

Monitoring Pest Populations and Damage

SECTION 3

IPM is based on consistently inspecting and monitoring for pests. The purpose of monitoring is to supply recent, accurate information with which appropriate decisions for managing pests can be made. Guidelines for making appropriate decisions can be established prior to monitoring (see section 4 on “Setting Injury and Action Levels”). Since each site is different, pest management decisions will depend on the circumstances encountered.

Monitoring as part of IPM was originally developed for agriculture. Over the years, this concept has been adapted for gathering information on pests of landscapes and structures in urban settings.

A regular and ongoing monitoring program will help answer the following questions:

- What is the extent of existing pest problems?
- Where are they located?
- What other pest problems exist?
- How are pests entering the building?
- What are the pests’ sources of food, water, and shelter?
- Are there conditions conducive to future pest problems that can be corrected?

This section provides a general overview of how to set up and operate a monitoring program. Detailed discussions on monitoring techniques for individual pests are provided in Part 2.

3.1 What Is Monitoring?

Monitoring is the planned, regular visual inspection of an ornamental planting, landscape or structure for detecting pests, pest damage or conditions conducive to pests or pest damage. Monitoring should take place in areas where pest problems do or might occur. Monitoring frequently includes the use of pest traps, such as sticky traps for cockroaches. Information gathered from these inspections is always written down to help determine what actions to take. Examples of monitoring forms are provided in **Appendix M**. An inspection checklist for detecting structural decay and structural pest damage is provided in **Appendix N**.

3.1.1 *Not Enough Time or Money?*

Time and money will constrain what will realistically be possible. The most important thing is to go out and look at the problems, and write down what is observed. Figure out how monitoring can be included along with routine maintenance activities to ensure that this will be done. Make sure that personnel who are asked to monitor understand what to look for and how to record the information. Supply them with easy-to-use monitoring forms whenever they go out. If the school is contracting out its pest control services, give the pest control company copies of these forms to use or have them develop their own forms subject to the approval of the school’s pest manager.

3.1.2 Levels of Effort Used in Monitoring

Monitoring need not be time consuming. The idea is to match the level of monitoring effort to the importance of the problem. Monitoring can vary from the extremely casual to the statistically strict, depending on what is most appropriate. The levels of effort are:

1. Reports from other people's (e.g., teachers) informal observations. This can be useful if used with a pest-sighting log to record verbal reports.
2. Monitoring as part of other tasks, with written observations. This serves to catch pest problems as they begin.
3. Careful inspection with written observations should be conducted when pest problems are significant.
4. Regular written observations and quantitative descriptions are appropriate when working on a pest problem related to public health.

3.2 Why Monitor?

A monitoring program increases familiarity with the workings of the target system. This knowledge allows anticipation of conditions that can trigger pest problems, and thus prevent them from occurring or catch them before they become serious. Monitoring enables intelligent decisions to be made about pest management actions, such as sealing cracks or setting traps.

Monitoring helps determine if action is needed. Is the pest population getting larger or smaller? If plants are being monitored, is the natural enemy population getting larger or smaller?

These questions affect whether or not treatment is needed. These answers depend on inspection of the problem sites on several different occasions. How many pests or how much pest damage can be tolerated? This is also referred to as setting injury and action levels, which is discussed in detail in section 4. Even when tolerance for pest presence is at or near zero, as in the case of rats, monitoring will result in early pest detection, reducing the likelihood of unexpected pest outbreaks.

Monitoring helps determine where, when, and what kind of treatments are needed. This includes preventive treatments such as pest proofing and sanitation. Monitoring will show where these are most needed. It is unnecessary (and expensive) to treat all parts of a building or all plants on the school grounds for a pest when not all areas may be equally infested. Monitoring will pinpoint infestations and problem areas. On plants, monitoring will help time treatments to target the most vulnerable stage of the pest. The vulnerable stage may vary depending on the type of treatment used.

Monitoring allows evaluation of pest management actions. Monitoring after an action will show the success or failure of that action, so that future actions can be modified.

- Did the action reduce the number of pests below the level that causes intolerable damage?
- How long did the effect last?
- Did the action have to be repeated?
- Were there undesirable side effects?
- Do pest management action plans need to be adjusted?

3.3 What to Monitor?

Monitoring plants and their pests includes the regular observation and recording of:

- The condition of the plants (their vigor and appearance).
- The kind and abundance of pests (e.g., insects, mites, moles, and weeds) as well as natural enemies (e.g., ladybugs, spiders, lacewing larvae, and syrphid fly larvae).
- The amount of plant damage.
- Weather conditions (record any unusually dry, hot, wet, or cold weather in the last few weeks).
- Human behaviors that affect the plants or pests (e.g., foot traffic that compacts the soil, physical damage to plants caused by people, and insistence on having certain plants grow in inappropriate situations).
- Cultural practices (e.g., pruning, fertilizing, mulching, and treating pests) and their effects on the plants and the pest population.

Tables 3-1 and 3-2 provide more information to help quantify monitoring information. Using the abundance ratings in **Table 3-2** will make monitoring faster and easier, and will help standardize observations. If data that is more precise is needed, count the number of pests or their signs in a given area or on a certain number of leaves.

Monitoring weeds should be a seasonal activity timed to determine new weed pests or those that escaped treatment.

- Evaluate cultural practices that may favor weeds such as mowing, aeration, fertilizer use and irrigation practices.

- Review foot traffic patterns that may increase weeds.
- Monitor in spring and summer when most weeds are present and can be identified.

Monitoring structures involves the regular observation and recording of:

- The conditions of the building inside and out (e.g., structural deterioration, holes that allow pests to enter, and conditions that provide pest harborage).
- The level of sanitation inside and out (e.g., waste disposal procedures, level of cleanliness inside and out, and conditions that supply food to pests).
- The amount of pest damage and the number and location of pest signs (e.g., rodent droppings, termite shelter tubes, and cockroaches caught in traps).
- Human behaviors that affect the pests (e.g., working conditions that make it impossible to close doors or screens, food preparation procedures that provide food for pests, etc.).
- Management activities (e.g., caulking, cleaning, setting out traps, and treating pests) and their effects on the pest population.

Table 3-3 provides specific information on monitoring tools for both plants and structures.

3.4 Identifying the Target Pest

It is extremely important to correctly identify the problem pest and the cause of the pest problem. A pest cannot be effectively managed without knowing what it is or why it is present. For instance, putting out mousetraps to control what is really a rat problem can only result in failure. Setting out ant baits without caulking their entry point will not prevent more ant problems later.

The UC IPM Pest Notes in Part 2 provide information that will help identify some of the most common pests found in and around schools. Take a specimen to a professional for identification for unusual pests. **Appendix K** describes how to properly collect and preserve an insect or plant specimen when seeking identification.

Once the pest is identified, read about its life cycle, food sources, habitat preferences, and natural enemies. Part 2, the UC IPM Pest Notes, will provide this information for the common pests, but if the pest is not included here, check the Recommended Reading section, **Appendix H**, at the end of this manual for books that can help. Knowing the life habits of the pest will give clues about what to look for when monitoring and help decide how to best manage the pest.

If only damage symptoms and not the pest itself are visible, a sleuthing job is in order. More observation or observation at a different time of day may be necessary. Talk to other pest management professionals, local gardeners, nursery personnel, Cooperative Extension staff, or university researchers.

3.5 Timing Monitoring Activities

Timing and frequency of monitoring differs depending on the site and the pest(s). Outdoors, monitoring usually begins when plants put out new leaves in spring, and ends when leaves fall in autumn. Plants with annually recurring pest problems receive more attention than relatively pest-free plants. Monitoring can be incorporated into routine grounds maintenance activities such as weekly mowing, or can be a separate activity that occurs bi-weekly, monthly, or less frequently, depending on plant, pest, site, weather, and other factors.

Indoors, monitoring might occur weekly during the early stages of solving a serious pest infestation, then taper off to monthly, once the pest problem is under control. Some pests are more active at night than during the day, thus, some monitoring may need to occur after dark. This is usually only necessary when trying to identify a nocturnal pest or trying to determine its travel routes and feeding habits. Once this is known, nighttime monitoring can often be replaced by daytime inspection of traps and plant foliage for signs of pest presence.

3.6 Recordkeeping

A monitoring program is only as useful as its recordkeeping system. Records serve as the memory of the IPM program and are more accurate and detailed than human memory. Written records must be kept and made available by request for at least 4 years. Use of written records can avoid erroneous conclusions when comparing effects of treatment or other variables on the pest problem.

Recordkeeping is important to the pest manager because:

- Written observations about the specific pests and their management increase the pest manager's knowledge.
- More can be learned about the specific pest problems because details, such as past treatment success or failure, won't be forgotten.

Recordkeeping is important to the school system and the IPM program because:

- Monitoring records form the basis for making decisions on the most sensible distribution of available resources to the areas most in need of attention or observation.

- Information can be easily and accurately passed from one employee to another.
- Information is not lost when employees leave or retire

What Should the Records Show?

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

The rest of the information to record is listed under “What to Monitor,” above. As mentioned before, the information in **Tables 3-1** and **3-2** will help to standardize some of the observations. **Table 3-1** is specifically for plants, but **Table 3-2** can be used for structural pests as well as plant pests.

It is also important to standardize the format and the process by which the records are kept in order to maintain continuity from season to season and person to person. See **Appendix M** for sample forms. Design forms with boxes to be checked off so less writing will be necessary.

Pest patterns emerge quickly when data gathered during monitoring are made visual, facilitating decision-making. This can be done by hand on graph paper, or by using one of the many graph-making features included in spreadsheet software. **Figure 3-1** shows fluctuations in cockroach trap counts.

3.7 Evaluating the Actions

Without evaluating the actions taken to reduce the pest problem, it will not be possible to improve the management program from year to year. Ask the following questions:

- Was the pest problem a significant one?
- Were the actions taken necessary or would the problem have gotten better if left alone?
- Did the actions taken and the least-hazardous treatments used adequately solve the problem?
- Could the problem be managed better next time? If so, how?
- Is more or better information needed to make treatment decisions in the future?

See **Appendix L** for sample pest management assessment of a school IPM program.

Table 3-1: Plant Condition Rating*

Plant Condition	Indicators of Plant Condition			
	Leaf Color	Amount/Size	Damaged Plant	Presence of Pest
EXCELLENT	Good	Adequate	None to few	No major ones
GOOD	Good	Slightly reduced	Few to common	A few minor ones
FAIR	Poor	Much reduced	Common to abundant	Either major <u>or</u> minor ones occurring frequently
POOR	Poor	Severely reduced	Innumerable	Both major and minor ones occurring frequently

Leaf Color: Note that there are healthy plants that do not have bright green leaves. Leaves can be purple, yellow, or sometimes a mottled yellow and green (variegated). “Good” leaf color will not always be the same; it will depend on the kind of plant.

Amount/Size of Growth: This refers to the length of the new growth for the season as well as the number of new leaves, and the size of the leaves, flowers, or fruit.

Damaged Plant Parts: Look at the whole plant. Are there leaves with holes, spots, or discolorations? Are there wilted or dead leaves? Are there dead twigs or branches? Is the damage only on old leaves while new leaves look perfectly healthy?

Presence of Pest Problems: A major pest problem is one that has seriously affected or injured the plant and requires management. A minor pest problem may or may not have affected or injured the plant and may or may not require management.

*Adapted from Michigan State University, 1980

Table 3-2: Pest and Plant Damage Abundance Rating*

Abundance Rating	Indicators of Abundance
Few	Organisms or plant damage occasionally found, but only after much searching
Common	Organisms or plant damage easily found during typical searching
Abundant	Organisms or plant damage found in large numbers—obvious without searching
Innumerable	Organisms or plant damage extremely numerous—obvious without searching

*Adapted from Michigan State University, 1980

Table 3-3: Tools Used in Monitoring

Tools	Use	Plants	Structures
Monitoring forms	to write down what is seen	X	X
Maps or site plans of the buildings or grounds	to mark where pests are found and where traps are placed	X	X
Clipboard	to hold the monitoring forms and maps	X	X
Flashlight with a halogen bulb	to detect nighttime pest activity and for viewing darkened areas (e.g. under counters, in closets) during the day. A black light bulb can be substituted to detect scorpions.	X	X
Sticky traps (for many insects the color of the trap is important, e.g., thrips are attracted to blue; whiteflies prefer yellow). Glue boards are used for monitoring rodents.	to monitor a variety of insects, mites, and small rodents.	X	X
Hand lens (a small magnifying glass)	to help to see mites and small insects A lens that magnifies things at least 10 times (=10X) is usually adequate. A 15X lens can be used to distinguish among various mite species and other similarly small pest organisms such as thrips.	X	X
Plastic bags or small vials	to hold specimens for later examination or identification.	X	X
Small knife or screwdriver	to dig up weeds for specimens or for control, to probe damaged wood and to extract insect droppings from wood.	X	X
Ladder	for examining hard-to-reach spaces	X	X
Camera	for documenting pest damage to plants or structures before and after IPM methods have been applied	X	X

Figure 3-1: Fluctuating Cockroach Trap Counts

