# IPM: from Integrated Pest Management to Intelligent Pest Management

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Boggs draws upon years of practical experience in providing technical support and educational outreach on tree pest diagnostics and management to reexamine well-known Integrated Pest Management principles through the lens of modern arboriculture. The result is a simple 4-Step approach to pest management. From determining which pests matter to deciding when to pull the pesticide trigger, this presentation uses real-life case studies to educate participants on how to apply intelligent pest management concepts to meet client needs and expectations.

**Extended abstract:**

Arboriculture has always included a customer service component. However, at no other time have tree service customers had access to so much information. Unfortunately, information that shapes societal attitudes towards pest management is often inaccurate, inconsistent, and subject to the vagaries of 1-minute media sound bites and 140-character text messages. Social networking means the impact of a single misapplication of an insecticide can quickly reverberate around the world to immediately influence the attitudes of tree care customers.

While it may seem that trying to meet client needs and expectations in the age of social media is like trying to hit a moving target, there is one expectation that remains unchanging: clients want perfect landscapes at minimal costs. Of course, there is no avoiding the fact that trees will have pests. Indeed, all landscape plants including trees are living organisms and there are other living organisms that will make a living on them. The only way to have perfect landscapes is to use silk flowers and artificial turf!

It is important to keep things in perspective; to educate our tree care clients on some simple facts about insect and mite tree pests. This is not an easy task given the common misconception that most insects and mites are pests. In fact, of the 90,000+ described species of insects in North America north of Mexico, only 6,700 are pests (7.4%) and only 700 are serious pests (0.7%). The remaining 6,000 (6.6%) insect species rarely cause significant damage. Mites and microorganisms probably conform to a similar if not more dramatic ratio.

This reality flies in the face of the public's perception that first and foremost, insects cause damage and they are scary! In fact, insects are so beneficial they are considered "key organisms" in all terrestrial ecosystems. This designation means that if insects are removed, the ecosystems would collapse! As the famed Harvard biologist, E.O. Wilson said, "*If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium*

*that existed ten thousand years ago. If insects were to vanish, the environment would collapse into chaos*."

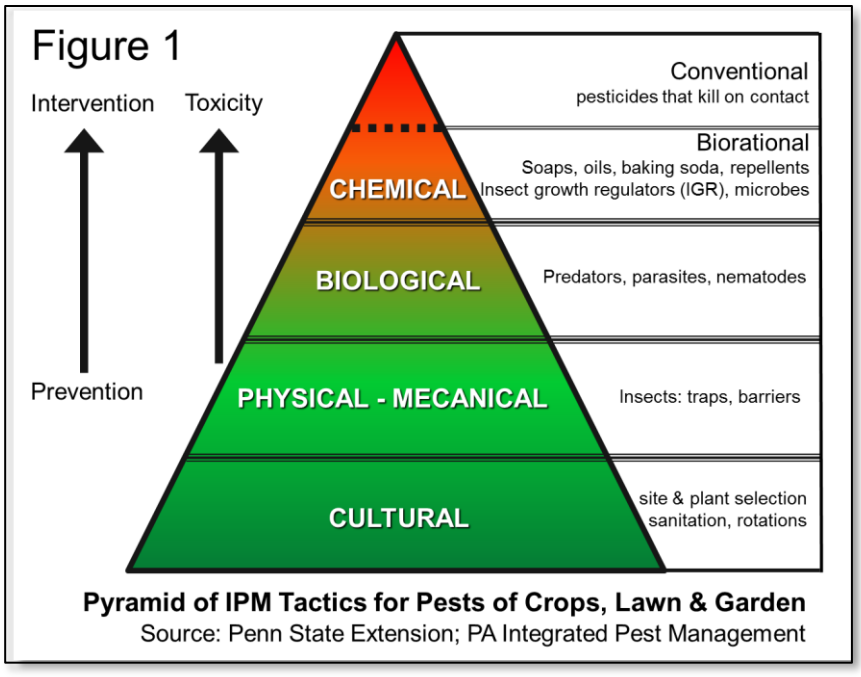
Very few insects are pests and all pests are not equal. A few hickory tussock moth caterpillars feeding on the leaves of a mature oak tree causes no harm to the overall health of the tree; it's not about looks, it's about tree health.

The Integrated Pest Management (IPM) concept first appeared in print in 1967 (1). The approach evolved out of pest managers and entomologists recognizing that the continual reliance on a single pest management tactic - insecticides - had produced a number of unintended consequences including pest resistance and negative environmental impacts. The IPM approach combined the judicious use of insecticides with other pest management tools including the use of cultural (e.g. plant selection) and biological (e.g. insect predators) pest suppression methods.

IPM was widely adopted by both agricultural crop managers as well as entomologists. In fact, it was so widely accepted by the scientific community that by 2000, there were 67 published definitions for IPM (2). Although different, some shared common ideas and language. For example, 54% included the word “economics;” 48% had the word "environment;" 25% included "ecology" or "ecological;" and 17% referenced "economic threshold" or "economic injury level."

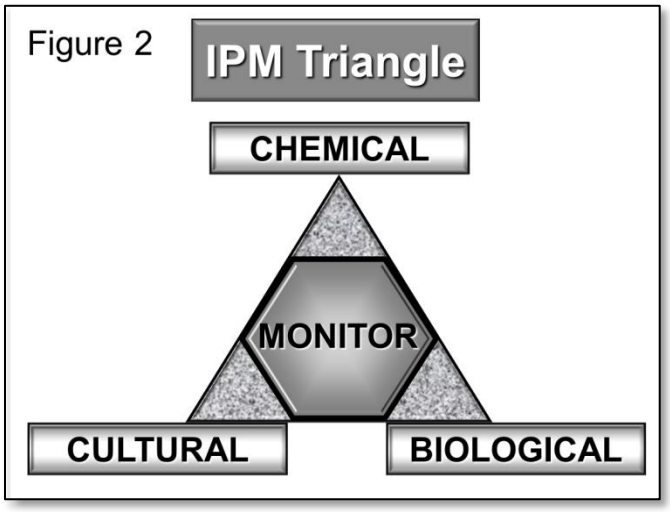
Many "how to" conceptual guides to IPM decision-making have also evolved over time. Some are lists; others are graphic depictions of the components of an IPM program. An example of an IPM list appears on the Cornel University Biological Control website (3). There are four components:
1. Set Action Thresholds
2. Monitor and Identify Pests
3. Prevention
4. Control.

A graphic depiction of the components of an IPM program appears in Figure 1 (4). "Cultural" tactics serve as the base signifying a greater importance compared to "Chemical" tactics at the top. The point is further emphasized by the arrows on the left showing tactics towards the base are "preventative" whereas tactics at the top are "intervention."



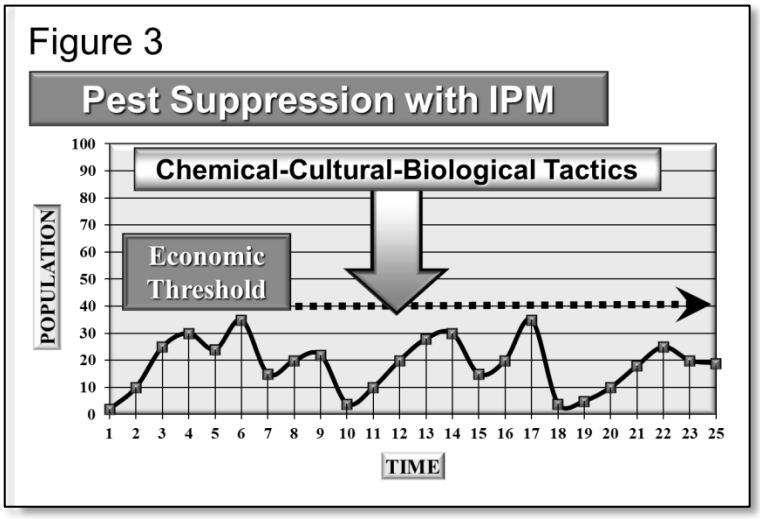
A simple 3-component graphic representation of IPM tactics has been used by the speaker for a number of years (Figure 2). The value of this elementary visual perspective is that the tactics are easy to remember and tied together by the need to "Monitor;" from keeping an eye on the overall health of trees, to monitoring for developing pest problems, to gauging the need to react, to assessing the efficacy of applied pest management tactics. Another way to visualize the importance of integrating all three components is to view this graphic as a three-legged stool with the seat being "Monitor." Remove any piece of the stool, and it collapses!

Figure 2




The IPM concept was first introduced to manage pest of field crops such as corn, soybeans, cotton, etc. Figure 3 illustrates that the objective is use the three basic IPM tactics to keep pest populations below a recognized "Economic Threshold" that has been established through scientific research.

Figure 3




Unfortunately, there are no economic thresholds for urban trees based on direct values such as those used for field crops. For example, just because a blue spruce was purchased for $500 does not justify spending $500 to protect the spruce; the tree would then be worth $1,000, but it's never going to be sold. Replacement cost values for urban trees are not connected to the economics of pest management decisions except for documenting loss; using them to justify expenditures falls under the "value added" economic column rather than return on investment.

Of course, the National Tree Benefits Calculator (5) does allow us to determine tree benefits values, such as impacts on property value, heating/cooling costs, etc., for urban trees. These values have been justifiably used to validate preventative insecticide applications to protect ash trees from emerald ash borer (EAB); however, they are not the same as the "Economic Thresholds" used in IPM programs which are like on - off switches over time. As pest populations approach Economic Thresholds (a.k.a. Action Thresholds), IPM tactics are brought to bear (switches are turned on) to suppress the pest population. The justification for action is that costs will be covered through increased crop yields, such as an increase in bushels of corn per acre. If the "switch" is an insecticide application, it's turned on to suppress, and turned off once the pest population drops below the economic threshold; applications are not continual. The switch is turned on and stays on with protecting ash trees from EAB and the expected return on investment is measured through indirect economic benefits such as reduced heating/cooling costs; the trees themselves are not being sold.

With no real economic thresholds for urban trees, pest management decisions are often based solely on "Aesthetic Thresholds." This is highly subjective; pest impacts are in the eyes of the beholder.

One of the 67 definitions for IPM published prior to the year 2000 read: "Integrated Pest Management means 'Intelligent Pest Management'" (6). Applying this prescient message to urban tree pest management means all aspects of modern arboricultural knowledge should be brought to bear in dealing with tree pests. Following is a simple 4-Step pest management program that meets that standard:

4 Steps in an Effective Pest Management Program for Urban Trees:

1. Support good tree health!
2. Identify the pest(s): the Diagnosis.
3. Separate the serious pests from the not-so-serious pests.
4. Devise a multi-tactic management strategy targeting the serious pests.

Supporting good tree health is the first step because by fully exploiting this step, steps 2, 3, and 4 may never need to be considered! Step 1 includes three simple actions: proper tree selection (right tree, right place); proper installation (plant it right!); and appropriate aftercare (proper watering, pruning, etc.). Tree selection includes considering trees that are resistant to a prevailing pest problem. Planting non-native birch trees where the North American native bronze birch borer is endemic is not a good idea; planting native birch trees is a good idea.

Proper pest identification has historically been viewed as the first step in a pest management program. However, as noted above, if step 1 is fully followed, there may be no need to identify a pest; there may be no pest! Of course, even the best managed trees may attract unwanted pests. The key is to make certain that you are making an accurate identification and you are certain the problem is indeed a tree pest and not some other problem such as a disease or physiological issue; the value of employing accurate tree problem diagnostics should never be ignored.

Separating the serious from the not-so-serious pests can be a challenge; however, the full evaluation should be based on pest impacts on tree health rather than on tree aesthetics. Fortunately, much has been learned over the years regarding the intricate relationships between native pests and their native tree hosts. Native pests are not killers of their native hosts; if they were, both would have gone extinct. However, it is common for native pests to select stressed or dying native hosts which takes us back to Step 1! It is important to keep things in perspective; to educate our tree care clients on the true facts about tree pests and their hosts.

Finally, devise a multi-tactic management strategy (IPM) targeting the serious pests. This final-step positioning of integrated pest management illustrates the proper perspective relative to tree pests: it's not all about pests, it's all about trees! This is why the simple 3-component IPM visual graphic presented in Figure 2 is so helpful; it's really a simple "treatment" selection triangle. Dealing with redheaded pine sawfly? Your hands and feet provide the most effective "Cultural" treatment of the problem: knock the sawfly colonies to the ground and step on them! Dealing with aphids? Perhaps the best "treatment" is to do

nothing a let the "Biological" component do the job; aphids are the meat items of the insect world. Have a North American tree that is heavily infested with the calico scale? This sucking insect is non-native to North America, so populations can build rapidly requiring the selection of a "Chemical" IPM component. However, using a systemic rather than a topical insecticide will reduce exposure to beneficial insects; it will preserve the "Biological" component on the IPM triangle.

The bottom line is that IPM should mean "Intelligent Pest Management." After all, the original IPM concept took us away from an identify-and-kill approach to pest management and focused our attention on more holistic perspectives. It's not just about tree pests, it's about trees; and it's also about arborists making intelligent pest management decisions.

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