



Ending Toxic Dependency: The State of IPM

State laws allow broad dependency on toxic pesticides; four states call for pesticide reduction and alternatives

by Jay Feldman and Laura Hepting

The Maine State Capitol Building in Augusta, as well as most other state-managed buildings are subject to state IPM law.

With increasing public awareness of pesticide hazards,¹ widespread agreement has emerged that integrated pest management (IPM) and organic practices are preferred land and structural management tools in both (i) embracing concerns about protecting health and the environment and (ii) utilizing practices that are efficacious and cost effective.² However, in the field of IPM, an approach to preventing and controlling unwanted organisms that has a history of varied definitions and policies, there are numerous perspectives, and critical disagreements, among public health and environmental advocates, regulators, and the pesticide and pest management industry. While organic agricultural practices are clearly codified in federal statute³ with a definition, acceptable methods and materials, and a certification and enforcement process, there is an absence of federal IPM policy that requires clear, meaningful and enforceable standards and practices for the management of state-owned public land and buildings. This report fills a critical gap in evaluating state IPM laws governing state property in the 50 states and the District of Columbia (hereafter referred to as states) with criteria for effective management benchmarks.

Since the laws themselves, however, do not alone ensure the implementation of an IPM program, the assessment in this report includes interviews with state officials and environmental advocates.

State policy restricting pesticide use on state-owned and managed property serves as an important measure of public health and environmental protection, given the widespread chemical exposure associated with the management of 195 million acres of land area across the U.S., affecting virtually all residents.⁴ State policy can also influence the direction of practices used by local jurisdictions (villages, towns, cities and counties) and on private lands, setting a tone that either encourages or discourages pesticide-dependent practices. Local government policy requiring organic or IPM practices is critical in the absence of state and federal law that adequately restricts pesticide use. The evaluation in this report of state laws governing specific species management practices on state-owned and managed property supports the need for defined and effective state IPM and organic programs, codified in policy and effectively carried out.

Methods

All state pesticide agencies were surveyed on IPM policy. Each state was requested to identify and provide copies of state IPM legislation, regulation, policy directives, and/or guidance materials, as well as the current contact information for the person/department in charge of the state's IPM program, if applicable. States were also requested to identify any local political subdivisions that have IPM policies and, if possible, provide copies (or web links) of local ordinances, policies, and/or guidance materials.

The survey response rate is 90% (45 of 50 states and the District of Columbia). Data from the remaining states was obtained through the review of state pesticide acts and other legislative/administrative policies available on states' websites, a research method that was also used to supplement information provided by participating states.

All state policies are analyzed for (i) an IPM policy governing state-owned and managed lands and buildings, (ii) definition of IPM, (iii) eight essential IPM components, (iv) IPM leadership and coordination, and (v) other related issues. To pinpoint the degree to which each state has institutionalized IPM, interviews were conducted with representatives from all states with an IPM policy to determine the degree to which these policies are being implemented.

Local IPM and pesticide reduction policies were compiled through internet research and review of Beyond Pesticides' database and files. Beyond Pesticides' coalition members provided assistance by facilitating various aspects of the process in their respective states.

Summary Findings

Four states, or 8%, adopt the IPM policy goal of pesticide reduction or curtailing unnecessary pesticide use on state-owned or managed property,⁵ while the vast majority (92%) of states either has no policy or one that is seriously deficient. Only two of the four states with specific pesticide reduction goals have a

mandatory program. All state IPM policies fail to incorporate the eight essential components of IPM (see box), and the majority of states (6 of 10) that adopt one or several of the IPM components do not explicitly establish the goal of pesticide reduction. Instead, this group of states treats IPM as a combination of approaches,

including the use of all available pesticides, without any attempt to prioritize the use of non-chemical methods or least-toxic chemicals only as a last resort. None of the state policies requires organic practices for management of state lands. Less than 18% of the states (9) have adopted at least one of the eight IPM program components critical to an effective program. No state incorporates all of the program components essential to IPM. Only seven states adopt multiple components, with one state incorporating six and another incorporating seven of the eight essential components.

Practices Essential to IPM

IPM is a pest management system that (a) eliminates or mitigates economic and health damage caused by pests (b) minimizes the use of pesticides and the hazards to human health and the environment associated with pesticide applications, and (c) uses integrated methods, site or pest inspections, pest population monitoring, an evaluation of the need for pest control, and one or more pest management methods, including sanitation, structural repairs, mechanical and biological management, other non-chemical methods, and, if non-toxic options are unreasonable and have been exhausted, least-toxic pesticides.⁷

The Eight IPM Program Essentials: (1) **Education/Training** - information for stakeholders, technicians; (2) **Monitoring** - regular site inspections and trapping to determine the types and infestation levels of species at each site; (3) **Pest Prevention** - the primary means of management calls for the adoption of cultural practices, structural changes, and mechanical and biological techniques; (4) **Action Levels** - determination of population size, which requires remedial action for human health, economic, or aesthetic reasons; (5) **Least-hazardous pesticides** - pesticides, used as a last resort only, are least-toxic chemicals not linked to cancer, reproductive problems, endocrine disruption, neurological and immune system effects, respiratory impacts and acute effects; (6) **Notification** - provides public and workers with information on any hazardous chemical use; (7) **Recordkeeping** - establishes trends and patterns in problem organisms and plants, including species identification, population size, distribution, recommendations for future prevention, and complete information on the treatment action; (8) **Evaluation** - determines the success of the species management strategies.

IPM Definition

In the 10 states that have codified in state law IPM practices for state-owned or managed property, two types of IPM definitions emerge:⁶

■ **Non-prioritized Tactical IPM.** With *non-prioritized tactical IPM*, the state IPM practices are defined as a combination of pest management



State parks and other state-managed lands, such as Squantz Pond State Park in Connecticut (pictured above), are impacted by state IPM law.

methods (2 states: MI, MN) with no priority for pesticide or hazard reduction. Additional states specify IPM as a combined method that minimizes health and/or environmental risks (1 state: OR), as well as economic risks (4 states: AZ, OH, WA). However, this definition can be and is generally interpreted from the perspective of the health and economic risks of not using pesticides, as opposed to analyzing the real hazards or uncertainties (because of inadequate health and environmental effects testing of pesticides) associated with pesticide use.

■ **Prioritized Strategic IPM.** With first tier *prioritized strategic IPM*, state IPM policy seeks to reduce or eliminate hazardous pesticide use on state-owned property and requires the use of clearly defined least-toxic pesticides only as a last resort (2 states: CA, NJ).

With second tier *prioritized strategic IPM*, state IPM policy seeks to reduce or minimize pesticide use, or unnecessary use, and adopt non-chemical practices, while using least-toxic pesticides without specifically requiring a last resort determination (CT, ME). The state of Maine's policy limits pesticide use to "low impact pesticides."

Both these approaches, either implicitly or explicitly, recognize the hazardous nature of pesticides, deficiencies in the process that regulates these toxic substances, the value of avoiding use when possible (precautionary principle), and the viability of prevention-oriented strategies not reliant on hazardous pesticides.

Eight Essential IPM Components

Nine states (of the ten with state property IPM policies) identify at least one of the following eight essential components of IPM in either the definition of the term or explicitly as a part of policy requirements pertaining to the management of state-owned property. The eight components include: (1) education/training (6 states: CT, ME, MI, MN, OR, WA); (2) monitoring (7 states: AZ, CA, ME, MI, NJ, OR, WA); (3) pest

prevention (6 states: AZ, CA, ME, MN, OR, WA); (4) action levels (4 states: AZ, CA, ME, OR), (5) least-hazardous/restricted pesticide use (3 states: AZ, CA, ME); (6) notification of pesticide use (1 state: ME); (7) recordkeeping (2 states: AZ, MI); and, (8) program evaluation (4 states: ME, MI, OR, WA).

IPM Coordinator

Two states (OR, WA) require the designation of IPM coordinators, one of which (WA) also requires coordinators to convene an interagency coordinating committee. Six states with state-owned property policies identify an employee with primary responsibility for IPM issues; most identify a state IPM coordinator or other state employee who is housed in the state pesticide agency (5 states: CA, CT, MI, MN, OR), and one state (ME) has an IPM coordinator at both the state's extension service program and pesticide agency.

IPM Policy Development and Implementation

Five states (CT, ME, MN, OR, WA) explicitly require widespread implementation of IPM on state-owned public property (land and buildings). Implementation is characterized by varying levels of activity. An additional five states (AZ, CA, MI, NJ, OH) require program development, but have yet to establish and implement a formal comprehensive program.

Local IPM and Pesticide Reduction Ordinances

Seventeen states (CA, CO, CT, FL, IA, KS, ME, MA, MN, NJ, NM, NY, NC, OH, OR, PA, WA) have one or more city, county or other political subdivision(s) with public property IPM or pesticide reduction ordinances (excluding school policies). Eight of these states currently have some degree of statewide IPM language as well. Only one of the seventeen states (Maine) does not have a state preemption law that prohibits local governments from restricting pesticide use on private land. Nationwide, over 100 political subdivisions have public property IPM or pesticide reduction ordinances.

| State ⁱ | Law | State Land ⁱⁱ | Definition | Components | Implementation ⁱⁱⁱ | Description |
|----------------------|--|-------------------------------------|---|---|-------------------------------|---|
| Alabama | no | no | no | n/a | no | n/a |
| Alaska | no | no | no | n/a | no | n/a |
| Arizona | ARS Chapter 22 (32-2320) | yes; Structures & surrounding areas | "Minimizes economic, health and environmental risks" | Monitoring, Action Levels, Least-toxic/Restricted use, Record-keeping | no | Delegates the responsibility of developing a structural pest control IPM program to the structural pest control commission. The state of Arizona defines structural pest control as controlling pests "that exist near or around structures, in ornamental shrubs and trees, on golf courses, along rights-of-way or in lawns or cemeteries and all pesticide application that could be harmful to public health or the environment." The commission is instructed to include several IPM components in the developed guidelines such as monitoring, record keeping, action levels, and natural control agents. |
| Arkansas | no | no | no | n/a | no | n/a |
| California | Assembly Bill 2472 | yes | Reduce use / least-toxic | Monitoring, Prevention, Action Levels, Least-toxic/Restricted use | Voluntary | Allows the state to conduct an IPM test run on State Capitol Park to serve as a model. Legislation set foundation for moving ahead with an IPM program. |
| | Food & Ag Code§11501 | yes; Agriculture, Urban | no | none | Voluntary | Requires DPR to consider and encourage least-hazardous pest control. DPR's Pest Management Analysis and Planning Program has the lead to implement "A Strategy to Increase the Adoption of Reduced-Risk Pest Management Practices." |
| Colorado | no | no | no | n/a | no | n/a |
| Connecticut | CGS§22a-66i | yes | Reduce use | Education/ Training | Required | IPM provision applies to all state agencies, departments and institutions. IPM is required if the Department of Environmental Protection (DEP) has provided an IPM model for the category of pest control used. These models have been provided, as well as record keeping formats and sample applicator bid specifications. Additionally, the Department has informed the state's municipalities of the IPM models. A public education program is also required. DEP models discuss additional IPM components. |
| Delaware | Dept. of Ag Pesticide Rules & Regs (4.2.2.1) | no | none | (iv) | no | IPM training requirement for applicator licensing. |
| District of Columbia | no | no | no | n/a | no | While the District of Columbia's Department of Health has recently established an IPM plan for rodent control and an overarching model IPM policy has been drafted, no IPM policy is currently in place. |
| Florida | no | no | no | n/a | no | n/a |
| Georgia | no | no | no | n/a | no | n/a |
| Hawaii | Ch 149A | no | "Sustainable . . . minimizes economic, health, and environmental risks" | none | no | A revolving fund is established to develop IPM strategies. A state official notes there is an existing cultural history of IPM methods, especially using pest exclusion/quarantines and biological controls. |
| Idaho | no | no | no | n/a | no | The state reports educational activities. |
| Illinois | no | no | no | n/a | no | n/a |
| Indiana | no | no | no | n/a | no | n/a |
| Iowa | no | no | no | n/a | no | State official reports the state supports and promotes IPM. |
| Kansas | no | no | no | n/a | no | n/a |

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|----------------------|---|---|---|---|--|-----------------------|--|
| Kentucky | 302 KAR Ch. 29 | no | no | "Minimizes economic, health, and environmental risks" | n/a ^{iv} | Required | Industrial, institutional, and structural pesticide applicators must be IPM certified, a requirement which is emphasized for health care facilities. The law does not require the actual use of IPM techniques. The state recognizes this loophole and is looking into resolving the situation. |
| Louisiana | no | no | no | no | n/a | n/a | n/a |
| Maine | Title 7 Ch. 413 | n/a | n/a | "Prevention and control based on predicted socioeconomic and ecological consequences" | Monitoring, Evaluation | n/a | Maine has established an IPM Council. However, no money has been awarded to the Council's fund, so the Council consists of volunteers. |
| | Title 22 Ch. 258-A §1471-X | Yes | Yes | none | none | Required | It is the policy of Maine to minimize reliance on pesticides. The state's agencies are directed to promote the principles and implementation of IPM and other science-based technology. |
| | Board of Pesticides Control, Pesticide Regulations Ch. 10 | no | no | "Selection, integration, and implementation of pest damage prevention and control based on predicted socioeconomic and ecological consequences" | Monitoring, Prevention, Action Levels, Evaluation | no | Definition only - applies to all Board of Pesticides Control regulations. |
| | Board of Pesticides Control, Pesticide Regulations Ch. 26 | Yes, All Occupied Buildings | Yes, All Occupied Buildings | "environmentally, socially, and economically compatible" | Education/ Training, Monitoring, Least-toxic/ Restricted use, Notification, Evaluation | Required | Requires IPM, with exemptions, in all occupied private and public buildings. Under this provision, prior notification of 1-7 days must be given in the event of a pesticide application, and applicators must identify pest conducive conditions and provide recommendations for practical non-pesticide control measures. The species, the extent of infestation, and any damage must be identified before pesticides are applied, with exceptions. A section on risk minimization also requires applicators to use low risk products. |
| | Executive Order 12 FY 06/07 & 16 FY 06/07 | Yes, State owned/ managed buildings and grounds | Yes, State owned/ managed buildings and grounds | none | Education/ Training, Least-toxic/Restricted use | Required | As part of an executive order addressing the promotion of safer chemicals, Governor John Baldacci requires state owned and managed buildings and their grounds be managed with the least amount of pesticide use by applying IPM principles. Vendors are required to comply through new pest management contracts. IPM training is to be provided to state employees as appropriate and as resources allow. The order also prohibits the cosmetic use of fertilizer-pesticide mixtures. Finally, it establishes a task force to identify and promote safer alternative to hazardous chemicals. |
| Maryland | no | no | n/a | n/a | n/a | no | n/a |
| Massachusetts | 333 CMR 12 | no ^v | no ^v | "Combining several different techniques" | none | Required ^v | Requires an IPM program be in place before any products are applied to areas on the groundwater protection list. An approved IPM plan must be in place to apply a product within a primary recharge area. |
| Michigan | R 285.637.14 (under revision) & Act 451 Part 83 | yes; Structures & surrounding areas | yes; Structures & surrounding areas | "Uses all suitable techniques" | Education/ Training, ^{vi} Monitoring, Record-keeping, Evaluation | Required | The IPM rule, which is currently under revision so that it is not in conflict with a similar rule, requires all schools, public buildings, day care centers, and health care facilities to have an IPM program in place. Additionally, pesticide applicators must be trained in a verifiable program that addresses numerous components of IPM. |
| Minnesota | Statute 17.114(2b) | no | no | "Combination of approaches" | Education/ Training ^{vi} | no | In sustainable agriculture code, state defines IPM and establishes programs to promote IPM. |
| | Statute 18B.063 | yes | yes | no | Prevention | Required | Directs the state to encourage IPM and require the use of IPM techniques on public lands, such as rights-of-way, parks, and forests. Some state agencies are implementing IPM. |
| Mississippi | no | no | no | no | n/a | no | n/a |
| Missouri | no | no | no | no | n/a | no | n/a |
| Montana | no | no | no | no | n/a | no | n/a |
| Nebraska | no | no | no | no | n/a | no | n/a |
| Nevada | no | no | no | no | n/a | no | n/a |

| State ⁱ | Law | State Land ⁱⁱ | Definition | Components | Implementation ⁱⁱⁱ | Description |
|--------------------|----------------------|--------------------------|---|---|-------------------------------|--|
| New Hampshire | no | no | no | n/a | no | n/a |
| New Jersey | Executive Order #113 | yes | Least-toxic | Monitoring | Required | Executive order that requires a pilot IPM program, the formation of a task force to study the potential for increasing IPM within state agencies, the development of a strategy for implementing IPM at state facilities, and evaluate current practices. |
| New Mexico | no | no | no | n/a | no | n/a |
| New York | no | no | no | n/a | no | n/a |
| North Carolina | no | no | no | n/a | no | n/a |
| North Dakota | none | no | no | n/a | no | n/a |
| Ohio | ORC Chapter 921 | yes | "Minimizes economic, health, and environmental risks" | none | no | Directs the state to develop and implement an IPM program. |
| Oklahoma | no | no | no | n/a | no | n/a |
| Oregon | ORS 634.650-634.665 | yes | Must consider human / environmental health | Education/ Training, Monitoring, Prevention, Action Levels, Evaluation, IPM Coordinator | Required | Requires state agencies to implement IPM. State agencies and institutions identified as having pest control responsibilities are further required to provide IPM training for pest management employees and must designate an IPM coordinator to manage the program. |
| Pennsylvania | no | no | "Combined pest control" | n/a | no | n/a |
| Rhode Island | no | no | no | n/a | no | n/a |
| South Carolina | no | no | no | n/a | no | n/a |
| South Dakota | no | no | no | n/a | no | n/a |
| Tennessee | no | no | no | n/a | no | n/a |
| Texas | no | no | no | n/a | no | Provision states the former structural pest control board may consult with an IPM expert (12§1951.211). |
| Utah | no | no | no | n/a | no | n/a |
| Vermont | no | no | no | n/a | no | n/a |
| Virginia | no | no | no | n/a | no | n/a |
| Washington | Chapter 17.15 RCW | yes | "Environmentally and economically sound manner" | Education/ Training, Monitoring, Prevention, Evaluation, IPM Coordinator | Required | Requires all state agencies to follow the principles of IPM if they are engaged in pest control activities. An additional provision requires the state agencies and institutions affected to provide employee training, to designate an IPM coordinator, and form an interagency IPM coordinating committee. |
| West Virginia | no | no | no | n/a | no | n/a |
| Wisconsin | no | no | no | n/a | no | n/a |
| Wyoming | no | no | no | n/a | no | n/a |

Original survey conducted in 2005 with extensive follow up through 2007

- i. Forty-five states and the District of Columbia (90%) responded to the survey and provided copies of legislation, regulation, policy directives, and/or guidance materials. Many of these participated in follow-up conversations. Data for those not responding to the survey was generated from state policies and websites.
- ii. This column asks the question: Does the state have a law on the use of IPM on state-owned and managed property?
- iii. Whether the state is required to or may adopt an IPM program on state property is determined from a review of state law and answers to survey questions in which states were asked to identify and provide copies of legislation, regulation, policy directives, and/or guidance materials. Interviews with state officials and public interest advocates supplemented this information.
- iv. Two state laws require IPM training/education for pesticide applicators generally and do not complement a statutory or policy requiring IPM on state property. This includes DE and KY.
- v. IPM is required by statute for areas of the state that are designated on its groundwater protection list. These areas may overlap with state property.
- vi. Where state training/education requirements for pesticide applicators complement an IPM law for state-owned and managed property, it is applicable and noted.

Discussion

The Problem of Definition

What exactly does IPM mean? The foundation of an IPM policy is its definition of the term, the techniques required, and its enforceability. However, IPM is a term that is used loosely with many different definitions and practices. Sixty-seven unique definitions have been cited in the scientific literature alone.⁸ Central to the difference is the degree to which the IPM definition allows toxic chemical use, or conversely, gives priority to preventive non-chemical and least-toxic management.

State Definitions

IPM definitions and prescribed components vary widely between states, smaller political subdivisions, IPM professionals, academics, industry, and organizations. The majority of states do not have a formal definition of IPM. Where definitions exist, they are vague and inconsistent.

Examples of the two types of definitions generally used in state IPM law affecting state-owned property follow:

1. Non-prioritized Tactical IPM, codified in six states (AZ, MI, MN, OH, OR, WA), is exemplified by language adopted in the state of Minnesota.

Minnesota 17.114(2b): Integrated pest management means use of a combination of approaches, incorporating the judicious application of ecological principles, management techniques, cultural and biological controls, and chemical methods to keep pests below levels where they do economic damage.

Additional language, codified in five states, add to non-prioritized tactical IPM an undefined requirement to minimize health and/or environmental risks (1 state: OR), and economic risks (3 states: AZ, OH, WA), as exemplified by the state of Arizona.

Arizona 32-2301(14): Integrated pest management means a sustainable approach to managing pests that combines biological, cultural, physical and pesticide tools in a way that minimizes economic, health and environmental risks.

2. Prioritized Strategic IPM, first and second tier, codified in four states (CA, CT, ME, NJ), is exemplified by language in the states of California and New Jersey.

California Assembly Bill No. 2472: Integrated Pest Management (IPM) means a pest management strategy that focuses on long-term prevention or suppression of pest

problems through a combination of techniques such as monitoring for pest presence and establishing treatment threshold levels, using non-chemical practices to make the habitat less conducive to pest development, improving sanitation, and employing mechanical and physical controls. Pesticides that pose the least possible hazard and are effective in a manner that minimizes risks to people, property, and the environment, are used only after careful monitoring indicates they are needed according to pre-established guidelines and treatment thresholds.

New Jersey Executive Order 113: Integrated Pest Management (IPM) consists of the use of a combination of pest monitoring, good sanitation practices, appropriate solid waste management, building maintenance, alternative physical, mechanical and biological pest controls, and only as a last resort the use of the least-hazardous chemical pesticide.

While four states imply the goal of pesticide reduction, overall, most states do not provide guidance beyond the vague definitions cited. Some states list components of IPM techniques or delegate responsibility to a state entity to develop further guidelines.

Eight Essential IPM Components

As the term integrated implies, IPM is comprised of multiple interdependent components that provide effective species prevention and management when implemented correctly. At its best, IPM is a precautionary method, effecting the adoption of practices that prevent the need for toxic chemical use.



Roadside spraying is a major pesticide use, and roadside management plans are often under the jurisdiction of states. Pictured above is a state managed road near Big Horn Canyon in Wyoming.

Preventing Problems

Successful implementation of IPM is based on altering the elements that lead to insect, rodent, fungal and plant problems. For structural pest management, this includes modifying the target species' entry, food source, and habitat. For lawn and landscape management, this means maintaining the health of these areas, from the soil up.

Basic prevention strategies include:

- **Entry Restrictions** - Restrict access of undesirable species that can get into buildings by, for example, installing and repairing screens, installing weather stripping and sealing holes and cracks.

- **Eliminate Food Sources** - Proper sanitation is essential in reducing the availability of food that serves as an attractant. Examples: vacuuming/mopping and emptying the trash regularly, and sealing/refrigerating food.

- **Habitat Management** - Modify the climate and living space that is an attractant. Common solutions include eliminating standing water and poor draining areas outdoors, and repairing leaks and maintaining adequate ventilation indoors.

- **Lawn and Landscape Maintenance** – Maintain loose, loamy soils with rich humus teeming with beneficial microorganisms, insects, earthworms, and other organisms. Key practices include soil aeration, maintaining proper soil pH, proper watering, and planting with local cultivars.

In total, nine states (18%) mention one or more components within state public property policy (1 component – CT, NJ; 2 components – MN; 4 components – CA, MI; 5 components – AZ, WA; 6 components – OR; 7 components - ME). However, none of the states address all of the necessary IPM components explicitly within their policy.

1. Education/Training. Education and training is typically carried out through workshops, training sessions, and written materials. Training generally involves the general public, other stakeholders, and all state personnel and state contractors that are responsible for pest management. Educational and training programs are intended to convey information that enables better understanding of the conditions that allow for insect, rodent, fungal, and plant issues, thresholds for action, pesticide hazard concerns, and methodologies for management.

IPM education is mentioned relatively often within state laws regardless of the presence or absence of other IPM provisions, but often exclusively relating to pesticide applicator training. Optional IPM training provisions are not counted in this evaluation. **Finding:** Eight states (CT, DE, KY, ME, MI, MN, OR, WA) include mandatory IPM training in their applicator or employee certification requirements. Two (DE, KY) are independent of an IPM policy.

2. Monitoring. Monitoring helps identify the nature, source, and extent of an insect or rodent problem, or, in the case of

land management, lawn and landscape issues. This includes regular site inspections and insect and rodent trapping to determine the types of species and population levels at each site. Monitoring allows managers to properly identify and manage a species problem before a serious outbreak occurs. Monitoring can also determine the possible causes of problems, such as leaky pipes, food crumbs, cracks in walls or around plumbing, or stressed plants. It may not be necessary for an entire property to be monitored, just those areas with the potential for problems, while other areas are monitored and managed on a complaint basis. A logbook of problems enables data-based decision making. Monitoring data is most efficiently used in conjunction with action thresholds (see below).

Finding: Monitoring is mentioned briefly in seven state policies (AZ, CA, ME, MI, NJ, OR, WA), often as part of an IPM definition.

3. Action Thresholds. Action thresholds, or action levels, are based on the population size of an organism or plant that requires preventive or remedial action for human health, economic or aesthetic reasons. The determination of action or acceptable levels can be based on a scientific or subjective judgment and cultural norms. Action thresholds depend on effective monitoring. **Finding:** Four states (AZ, CA, ME, OR) make some mention of action levels in their policy, referring to the need for species and situation-specific thresholds.

4. Prevention. Non-chemical pest prevention is increasingly viewed as the primary strategy of IPM. Key to prevention is habitat and structural modification and cultural practices that reduce or eliminate sources of food, water, shelter, and entryways, as well as practices that support healthy soil and landscapes. Physical, mechanical and biological controls can head off many problems before they begin. Exceeding unacceptable problem thresholds can be prevented through cultural controls such as proper sanitation and housekeeping, cleaning waste disposal systems, structural maintenance, good soil health, and other long-term, non-chemical strategies. **Finding:** Six states (AZ, CA, ME, MN, OR, WA) recognize prevention as part of their public property IPM policy.

5. Least-Toxic Tactics Criteria. The least-hazardous approach to managing unwanted species first and foremost includes non-chemical methods, such as cultural practices and physical, mechanical and biological controls. However, when pesticides are determined to be necessary, the use of least-toxic pesticides is often incorporated into policy and practice. If there is no way to avoid pesticide use, least-toxic pesticides include those that are least-hazardous to human health and ecological balance (natural

controls and non-target organisms), and least damaging to the built and natural environment. **Finding:** Three states (AZ, CA, ME) include this parameter in relation to their IPM policy.

6. Notification. If a chemical control method is utilized, notification of pesticide applications provides the public with the opportunity to take precautions to avoid direct exposure to pesticides, which is especially important for pregnant women, children, the elderly, those with weakened immune systems, and those who are chemically sensitive. **Finding:** One state (ME) incorporates notification into its IPM policy. However, at least 21 states have adopted laws requiring notification of lawn, turf and ornamental pesticide applications by hired applicators and 31 states require prior notice and/or posting at schools. Several local jurisdictions also provide notification for mosquito spraying. Existing notification mechanisms vary between states and jurisdictions - some areas require universal notification (pre- or post-application), others use a registry, and others require posting signs in the treated area (pre- or post-application).⁹

7. Recordkeeping. A recordkeeping system enables the identification of trends and patterns in pest outbreaks, and the evaluation of pest management decisions. Information recorded at every inspection and/or treatment facilitates pest identification, population size, distribution, recommendations for future prevention and complete information about the action(s) taken. **Finding:** Two states (AZ, MI) incorporate recordkeeping as a component of IPM.

8. Evaluation. Evaluating records enables the adjustment of practices and fine tuning of a site-specific IPM program. **Finding:** Four states (ME, MI, OR, WA) include evaluation as an element of IPM.

Leadership, coordination and oversight

IPM Coordinator. An IPM coordinator establishes a management function and IPM program accountability. An IPM coordinator is typically someone who normally manages unwanted species problems, such as a facilities manager, sanitation engineer, or someone else who regularly oversees building and/or grounds operations or other ecological management services. Coordination among state agency IPM leaders enhances opportunities for increased program and cost effectiveness. **Finding:** Two states (OR, WA) call for the designation of an IPM coordinator for each pre-determined state agency that is explicitly required to implement IPM, and one (WA) of the two states also requires coordinators to convene as an interagency coordinating committee.

State Policies and Implementation

The description of state policy in the following 11 states, 10 of which utilize at least one essential IPM component in managing state-owned public property, provides an overview of the different approaches to IPM. Summary descriptions of all 50 states and the District of Columbia are included in Table I.



Arizona (ARS Chapter 22; 32-2320) delegates the responsibility of developing a structural pest control IPM program to the structural pest control commission. The state of Arizona defines structural pest control as controlling pests “that exist near or around structures, in ornamental shrubs and trees, on golf courses, along rights-of-way or in lawns or cemeteries and all pesticide application that could be harmful to public health or the environment.” The commission is instructed to include several IPM components in the developed guidelines, such as monitoring, recordkeeping, action levels, and natural control agents. Arizona did not provide feedback on the status of the development of these guidelines for implementing an IPM program on state-owned property.



California (Food and Agriculture Code §11501) requires the Department of Pesticide Regulation (DPR) to consider and encourage least-hazardous pest control methods. In 1977-78, DPR began an IPM initiative to encourage and facilitate the adoption or improvement of IPM policies. In 1995, a Pest Management Strategy was developed to increase the adoption of less-toxic pest management.



Paradise Beach State Park in California.

In 2002, Assembly Bill 2472 became law (Title 2 Section 14717), stating, "The Legislature finds and declares that the safe handling, reduction, or elimination of pesticide use in state buildings and on state lands is an important step in providing all state employees and members of the public with a safe, healthy environment." The act goes on to establish the intent of the legislature to enact IPM legislation, and adds a statutory provision allowing the state to implement a demonstration project to study IPM practices and develop a model. A DPR representative confirms that at present, while there may be prospects, no model has been developed, and no additional IPM legislation has been enacted.

In short, while California has been promoting the concept of IPM for many years, the state is only technically beginning to establish a program at present and currently relies on the voluntary use of IPM techniques. The state is developing a strategy to reduce the risk of pesticide management practices, with the intent to protect environmental and public health through the reduction and elimination of pesticides on public property.



West Quoddy Head Lighthouse in Maine's Quoddy Head State Park.



Connecticut (General Statutes §22a-66l) states, "Each state department, agency or institution shall use integrated pest management at facilities under its control if the Commissioner of Environmental Protection has provided model pest control management plans pertinent to such facilities." In accordance with this condition, several specific model IPM plans, recordkeeping formats and sample applicator bid specifications have been developed and distributed. Additionally, this statute directs the Commissioner to "notify municipalities, school boards, and other political subdivisions of the state of the availability of the model plans for their use." The Department of Environmental Protection has achieved this through mass mailings. Other noteworthy provisions include an exception for public health emergencies, as determined by the Commissioner of Public Health, and a requirement to develop and implement a public education program to inform the public and encourage the use of IPM techniques on private property.



Maine (Title 7 Ch. 413) has established an IPM Council. The law states, "The council shall facilitate, promote, expand and enhance integrated pest management adoption in all sectors of pesticide use and pest management within the State." A fund to develop and implement IPM programs was also created, but no funds have been appropriated. The state reports that the Council has remained intact, relying on volunteers.

It is also the policy of Maine (Title 22 Ch. 258-A§1471-X) to minimize reliance on pesticides. The state's agencies are directed to promote the principles and implementation of IPM and other science-based technology.

The Maine Board of Pesticides Control (Pesticide Regulations Ch. 26) requires IPM in all residential rental property, and occupied commercial, institutional and public buildings. A pesticide as a last resort determination is required for residential rental property. Under this provision, prior notification of 1-7 days must be given in the event of a pesticide application, and applicators must identify pest conducive conditions and provide recommendations for practical non-pesticide control measures. The species, the extent of infestation, and any damage must be identified before pesticides are applied, with exceptions. A section on risk minimization also requires applicators to use low risk products.

Governor John Baldacci also issued Executive Orders 12 FY 06/07 and 16 FY 06/07 addressing the promotion of safer chemicals in consumer products and services. Order 12 FY 06/07 requires state owned and managed buildings and their grounds to be managed with the least amount of pesticide use by applying IPM principles. Vendors are required to comply through new pest management contracts. IPM training is to be provided to state employees as appropriate and as resources allow. The order also prohibits

the cosmetic use of fertilizer-pesticide mixtures. Finally, 16 FY 06/07 refines requirements for a Task Force charged with identifying and promoting safer alternatives to hazardous chemicals. A task force member reports that these IPM measures are only being carried out in the Capitol area at the writing of this report, but the state is working on expanding the program.



Massachusetts (333 CMR 12) has outlined a unique set of circumstances that require IPM, presenting it as a tool to protect buffer zones and sensitive areas. The state requires the adoption of an IPM program for areas on the state's groundwater protection list or within a primary recharge area before any pesticide products may be applied.



Michigan (regulation no. 285.637.14 - currently under revision so that it is not in conflict with a similar rule, Act 451, Part 83) requires all schools, public buildings, day care centers, and health care facilities to have an IPM program in place. Additionally, pesticide applicators must be trained in a verifiable program that addresses numerous components of IPM, "with consideration for reducing the possible impact of pesticide use on human health and the environment, including people with special sensitivities to pesticides."



Minnesota (Statute 17.1142b) requires, under its sustainable agriculture code, that the state develop "a state approach to the promotion and use of integrated pest management, which shall include delineation of the responsibilities of the state, public postsecondary institutions, Minnesota Extension Service, local units of government, and the private sector; establishment of information exchange and integration; procedures for identifying research needs and reviewing and preparing informational materials; procedures for factoring integrated pest management into state laws, rules, and uses of pesticides; and identification of barriers to adoption."

Minnesota Statute 18B.063 requires the state to use IPM techniques in its management of public lands, specifically rights-of-way, parks, and forests. In addition, it is specified that the state shall focus on using "planting regimes that minimize the need for pesticides and added nutrients." The IPM and Sustainable Agriculture Plan

Local IPM and Pesticide Reduction Ordinances

Local ordinances are increasingly important in institutionalizing IPM and similar concepts in the management of public property. Local efforts share a common goal of pesticide reduction through prevention and non-chemical strategies.

Local IPM policies often include pesticide reduction goals. Some towns are adopting organic practices on parkland or all town properties (e.g. Plainville, CT, Lawrence, KS, Townsend, MA). Pesticide reduction policies, such as bans on the most toxic categories of pesticides and pesticide reduction goals (e.g. New York City, San Francisco, Seattle, and other cities), protect public health by contributing to pollution prevention.

Over 100 political subdivisions have IPM/pesticide reduction ordinances, which vary from county-wide policies to pesticide-free parks, within 17 (CA, CO, CT, FL, IA, KS, ME, MA, MN, NJ, NM, NY, NC, OH, OR, PA, WA) states (excluding school IPM). Eight of these states have some form of state IPM policy, and all but one have a state preemption law restricting localities from limiting pesticide use on private property.

State preemption laws, which exist in 41 states, have rendered many community efforts void of authority to adopt local pesticide restrictions on private property. Preemption generally refers to the ability of one level of government to override laws of a lower level. After the Supreme Court upheld the right of local governments to restrict pesticide use on private property under federal pesticide law (*Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1984), the chemical industry successfully lobbied state legislatures to take away this authority in 41 states. These laws, called state preemption laws, effectively deny local residents and decision makers their democratic right to better protection when the community decides that minimum standards set by state and federal law are insufficient to protect local public and environmental health. Today, as pesticide pollution and concerns over human and environmental health mount, municipal authority is viewed as increasingly important.

When states were asked if they track local IPM ordinances, only two states (CA, ME) answer in the affirmative, and three additional states (MN, NM, NC) indicate an awareness of local IPM policies. Twelve states report they do not track and are not aware of IPM policies enacted by local jurisdictions and numerous states chose to disregard the question in the survey.

for State-Owned Lands has been created in response to this statute, which outlines strategies for developing an IPM program. Minnesota's IPM Program Coordinator cites several state agencies that have implemented IPM methods and also notes they have not experienced any known resource constraints in implementing the program.



New Jersey (Governor James J. Florio issued Executive Order #113 in 1993) directs the Department of Environmental Protection and Energy to conduct a pilot IPM program, form a task force to study the potential for increasing IPM within state agencies,



The Washington State Capitol in Olympia.

develop a strategy for implementing IPM at state facilities, and evaluate current practices. The state did not provide records on implementation of this broad IPM policy on state-owned property. A local advocate notes that the order did help launch the grassroots IPM campaign within the state, and that pest control seems to vary with the state's administration.¹⁰

Ohio law (ORC§ 921.18(D)) states, "The director [of agriculture] shall establish standards governing the



development and implementation of integrated pest management practices that are designed to prevent unreasonable adverse effects on human health and the environment." Further, "The director may enter into cooperative agreements with other state agencies for the implementation of voluntary or mandatory integrated pest management practices." No such program has been developed. A state pesticide representative notes that they are not aware of any action on the law and stated IPM has been shelved in the past.

Oregon (Revised Statutes, ORS§634.650-665) requires state agencies to implement IPM. The language specifically outlines the departments that have duties related to pest management: Agriculture, Fish and Wildlife, Transportation, Parks and Recreation, Forestry, Corrections, Administrative Services, and State Lands, as well as each state institution of higher education. Each of these state agencies and institutions are further required to provide IPM training for pest management employees and must designate an IPM coordinator to manage the program.

After the implementation of these requirements, there was an

active committee for approximately five years according to a representative of the Department of Agriculture's Plant Division. Training information was developed and agency progress reports were required. Participation waned as the program became repetitive and resources were shifted away from IPM to support another program. The representative of the Plant Division feels the program has been a success, as it is believed that all agencies did implement IPM methods and a basic understanding of IPM has been achieved throughout the state's agencies. However, a state advocate says the policy did not result in significant change from the state's prior pest management practices.¹¹



Washington (revised code 17.15) reads, "[I]t is the policy of the state of Washington to require all state agencies that have pest control responsibilities to follow the principles of integrated pest management." The code continues by defining IPM as pest management methods that are environmentally and economically sound, and includes several IPM components within the definition. Other provisions outline exactly which state agencies and institutions must implement this policy, lists IPM training requirements, requires the designation of IPM coordinators, and establishes an interagency IPM coordinating committee.

The language of this policy is one of the most comprehensive in the nation. However the definition remains vague – the result of compromises made to find middle ground among the state's stakeholders. Additionally, as a state advocate points out, the reality of implementation often reveals a different picture. It has been observed that the policy has not effectively reduced pesticide use except in cases where pressure has been applied to specific programs.¹²

A state employee involved in Washington's IPM efforts confirmed that in the decade that has passed since the adoption of its policy, the implementation of IPM has not been widespread, largely because there has not been one person consistently in charge of the program, due to employee turnover. Despite a 1997 statutory requirement for yearly reports from the state's agencies, the documentation ceased in 2001. The state representative stated that the "success rate is all over the map," and the agencies in charge of parks and recreation, transportation, ecology and others have done a better job implementing IPM because on-site individuals took initiative. Additionally, it is thought that limited funding may have been an impediment as resources for training and materials largely need to be self-generated.

State Overview

IPM law governing the management of state-owned and managed property varies wildly nationwide. If the ten states that have adopted some form of an IPM policy affecting public property

Table 2. State and Local IPM and Preemption Policies

| State | School IPM ¹⁴ | State Public Property IPM | State Preemption ¹⁵ | Local Public Property IPM /Reduction ¹⁶ |
|----------------|--------------------------|---------------------------|--------------------------------|--|
| Alabama | | | ■ | ■ |
| Alaska | | | | ■ |
| Arizona | □ | □ | ■ | ■ |
| Arkansas | | | ■ | |
| California | □ | □ | ■ | ■ |
| Colorado | | | ■ | ■ |
| Connecticut | □ | ■ | ■ | ■ |
| Delaware | | | ■ | |
| Florida | | | ■ | ■ |
| Georgia | | | ■ | ■ |
| Hawaii | | | | |
| Idaho | | | ■ | |
| Illinois | ■ | | ■ | ■ |
| Indiana | | | ■ | ■ |
| Iowa | | | ■ | ■ |
| Kansas | | | ■ | ■ |
| Kentucky | ■ | | ■ | |
| Louisiana | ■ | | ■ | |
| Maine | ■ | ■ | | ■ |
| Maryland | ■ | | | ■ |
| Massachusetts | ■ | | ■ | ■ |
| Michigan | ■ | ■ | ■ | ■ |
| Minnesota | □ | ■ | ■ | ■ |
| Mississippi | | | ■ | |
| Missouri | | | ■ | |
| Montana | □ | | ■ | |
| Nebraska | | | ■ | |
| Nevada | | | | |
| New Hampshire | | | ■ | |
| New Jersey | ■ | □ | □ | ■ |
| New Mexico | | | ■ | ■ |
| New York | ■ | | ■ | ■ |
| North Carolina | ■ | | ■ | ■ |
| North Dakota | | | ■ | |
| Ohio | | □ | ■ | ■ |
| Oklahoma | | | ■ | ■ |
| Oregon | | ■ | ■ | ■ |
| Pennsylvania | ■ | | ■ | ■ |
| Rhode Island | ■ | | ■ | ■ |
| South Carolina | | | ■ | ■ |
| South Dakota | | | | |
| Tennessee | | | ■ | ■ |
| Texas | ■ | | ■ | ■ |
| Utah | | | | ■ |
| Vermont | □ | | | ■ |
| Virginia | | | ■ | ■ |
| Washington | | ■ | □ | ■ |
| West Virginia | ■ | | ■ | ■ |
| Wisconsin | | | ■ | ■ |
| Wyoming | | | | |
| TOTAL | 20 | 10 | 41 | 35 |

■ = Required, □ = Recommended; except for State Preemption, □ = local ordinance restriction on private property must be approved by state.

were to correct existing deficiencies and fully implement these policies, then 31% of the nation's population would be protected from unnecessary pesticide use on state-owned public areas.¹³

As each state's experience shows, there are a variety of potential roadblocks to establishing a successful state IPM program.

Conclusion

While IPM has been embraced rhetorically by the pest management industry and officials responsible for state-owned and managed property, this survey of state laws, policies and practices tells a far different story of actual policy and operations. The study finds that while some components of IPM are in place

Passing an IPM policy takes initiative from local activists, the general citizenry and elected officials. Weak legislative language, resource constraints, lack of leadership, shifting priorities, and no commitment to enforcement are some of the hurdles that state governments experience with their IPM policy.

and broader programs are in development, currently less than 18% of the states (or nine states) with state property policies adopt at least one of the essential components of IPM. Even more striking, only four states adopt the IPM goal of pesticide reduction or curtailing unnecessary pesticide use on state property and only two of the four have a mandatory program in place. This raises critical questions about the lack of serious effort by state governments to put in place IPM programs on state property. At the same time, there are a number of bright spots among the states that have developed or are developing effective IPM programs.

IPM as a method has proven that land and buildings can be managed cost-effectively through a precautionary approach that adopts preventive practices for insect, rodent and landscape problems and eliminates toxic chemical use. The growing number of scientific studies linking widely used pesticides to adverse health effects and the cost-effectiveness of prevention-oriented management strategies suggests that this is good public health and cost-saving policy. Sound management policies and practices that adopt IPM and organic methods for state-owned and managed property have the potential of affecting 195 million acres of land area and virtually all residents of the U.S.



Recommendations

1. State Action. States must adopt policies (through action of the state legislature or agency regulation) to manage state-owned property with IPM and organic practices that are clearly defined with the goal of eliminating hazardous and unnecessary pesticide use, address the eight essential IPM program components, and ensure adequate funding, full coordination, accountability and enforcement. States should repeal preemption of local authority to restrict pesticides on private property.

2. Local Action. States should encourage local jurisdictions to adopt policies and private property owners to put in place programs that ensure IPM and organic principles of eliminating toxic pesticide use.

3. Federal Action. The U.S. Congress should adopt legislation that requires the uniform adoption of IPM and organic practices by state governments, tied to the transfer of federal funds for programs in the states (e.g. highway construction, school construction, pesticide regulation, water quality programs, Centers for Disease Control and Prevention (CDC) mosquito control programs, and others).

Endnotes

1. Ubiquitous presence in the human body (U.S. Centers for Disease Control and Prevention. 2005. Third National Report on Human Exposure to Environmental Chemicals. <http://www.cdc.gov/exposurereport/3rd/>), the built environment (Rudel, R., et al. 2003. Phthalates, Alkylphenols, Pesticides, Polybrominated Diphenyl Ethers, and Other Endocrine-Disrupting Compounds in Indoor Air and Dust. *Environmental Science and Technology* 37(20): 4543-4553; Nishioka, M., et al. 2001. Distribution of 2,4-D in Air and on Surfaces Inside Residences After Lawn Applications: Comparing Exposure Estimates from Various Media for Young Children. *Environmental Health Perspectives* 109(11); Lewis, R., et al. 1991. Determination of Routes of Exposure of Infants and Toddlers to Household Pesticides: A Pilot Study. EPA: Methods Research Branch.) and natural environment (Colborn, T., D. Dumanoski, J.P. Myers. 1996. *Our Stolen Future*. New York: Penguin Group.), including widespread water contamination (US Fish and Wildlife Service, Department of Environmental Quality. 2001. Pesticides and Wildlife. <http://www.fws.gov/contaminants/Issues/Pesticides.cfm>; RJ Gilliom, JE Barbash, CG Crawford, et al. 2006. The Quality of Our Nation's Waters: Pesticides in the Nation's Streams and Ground Water, 1992-2001. USGS Circular 1291.); toxicity to wildlife (Defenders of Wildlife. 2005. The Dangers of Pesticides to Wildlife [white paper]. http://www.beyondpesticides.org/pesticidefreelawns/resources/DWDangers_Pesticides_Wildlife.pdf; Anway, M.D., A.S. Cupp, M. Uzumcu, M.K. Skinner. 2005. Epigenetic Transgenerational Actions of Endocrine Disruptors and Male Fertility. *Science* 308: 1466-1469; Anway, M.D., C. Leathers, M.K. Skinner. 2006. Endocrine Disruptor Vinclozolin Induced Epigenetic Transgenerational Adult-Onset Disease. *Endocrinology* 147(12): 5515-5523; Chang, H., M.D. Anway, S.S. Rekow, M.K. Skinner. 2006. Transgenerational Epigenetic Imprinting of the Male Germline by Endocrine Disruptor Exposure During Gonadal Sex Determination. *Endocrinology* 147(12): 5524-5541; Beyond Pesticides. 2005. Environmental Effects of 30 Commonly Used Lawn Pesticides. <http://www.beyondpesticides.org/lawn/factsheets/30enviro.pdf>); and health problems in humans (Beyond Pesticides. 2005. Health Effects of 30 Commonly Used Lawn Pesticides. <http://www.beyondpesticides.org/lawn/factsheets/30health.pdf>; U.S. EPA. 2003. Tackling a Suspected Hazard of Aging. <http://www.epa.gov/ord/archives/2003/september/htm/article1.htm> (accessed March 4, 2005); U.S. EPA. 2002 Oct 31. EPA Announces New Aging Initiative To Protect Older Persons From Environmental Health Threats. EPA Pesticide Program Update: Office of Pesticide Programs; National Research Council. 1993. Pesticides in the Diets of Infants and Children. Washington, DC: National Academy Press; Repetto, R., et al. 1996. Pesticides and Immune System: The Public Health Risk. Washington, DC: World Resources Institute.), such as respiratory ailments (Beyond Pesticides. 2005. Asthma, Pesticides and Children: What you should know to protect your family. <http://www.beyondpesticides.org/children/asthma/index.htm#brochure>), cancer (Evans, N, Ed. 2006. *State of the Evidence: What Is the Connection Between the Environment and Breast Cancer?* 4th edition. San Francisco: Breast Cancer Fund; Clapp, R., G. Howe, M. J. Lefevre. 2005. *Environmental and Occupational Causes of Cancer: A Review of Recent Scientific Literature*. Lowell: University of Massachusetts, Lowell Center for Sustainable Production. <http://www.sustainableproduction.org/downloads/Causes%20of%20Cancer.pdf>), endocrine disruption (Colborn et al., 1996), and altered neurodevelopment (Colborn, T. 2006. A Case for Revisiting the Safety of Pesticides: A Closer Look at Neurodevelopment. *Environmental Health Perspectives* 114[1]).
2. Wang, C., G. Bennett. 2006. Comparative Study of Integrated Pest Management and Baiting for German Cockroach Management in Public Housing. *J. Econ. Entomol.* 99(3): 879-885.
3. 7USC6501, Organic Foods Production Act of 1990, Title XXI Food, Agriculture, Conservation and Trade Act of 1990 (Public Law 101-624).
4. Includes state and local managed lands in the U.S., Lubowski, R.N. et al. 2006. Major Uses of Land in the United States, 2002. USDA, Economic Research Service, EIB-14.
5. This study does not evaluate schools IPM policy, which is addressed in a separate report. See *Schooling of State Pesticide Laws 2000 and 2002*. www.beyondpesticides.org/schools/publications. Also not included are all rights-of-way management programs, which are governed by a mix of state laws and agency guidance. See *The Right Way to Vegetation Management*. 1999. <http://www.beyondpesticides.org/infoservices/pesticidesandyou/Spring%2099/The%20Right%20Way%20to%20Vegetation%20Management.pdf>.
6. Many states establish definitions of IPM for school pest management, protected areas, or incorporate their definition into training and education guidelines for pesticide applicators in the urban environment and agriculture.
7. Bajwa, W.I., and M. Kogan. 2002. Compendium of IPM Definitions (CID): What is IPM and how is it defined in the Worldwide Literature? University of Oregon, Integrated Plant Protection Center; Publication No. 998. <http://ipmnet.org/IPMdefinitions/>.
8. Cultural practices for buildings includes general facility management, and general occupant behavior that contributes to insect harborage and access; and in the landscape context includes choice of plant varieties, fertilization techniques, dethatching, aeration, pH, watering, and more.
9. Beyond Pesticides. 2004. State Lawn Pesticide Notification Laws. *Pesticides and You* 24(2): 22. <http://www.beyondpesticides.org/infoservices/pesticidesandyou/Summer%2004/State%20Lawn%20Notification%20Laws.pdf>; Beyond Pesticides. 2007. State and Local School Pesticide Policies. <http://www.beyondpesticides.org/schools/schoolpolicies/index.htm>.
10. Nogaki, J. 2007. New Jersey Environmental Federation. Personal communication. Executive order helped to initiate a grassroots campaign with municipalities and the 2002 school IPM law.
11. Cox, C. 2007. Center for Environmental Health, formerly Northwest Coalition for Alternatives to Pesticides. Personal communication.
12. Storey, A. 2005. Washington Toxics Coalition. Personal communication.
13. U.S. Census Bureau. 2007. State & County QuickFacts. <http://quickfacts.census.gov/qfd/index.html>. (Based on 2000 census data.)
14. School IPM indicates states that have adopted pesticide acts and regulations that address the protection of children by specifically focusing on pesticide use in, around or near schools. For the purposes of this analysis, policy affecting public primary (K-12) schools are considered. Source: Beyond Pesticides. 2006. State and Local School Pesticide Policies. <http://www.beyondpesticides.org/schools/schoolpolicies/index.htm>.
15. Preemption refers to the ability of one level of government to override laws from a lower level. While local governments once had the ability to restrict the use, sales and distribution of pesticides, pressure from the chemical industry led many states to pass legislation prohibiting municipalities from passing local pesticide ordinances that are stricter than state policy. Source: State Preemption Laws. 2005. <http://www.beyondpesticides.org/lawn/factsheets/Preemption%20Factsheet.pdf>.
16. Local public property IPM/pesticide reduction policies encompass ordinances that aim to protect local jurisdictions ranging from counties to schools to pesticide-free parks. Source: Beyond Pesticides. 2007. Local IPM/Pesticide Reduction Policies.