipes, cables, and wires
- ❑ Seal and repair air conditioning units
- ❑ Screen openings under decks, porches, ramps, and stairways
- ❑ Fix leaking irrigation or sprinklers that hit stucco or wooden siding

Windows ❑ Repair ❑ Replace ❑ Weatherstrip ❑ Screen

❑ Other_____

- ❑ Repair roof
- ❑ Bring order to storage sheds
- ❑ Store grass seed in rodent-proof containers
- ❑ Remove debris, lumber, or rock piles
- ❑ Move compost into rodent-proof container
- ❑ Cut grass or weeds
- ❑ Remove fallen fruit or nuts

Pest Proofing—Cleaning and Repair Needed Inside

Date _____ School _____

Building#/Location _____

Inspector _____

For each cleaning or repair, specify location and action needed. Use the grid on the following page to draw a floor plan that will help clarify locations. State priority for each work item.

Note: Make extra copies of the floor plan grid and use one for each location listed below where cleaning or repair is necessary.

Locations

- ” Kitchen
- ” Pantry or food-storage area
- ” Cafeteria and dining room
- ” Snack areas and teachers’ lounge
- ” Classrooms
- ” Rooms with extensive plumbing: restrooms, locker rooms, and science labs
- ” Hallways, including lockers
- ” Auditorium, multi-purpose room, gym
- ” Offices and office-storage area

Doors ” Repair ” Replace ” Weather-strip ” Install doorsweep

Other _____

- ” Seal holes in wall around pipes, cables, and wires
- ” Seal cracks, crevices, and holes with caulk or paint
- ” Correct excessive moisture problems
- ” Screen drains
- ” Remove clutter including out-of-date paper notices from walls and bulletin boards
- ” Store rodent nesting material (fabric, paper, or plastic) in rodent-proof containers
- ” Store human and pet food in pest-proof containers
- ” Dispose of insect- or rodent-infested goods
- ” Clean drains
- ” Fix leaky plumbing

Continued: Pest Proofing—Cleaning and Repair Needed Inside

Floor Plan

Building location _____

Draw a floor plan and mark locations for cleaning or repair.

Pest Inspection—Sanitation Report

Date _____ School _____

Building#/Location _____

Inspector _____ Inspection Type ” Initial ” Quality control ” Routine

Evidence of Infestation

Pest	Location	Pest	Location
Ants		Fleas	
Cockroaches		Stored-product pests	
Mice		Pigeons	
Rats		Other	

Sanitation survey

	yes	no		yes	no
Food preparation			**Receiving**		
Equipment clean			Floors clean		
Appliance drip pans clean			Clutter		
Floors clean			Empty boxes stored in cold storage		
Floor drains clean			Empty boxes stored away from kitchen		
Sink drains clean			**Student and Staff Areas**		
Counters and tables clean			Restrooms clean		
Food stored in pest-proof containers			Plumbing leaks		
Perishables stored in refrigerator			Locker room clean		
Garbage removed daily, end of day			Food stored in locker room		
Spillage cleaned regularly			Teachers’ lounge clean		
Floors and counters dry; no standing water			Food stored properly in lounge		
Plumbing in good repair; no leaks			Food stored in student, staff, or teacher desks		
Windows and doors screened			Trash removed daily before closing		
Gaps around doors or windows repaired			Janitorial closet clean		
Pest proofing needed			**Pest proofing needed**		
Storage areas			**Exterior**		
Floors and clean			Dumpster/garbage cans cleaned weekly		
Floor drains clean			Dumpster/garbage cans have lids		
Food stored in pest-proof containers			Lids closed on Dumpster/garbage cans		
Recyclables cleaned before storing			Garbage area downwind from kitchen		
Spillage cleaned regularly			Dumpster/garbage area clean		
Items stored 6″ to 8″ off floor			Garbage removed at least weekly		
Items stored 12″ to 18″ away from wall			Pet waste removed daily		
Stock rotated			Loading dock clean		
Area neat and tidy; no clutter			Gaps under/around doors repaired		
Pest proofing needed			Area is trash- and weed-free		
			Area is dry; no standing water		
			Pest proofing needed		

Comments/Recommendations _____

_____

_____

Pest Control Trouble Call Log

TROUBLE CALLS						PEST MANAGEMENT RESPONSE		
Date	Building	Problem description	School contact	Phone	Date	PCO name	Action taken (practice used)	Materials* used & amounts

Various Items Useful for Monitoring and Management ◈ Ingrid Carmean, Carmean Consulting

GENERAL ITEMS

Vacuum cleaner. Lightweight vacuum cleaners are inexpensive and portable—ideal for ants, spiders and stored-product pests. For rodent droppings and cockroaches, use a vacuum equipped with a triple filter. **Caulking gun** and **sealant** are used to seal cracks on the outside of buildings where ants enter and anywhere roaches can hide. Adjacent to the building, seal the crack between the foundation and mowing strip or concrete pad to eliminate ant nests.

Monitoring traps such as rat or mouse glue boards can be used for capture and removal of many pests that have come in from the outside such as oriental cockroaches and beetles. Affix **color-coded dots** to walls or cabinets to mark locations of monitoring traps. Near student areas use another system such as notations on a map because dots will mysteriously disappear.

ANTS

Sanitation—Use ant-proof containers to hold candy and other food items that would otherwise attract ants. **Dr. Bronner's Peppermint Castile Soap** or other soaps can be used to clean up ant trails.

Exclusion—Use **pruning shears** to trim shrubs away from a building so ants cannot use them as a bridge to cross over to another building. A **tree trimmer** or **pruning stick** (also excludes rats) for higher branches—these serve the same purpose as pruning shears. **Tanglefoot** is used to band the trunks of trees and shrubs that have honeydew-producing insects in them. This prevents ants from crawling up these plants. Be sure the Tanglefoot will not girdle the tree as it can with some young and thin-barked trees.

Chemical management—Smorgasbord of ant baits in bait stations, gels and granular baits. A combination of sugary and protein-rich baits is more likely to attract ants than single-bait products. Use a **bait gun** to place gel baits in cracks.

COCKROACHES

Large and small bait stations. Use the correct station for different roach species.
Bait gun (also for ant baits) Used to place gel baits in cracks

WASPS

Use **masking tape** to seal up the inside of portables that have wasps invading from the ceiling during fall and winter. Seal holes and cracks on the outside of buildings. **Hardware cloth**. Useful for excluding wasps if ⅛-inch mesh.

SPIDERS

Use **Websters** (spider brushes) to wipe down and clean up spiders and spider webs. **Vacuum cleaners** can also be useful here.

BIRDS

Items to exclude birds. These are place and species specific. Consult a specialist in bird control to select the ideal exclusion devices. Devices include nets, spikes, and electrical shocking items.

FERAL CATS

Live traps. Use jack mackerel for bait. Set traps where cats are active. Don't leave out for long periods or you'll attract rats, yellowjackets, and flies.

MICE AND RATS

Live traps for mice. Place tin cats and repeating mouse traps near doors and check traps regularly. Place **glue boards** along the midpoint of a wall so mice or rats will run into them. **Hercules putty** is used to hold down rat traps, especially sticky traps. **Snap traps** are placed in corners; pre-bait for rats, sometimes for mice. Place next to wall in pairs. Bait is less important than good placement. For roof rats, use fruit, nuts, snails or even cockroaches. **Rat zappers** will catch mice or rats that wander into a building; also useful for trap-shy rats. Use **twigs** or other debris to check whether rats are still using a particular hole. Use **copper wool** to fill holes that rats and mice use for entry. **Tie-down stakes for bait boxes.** If you choose to use poison baits for rodents it's important to prevent access to the bait stations by curious students. Tie-down stakes will secure bait stations, or use Liquid Nails®, which comes in a caulking-type tube. **Doorsweeps.** These inexpensive and easy-to-install devices will discourage rodent entry. Rodents can chew through doorsweeps, but are more likely to squeeze under a door if there isn't a barrier in place. **Hardware cloth** will exclude mice and rats. Use **talcum powder** to check for footprints of rats and mice. Rats do not always leave droppings, so talcum powder will help determine if they're in the area. If deer mice visit, take precautions against inhaling the deadly respiratory hantavirus these mice transmit. Use a high-quality HEPA-filtered vacuum cleaner to vacuum mouse droppings.

ITEMS THAT DON'T WORK

Ultrasonic devices and **owl decoys**

E. Pest Summaries: Information About Specific Pests

The pest summaries that follow are intended to complement information covered in the structural tour. Originally developed by Ingrid Carmean, the pest control operator who's led many of DPR's structural training workshops, the information in the summaries is not meant to be exhaustive or to replace UC Pest Notes. The summaries refer specifically to pests and structural problems you might find in and around school buildings. We suggest you consult UC Pest Notes for details about identification and biology of pests.

Pest	pages	Species in California
Ants	38	Argentine ants, California fire ants
Cockroaches	39–40	German, brownbanded, oriental, smokybrown, American, & Turkestan cockroaches
Rats & mice	41	Roof & Norway rats; house mice, deer mice
Birds	42–43	Pigeons, seagulls, starlings & swallows
Termites	44	Dampwood, drywood, and subterranean termites
Tree squirrels	45	Western grey squirrel, Eastern or red fox squirrel, Eastern grey squirrel. Ground squirrels are covered in a separate curriculum.
Black widow spiders	45	Note that there are no brown recluse spiders in California.
Paper wasps	46	Also known as umbrella wasps. Yellowjackets are covered in a separate curriculum.
Bats	46	Mexican free-tailed bat, California myotis
Feral cats	47	*Felis domesticus*

Argentine ants

Argentine ants can be overwhelming in numbers. They can invade a whole shelf of kids' lunches and render them unpalatable, or they can be distracting as they trail across a classroom floor. They don't sting and rarely bite, and their bite is only a small pinch.

Management

Argentine ants usually nest outside. The following strategies will prevent them from moving inside.

Eliminate food—The first defense is sanitation. Clean up sweets, or whatever is drawing the ants into a structure. Frequently, sanitation alone will help keep Argentine ants out of a classroom. **Eliminate access**—Secondly, seal any entryway the ants have found into a building, often through a crack in the foundation or wall. Sometimes it's necessary to put a better weather seal on the doorways. **Eliminate harborage**—If the ants have set up a colony inside, this may mean simply cleaning them up with a little soapy water, taking the object they have nested in outside, and cleaning out the colony. Almost always, indoor colonies will inhabit a potted plant, but it's important to check other small places like cardboard, pipes, and even between items in a chest of drawers. Follow the trail to the source.

If the above methods do not prove effective, then use self-contained bait stations. The bait takes three days or longer to eliminate the colony. Educate everyone in the vicinity that massive numbers of ants will pour in soon after discovering the bait station.

Next on the list is to decrease the number of colonies outside. Eliminating food sources for ants can help. Many ants find food in shrubs, flowering annuals, and some landscape trees around schools, making them difficult to manage. Liquid baits, Tanglefoot, pruning, chemical barriers on the trunks of trees and bushes, or systemic pesticides can help. The secondary food sources for ants are sugars and other human food trash that accumulates around school grounds. At one school, a single quart of sugar provided enough food for a one-inch-wide trail of ants surrounding the outside and inside of a building that contained a basketball court, band room and wrestling room. After the sugar was removed it took two months for the ant population to noticeably decrease.

Baiting for Argentine ants outside may reduce numbers, especially if certain timing considerations are followed. Bait early in the spring when numbers of ants are low. February is not too early to start. Use protein baits in tamper-resistant bait stations in early spring through May and June (e.g., Maxforce® or Fluorgard®). During mid-summer, baiting with a sugary gel or liquid is most effective (e.g., Uncle Albert's® Super Smart Ant Bait, Maxforce® Ant Killer Bait Gel, or Revenge Liquid Ant Bait®). Aphids, which have been supplying the ants with sugary honeydew, will die off in the summer, and sugar bait becomes very attractive to the ants.

Argentine ants need moisture. Their colonies are frequently found next to trees, sidewalks, and foundations as well as in the cracks of sidewalks where water is retained. Colonies can sometimes be found in warm, well-watered soil and not next to anything obvious. Baits outside can also be used to manage ants. If, as a last resort, you drench a colony with a liquid pesticide, keep in mind that colonies are only 3 inches deep, so there's no reason to spray more than would saturate this depth. There is never any reason to spray ant trails as the foragers are the oldest ants and less than ten percent of the colony is foraging at any time. Spraying these ants is like cutting hair or fingernails.

California fire ants

California fire ants have painful, multiple stings, and at times get into food. (Note: This is a native species, not the South American red imported fire ant.) Indoors, seal any cracks that offer access and permanently put those entryways out of commission. Containerized bait stations can effectively kill the ants. Outdoors, place granular baits in tamper-resistant bait stations to minimize the possibility of human exposure to baits. Bury the bait stations slightly to reduce visibility.

Cockroaches

Use UC IPM's Pest Note #7467 to identify all species common to California except for field and Turkestan cockroaches. For positive identification, bring specimens to your local agricultural commissioner's office, vector control, university biology department or the UC cooperative extension office. See *What sticky monitoring traps can show you* on page 28.

Oriental cockroaches are dark reddish-black, about 1¼ inches long, and smell bad. Also known as water bugs, they stain surfaces and can spread diseases. They can pick up harmful bacteria in the dirty and damp places where they live. Like other roaches, their body parts or feces can trigger childhood asthma.

To manage oriental cockroaches outdoors, first find areas in which they're developing, such as water christies or other damp utility holes in the ground, cracks between the sidewalk and the dirt underneath, damp clutter (wet cardboard or leaves), and dense groundcovers such as ivy. These areas can be treated using large cockroach bait stations or granular bait such as Niban® in a bait station. Treat cracks between the sidewalk and the dirt underneath, and cracks in foundations with gel bait. To exclude oriental cockroaches, fix weather stripping on the bottom of doors to form a tight seal. Seal the cracks in the foundation and fill in the cracks between sidewalk and dirt. Fix gaps around air conditioners and the point where water and gas pipes enter a building. Finally, repair cracks in floors.

Since most oriental cockroaches found indoors come in from the outside, sticky traps every 20 to 40 feet on the floor along the edges of a room will best manage them inside. If upon inspection you find there are aggregations of cockroaches, use a strong vacuum to remove as many as possible. Using a metal spatula, scrape cracks that are large enough to hide oriental cockroaches. Use a strong vacuum to remove cockroaches and debris from cracks, then seal using a caulking gun and sealant. Alternately, you can place bait in the corners near these cracks, or put a light covering of a borate-containing dust product in them. It's also important to check the seams of incoming bulk items like grains or flour for cockroach egg cases. This is a favorite egg-laying place for oriental cockroaches. Cockroaches can be caught in small jars that have been baited with white bread dipped in beer. Rub a thin film of petroleum jelly inside the jar. Rough up the outside surface of the jar or slip the jar into a cloth sleeve so the roaches can climb up easily on the outside of the jar, drop in, and then cannot climb out.

Turkestan cockroaches, male (left) and female (right). About 1½ times actual size. *Photo courtesy Ingrid Carmean.*

Not much is yet known about **Turkistan cockroaches**. The male looks like a small American cockroach, the female like an oriental cockroach with cream-colored stripes on the shoulder; nymphs are bicolored, dark toward the rear, pale brownish-red toward the head. Adults are about one inch long. They have life cycles and habitats that closely resemble oriental cockroaches, often preferring to live underneath cracked and raised concrete and asphalt.

German cockroaches are light brown, about ½ inch long, and have a life cycle of only 3 months, allowing them to rapidly increase their population. They live indoors in warm, humid areas such as kitchens and restrooms. Like some other roach species, they can trigger childhood asthma, inadvertently transmit diseases, and they're messy.

German cockroaches are strongly thigmotrophic—they like to touch surfaces—so they prefer being in cracks. Using a strong vacuum, vacuum the cracks in the area where the cockroaches are hiding twice, about five

minutes apart. During the first pass, the roaches will scatter because the air current disturbs them. They'll resettle by the time you come back for them. Using a metal spatula, scrape out any remaining cockroaches and debris from the crack. Vacuum again, then apply bait (for example, Avert® or Combat®) or dust lightly with boric acid (for example, Roach Prufe®), or seal the crack.

Check all incoming cardboard boxes for cockroaches. Don't store anything in cardboard boxes—instead use plastic containers. Check for German cockroaches in areas that are hot and humid—restrooms and kitchens, and under classroom sinks. Field cockroaches (see below) are more likely to be scattered throughout a classroom and visible during the day than German cockroaches.

Field cockroaches are light brown, about ½ inch long, with a dark line between eyes and on underside of the abdomen. These cockroaches look very much like German cockroaches, but their behavior is almost the opposite. They're not very social, are active during the day, and attracted to light. They develop and live outside, coming inside accidentally when attracted to light and probably the warmth of buildings. This especially happens in the fall. Due to the low humidity inside, field roaches die in about three days.

Although not associated with filth as other pest cockroaches, field cockroaches can build up in numbers and be quite bothersome. Like other roaches, they may be a causal agent of childhood asthma.

Good weather stripping around the doors should decrease field cockroach problems considerably. Once inside, these cockroaches die in about three days. Because field roaches are quite active they can be easily caught in sticky traps. However, in larger numbers their bodies should be vacuumed up with a HEPA-filtered vacuum and removed from the classroom and school environment. *There is no reason to use an insecticide indoors for field cockroaches.* Niban® (boric acid) is the only bait outdoors that will affect these cockroaches—it can be scattered in the ground cover.

American cockroaches are reddish brown and about 2 inches long. They prefer warm outdoor environments, and are usually found in sewers, basements, and lower floors of buildings. Their management is similar to that of oriental cockroaches (see above).

Rats and Mice

Both rats and mice have guard hairs, which are longer sensory hairs that stick out from the rest of their fur. They feel safest when these hairs touch every possible surface. They prefer running along a wall, or better yet, being in a corner. When using sticky traps, place them at the midpoint of a wall, not in a corner. This way the rat or mouse will run into the trap at full speed and be caught. Placing two or more traps in one spot will prevent the rodent from jumping over them. You can place snap traps on the floor in corners or at the midpoint of the wall. The range of most rats is 25 to 100 feet, but in some circumstances roof rats can travel over 300 feet. The range of a mouse from home to food is typically ten to thirty feet.

Rats

When inspecting for rats, check for droppings, which for roof rats are ½ inch long, and for Norway rats ¾ inch long. Also look for greasy, dirty marks visible along pathways when rats have been in an area long enough. You may also find gnawed food, wood particles, or you may see or hear rats in walls or ceilings.

When setting traps, be aware that rats are cautious, so prebaiting will get them used to feeding from the trap. **Snap traps** work well when prebaited, but be careful—they're powerful; keep them out of the reach of children by placing in a long PVC pipe. You can also screw snap traps onto building sides or tree limbs along well-traveled rat paths. The traps will be invisible to children but accessible to rats, especially roof rats. **Sticky traps** are not as effective as snap traps. Rats will usually sense and avoid them. **Rat zappers** will electrocute a rat or mouse that wanders into them. Keep them out of the reach of children. If you use rat baits in secured **tamper-resistant bait stations**, don't bait in areas where the rat will die, then move to an inaccessible spot. Some tamper-resistant bait stations have snap traps designed to go inside them.

Mice

When inspecting for mice, check for ¼-inch long droppings and evidence of feeding. Listen for scratching or gnawing noises in walls.

Place **snap traps** in corners with the trigger out. These can be also placed along walls with the trigger end toward the wall. You can place **glue traps** along the midpoint of walls. Be aware that in many schools and offices, staff or students who have discovered a live or dead rodent affixed to a glue trap have raised a ruckus. (It's the issue of a quick death with a snap trap or a slow, tortuous death with a glue trap.) A **rat zapper** placed along the wall will also kill mice (quickly).

When trapping mice, set more traps than seems necessary to increase the possibility of catching a mouse or all the mice in an area. Although mice are more curious than rats, pre-baiting often increases the number of mice caught.

WARNING: Deer mice may inhabit the area along with house mice. Deer mice are common and carry the deadly but rare airborne respiratory hantavirus. *Do not sweep or vacuum any mouse droppings with less than a high-quality HEPA-filtered vacuum cleaner.* Spray bleach on the droppings before removing. Wear a face mask when cleaning up suspicious droppings.

Birds

Schools are not supposed to be sterile environments devoid of any birdlife. Often, the birds attracted to school buildings and grounds are not the occasional finch or robin, but gregarious species that stain the sides of buildings with their droppings and crowd around outdoor eating areas. Some schools have no bird problems—others are overwhelmed. It's a good idea to consult a specialist in bird management to select the ideal exclusion devices or architectural fixes for your situation, whether the school is overrun with a loft of pigeons, flock of seagulls, murmuration of starlings, or flight of swallows.

Pigeons

When pigeons invade a school, they leave filth and odor from their droppings. The droppings may harbor histoplasmosis, a systemic fungal disease that can infect humans. Droppings can deface and increase the deterioration of buildings, and may kill vegetation. Pigeons carry a number of diseases and also harbor parasites such as fleas, lice, mites, and ticks, although many of these do not attack humans. Various fabric and pantry pests inhabit pigeon nests and can enter structures if nests are nearby.

Pigeons will stay in the neighborhood if they have good roosting and nesting areas with nearby food and water. To manage these birds, start by eliminating access to roosting and nesting areas. Work with a bird management specialist to select spikes or other barriers so that pigeons can't land on roofs, ledges, gutters, window sills, and other flat surfaces. Harassment by owl decoys don't work—pigeons soon notice that these inflatable raptors are motionless.

Eliminating water and food, wherever possible, is another strategy. Pigeons need one ounce of water every day. You can also render water unpalatable with light oil or soap. The pigeon diet is varied, consisting of spilled grain, garbage, insects and other foods. Some people feed pigeons intentionally, while others inadvertently leave behind food that pigeons eat. It's important to let everyone in the area know that they shouldn't feed the pigeons.

It's also possible to trap pigeons and remove them by using one-way traps. Don't release pigeons into the wild because they'll find their way back home.

Seagulls

There are two main species in California, the California gull and the ring-billed gull. These look quite alike and both change in appearance as they age.

Gulls can transmit diseases by fecal contamination of outdoor food-serving and eating areas. Not only do they pester anyone eating outdoors for food ("Mine, mine, mine!"), but they break open plastic trash bags and spill garbage. They can nest on rooftops. Gulls have adapted to human behavior, and their population continues to increase. In one area during a nine-year period, 20 pairs of nesting gulls grew to 80,000.

Gulls are classified as migratory birds and are therefore protected. Permits are required for any method used to manage gulls except exclusion and frightening. Seagulls are susceptible to frightening—loud noises work, but these wouldn't be acceptable at schools. Recordings of gull distress sounds can work. The gulls first investigate the sound, then leave after about five to ten minutes. You can also harrass gulls with trained birds of prey and small radio-controlled aircraft modified to resemble falcons. Also, dead gulls or decoys, which are placed to resemble dead gulls, will frighten them. The effectiveness of these strategies depends on how established the gulls are in a certain area.

Porcupine wires prevent gulls from roosting on window ledges and rooftops. For larger expanses such as rooftops or ground areas, either steel (28 gauge) or monofilament (50 lbs.) wire will prevent seagull landings.

If you find nests at the end of the season, remove nesting material and then exclude the gulls from these areas. Other effective methods that require a permit include removing nests during nesting season, removing gulls by trapping, and sterilizing eggs and then returning them to the nest.

Starlings

About the size of a robin, starlings are black with a yellow bill that darkens during fall and winter. Unlike most other bird species, starlings walk rather than hop. In the 1890s, these birds were released in Central Park by someone who was amused by the idea of introducing all of the birds mentioned in Shakespeare's works to the United States.

During the fall, starlings roost together in large flocks of 50 to several hundred or more. Their droppings may be a source of histoplasmosis. The droppings can also damage building surfaces due to their acidity. Starlings are beneficial during the spring when insects such as lawn grubs make up about one-half of their diet. During the winter, however, starlings feed on garbage and can become pests around schools.

To discourage starlings from roosting around a school, place porcupine wires on perches, or cover perches with a sloped surface of wood, metal or Plexiglas at an angle of 45° or more. Starlings avoid resting on sloped surfaces. Thin bushes and trees where birds tend to aggregate. Sudden loud sounds frighten starlings as well as bright lights (especially around night-roosting areas), Mylar reflective tape, or even eye spot balloons. Starlings and most other birds don't hear ultrasonic sounds. Consistent harassment of starlings for 3–4 nights will usually scatter them, especially if they're new to the area and you're persistent. Soft, sticky repellents work well, but place masking tape on the surface first to increase effectiveness on porous surfaces. During nesting season, you can trap starlings in fake nesting boxes that have a modified rat trap for a door. You can also trap them in large cages containing live starlings as decoys. Starlings are not protected by federal law, but contact your county agricultural commissioner before you trap starlings.

Swallows

Two swallow species attach their nests to buildings. Cliff swallows nest in large colonies and build jug-like mud nests. Barn swallows nest singularly or in loose groups in open mud nests.

Although swallows help keep insect populations down, their droppings can be a health hazard, foul machinery, as well as being messy. These problems are more noticeable for cliff swallows because their numbers are much greater in single locations. Many parasites, some of which bite humans, live in swallow nests. English sparrows may reuse the nests, creating more of a mess.

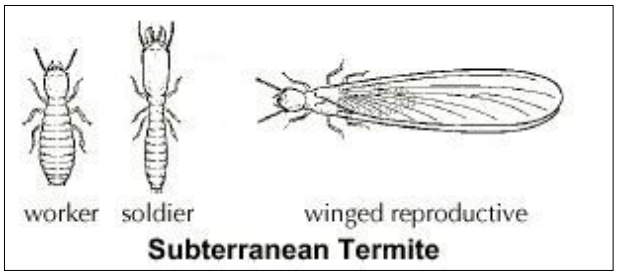
Swallows are protected migratory, insectivorous birds. Permits are rarely given that allow someone to harm or kill swallows or their eggs. Exclusion is allowed if no eggs are present. If local laws don't prohibit it, nest removal is allowed if no eggs are present. Since swallows will lay their eggs before the nest is complete and rebuild a nest that's destroyed, it's important to keep up with nest removal during the nest-building season.

Exclude swallows with netting or poultry wire with a ¾-inch mesh. If a net is used it must be coarse enough, and be set up in such a way that it doesn't entangle any swallows. The architectural design itself can do much to prevent swallows from nesting on buildings. Obtuse or rounded overhangs, or those shorter than 6 inches (or better yet no overhangs) will discourage nest building. A smooth, slick surface, which prevents these birds from gaining a foothold, also discourages nesting.

Sticky repellants may help swallows to nest because they make it possible for the birds to gain a foothold on the surface. As with most birds it's best to seek the advice of a bird control expert for your specific problem before beginning a program.

Termites

Termites are often mistaken for winged ants. Ants have thin waists and their hind wings are smaller than their front wings. Termites have broad waists and their four wings are of equal size. **Dampwood termites** usually live in cool, humid places such as fallen logs in forests, and are uncommon as structural pests. **Drywood termites** are about ½ inch long with a reddish-brown head and thorax. They kick out small fecal pellets from tiny holes in their galleys. They feed on dry wood and survive well without a moisture source. Drywood termites have small, slow-growing colonies, which generally occupy only one piece of wood. Most attics in the Central Valley are too hot for them to survive. The winged adults of **subterrranean termites** are smaller than drywood termites, and are dark brown with dark wings. The western subterranean termite is the most destructive termite pest in California. Subterranean termites require contact with the soil, which contains much of their nest, although they can survive if their food source has a constant supply of water. The Formosan termite, another species of subterranean termite, has eaten its way through the French Quarter of New Orleans, but so far has only been identified in a small area near San Diego.



Drawing courtesy UC IPM

Foundation sand barriers prevent subterranean termites from constructing tunnels—which means they can't invade wooden structures resting on the foundation. Sand with particle sizes in the range of 1–3 millimeters is used to replace soil around the building's foundation and sometimes in the crawl space. Use a 3" layer of sand (#3 Lapis) for a sand barrier underneath slab construction to create a permanent sand barrier to both western subterranean and Formosan termites. When landscaping areas next to buildings, lower the soil level to avoid soil–building contact.

A number of maintenance-related procedures will help prevent termite infestations. Inspect areas around stucco siding that reaches the ground—this condition promotes termite infestations. Inspect utility and service boxes attached to the building to see that they're sealed and don't provide shelter or a point of entry for termites. You can greatly reduce chances of infestation by removing or protecting any wood in contact with the soil. Inspect porches and other structural or foundation wood as well as abandoned tree stumps, stored lumber, untreated fence posts, stacked pallets, pieces of wooden mulch, and buried scrap wood near the structure that may attract termites. Use screening over attic vents and seal other openings such as knotholes and cracks to discourage the entry of winged drywood termites. Although screening of foundation vents or sealing other openings into the substructure helps keep out termites, these procedures may interfere with adequate ventilation and increase moisture problems, especially if the screening is a very fine mesh.

Avoiding moisture problems will also help discourage termite infestations. Keep structures dry by maintaining proper drainage, keeping drains clean so water flow is unimpeded, and keeping attic and foundation areas well ventilated and dry. Inspect basements periodically to ensure that there is no standing water or flooding. Where problems recur, inspect frequently.

Tree squirrels

Tree squirrels are easily distinguished from ground squirrels—if frightened, a tree squirrel will run up into a tree, whereas ground squirrels run into holes in the ground.

Although many regard tree squirrels as cute, they pose problems when they gnaw on electrical wiring and cause electrical outages or even fires. They gnaw on walls and structural timbers, and sometimes damage structures. If cornered, they bite and claw viciously. They carry several diseases, which can spread to people, and harbor ectoparasites, which can cause plague, epidemic typhus, and clostridium. Stored-product pests can develop in large numbers in their cache of food and move to a human food supply nearby.

Tree squirrels are best managed by excluding them from trees and structures. Prune back tree limbs at least ten feet from a building. Prevent squirrels from accessing trees by wrapping the trunk with a metal band two feet wide and 3–4 feet above ground. Other access points from fences and other trees must also be denied. On buildings, look first above eye level at areas that frequently have structural flaws or openings: uncapped chimneys, behind ivy or other wall-climbing vines, vents in attics, and windows in disrepair. If you don't notice openings, check similar areas below eye level including vents in basements, drainpipes, and again, windows in disrepair. Occasionally, squirrels will make their own holes by gnawing through the side of buildings. Seal off all access areas with ½-inch hardware cloth or sheet metal.

Tree squirrels can be live-trapped and some species kill-trapped (check local laws.) If live-trapped, they must be either euthanasized (again, check local laws) or released five miles from the trap site. The eastern or red fox squirrel is not native and can be taken any time it damages property or crops. You can use box traps for gophers for red fox squirrels. Set the traps high in trees and away from children, where the squirrels have ready access to them. Then prebait with nuts, which allows the squirrels to get used to the traps. Be sure to tie the bait to the trigger. Red fox squirrels are too large for standard rat traps, but smaller squirrels can be caught with these if local laws allow. Be sure to prebait and set in the appropriate manner, not out in the open where you might catch non-target animals.

Black Widow Spiders

Black widow spiders are sometimes confused with other black-or dark-colored spiders. They're the only spider with a red or red-orange hourglass pattern on the underside of the abdomen, although sometimes you'll see only two dots or no pattern at all. It's only the mature female that has the characteristic black widow coloring and shape, and this is the only stage that can bite and penetrate human skin.

Black widow spiders are more of a perceived problem than an actual one. No deaths have been reported to the American Association of Poison Control Centers since its first annual report in 1983. Black widow bites are reported to be painless or similar to a slight pin prick. Sometimes knowing whether you've indeed been bitten by a black widow is questionable. Black widows are shy, nocturnal, and docile. However, a female spider may bite when trapped in clothing or defending her egg sac.

They're rather fragile spiders and can be controlled by swatting with a fly swatter. At night when they're more obvious, you can go around killing them with a fly swatter and flashlight. You can also vacuum them up along with their webbing.

Black widows are frequently found in firewood or rock piles, or other undisturbed areas that offer hiding places such as dark corners and small holes. You can eliminate hiding places by adding more light to dark holes, sealing holes, and cleaning up clutter.

At one school, black widows hid in holes at the base of hand rails. Once these holes were closed, black widows disappeared.

Paper wasps (umbrella wasps)

Paper wasps (also known as umbrella wasps) are semi-social insects that live in relatively small colonies. They have long legs and wings, and a pinched or threaded waist. These wasps build small, open-celled nests under eaves, overhangs, and roof peaks, and under decks and railings. Their nests are not enclosed and hang from one pedicel or supporting stem. Although in the same family as yellowjackets, paper wasps are less aggressive.

The perception of this wasp as a threat is the reason most people consider it a pest. Wasps are beneficial due to the many pests they feed upon. The reaction to the sting of this wasp varies from individual to individual. It varies from short-term pain and redness to a life-threatening allergic reaction. Paper wasps can damage wood by scraping it for nesting material, and debris can accumulate under a nest and be difficult to clean.

Clean, freshly painted surfaces are less likely to have wasp nests constructed on them and most painted surfaces are not used by wasps for nesting materials. Screen and caulk areas near the attic to prevent wasps from entering and making nests. This will also prevent overwintering wasps from staying in the attic areas and then entering classrooms during warmer fall and spring days. Trim bushes to reduce nesting sites and increase visibility of nests.

If necessary, spray at night and do so at a distance from the nest. Most aerosol cans designed for wasp control will shoot from 16 to 20 feet. Do not stand on a ladder because you might fall if wasps attack. Don't use a flashlight; this will direct the wasps to you. If you stand under the nest many of the wasps will drop straight down on top of you. Some products contain essential plant oils and are exempt from notification and posting requirements of the Healthy Schools Act.

Bats

You can observe bats flying at dusk. To estimate colony size, watch between 30 minutes before sunset and continue observing until one hour after the first bat has emerged. You can find evidence of bats by locating droppings, urine on walls, or smug marks where bats enter and exit. Bat droppings break apart like soft graphite, while those of mice resemble little rocks, unless fresh, when they're soft but stay clumped. Bat droppings also sparkle in the sunlight. (Droppings of deermice can contain hantavirus so it's important to wear a face mask and wash hands thoroughly, or wear disposable gloves when handling any suspicious droppings.)

Bats have good qualities. They eat billions of flying insects such as mosquitoes, midges, and moths. There are many folktales vilifying bats and sometimes people are uncomfortable with them. Most of these folk tales are false, but bats are often considered pests for good reasons. Bats transmit diseases that include Chagas disease, endemic relaxing fever, St. Louis encephalitis, and rabies. Bats do not show any particular behavior when infected and although the incidence of rabies in bats is low, you should never pick up a bat lying on the ground or displaying any unusual behavior. Their droppings and urine can be odorous, and can support the fungus that causes histoplasmosis.

Start a bat management program when young bats are gone, preferably in the late summer or fall. To construct one-way valves, place netting over exit holes so that bats can crawl out of the building and underneath the netting that covers the exit holes, but cannot re-enter the building upon return.

There are materials that exclude bats from buildings depending on the situation. You can simply stuff copper wool into a hole, or you may have to net an entire building. At one high school, the M&O staff sealed a long area outside a building because bats had become so noticeable.

Feral Cats

Feral cats can carry diseases that are transmitted to humans. These include rabies, distemper, cat scratch fever, toxoplasmosis, leptospirrosis, salmonellosis, mumps, and ringworm. They also carry other endo- or exoparasites like fleas and ticks which themselves vector diseases. Fleas from feral cats can become a problem in a classroom.

Feral cats have unpredictable behavior. At first they may be friendly, but then suddenly turn aggressive. When appropriate food and harborage are present, cats can reproduce at the rate of 30 kittens per year and usually live for only three to five years. The cat food left by well-meaning neighbors, teachers and students is also food for rats, mice and ants. Even well-fed cats will still hunt for birds and other wildlife because hunting and hunger instincts are in two separate areas of the brain. If you maintain a cat refuge the word will get around and people will drop off kittens and stray cats.

Manage feral cats by eliminating food and harborage, and relocating cats. Keep available food to a minimum by using trash cans with good covers that are closed when not in use. Educate the public why they shouldn't feed the cats. Remove harborage by closing gaps in connex boxes with screening, sealing areas under portables and holes in foundations. Check old off-site vehicles and sheds for harborage.

Relocate cats by trapping them with a cat-sized live trap. Other types of traps may be legal in your area, but would be bad for public relations. Bait with fish (jack mackerel, for example)—cats love the smell. Position the trap against a wall, shrub, rock or other large object and then place a large piece of plywood over the trap. If you don't trap cats quickly, try a few tricks. You can pre-bait the trap, allowing cats to feed successfully in the trap before setting it. You might have to wire it open. If you're sure there are still cats around move traps to different spots. Reuse traps immediately after you've made a successful catch. The odor of cat urine and fish is almost irresistible to cats. (Cats almost always urinate when caught.) You should have a cage in which to put the trapped cats. Finally, take the cats to the SPCA or a similar organization.