

October 2011

# The Business Case For Integrated Pest Management in Schools: Cutting Costs and Increasing Benefits

## Harnessing the Benefits

Integrated Pest Management (IPM) is a proven approach that focuses on prevention of pest problems using methods that have minimal impact on human health and the environment. IPM practices include sound

preventive maintenance, high sanitation standards and staff education, along with pest monitoring, accurate pest identification and recordkeeping. IPM can reduce pest complaints by 78% to 90% with no long-term increase in costs (Gouge *et al.* 2006).

## How Pike Township (Indianapolis, Indiana) Transformed Their Schools

Prior to 2008, the Metropolitan School District of Pike Township in Indianapolis, Indiana was using a reactive approach to pest problems, routinely spraying pesticides in school facilities. When a school board member heard that IPM was more effective, safer for students and better for the environment she asked, "Why aren't we doing that?"

The curiosity of this school board member sparked a dialogue among the district superintendent, a local

non-profit called Improving Kids' Environment and Dr. Marc Lame, an entomologist at Indiana University. Along with the district's facilities director and a pair of motivated principals, they formed an IPM team. The team initiated a pilot in two schools, conducting "crawl-through" site assessments to gather baseline data on the current management practices, pest problems and pest-friendly conditions.

After the initial assessments, the district designated an IPM coordinator and created action items to address immediate and long-term needs, including sealing pest entry ways and organizing IPM training for groundskeepers, custodians and kitchen staff.

After completing two successful pilot sites, Pike Township expanded their IPM program district-wide. Without increasing costs, Pike Township turned an old-style extermination approach into a safer, far more effective IPM program, reducing the annual number of pesticide applications by 88%.





## What is High-level IPM?

IPM is a continuum of practices starting with inspection and monitoring, responding to pest infestation when found, and progressing to comprehensive prevention-based programs that limit pest access to food, water and shelter. High-level IPM requires:

- ▶ Pest managers who understand how to diagnose the cause of pest problems and educate staff on prevention.
- ▶ Careful inspection and monitoring for pests and pest-friendly conditions.
- ▶ Effective sanitation and facility maintenance to eliminate food and water sources, and access to buildings.
- ▶ Education for all appropriate staff to fully implement all aspects of IPM.
- ▶ Healthy soils and plants and effective cultural practices that prevent problems with insects, rodents, diseases and weeds.
- ▶ Pesticide use only when non-chemical measures are inadequate to provide reasonable control.

When needed, pesticide products can be selected that minimize risks to students and staff (Green and Gouge 2008). Many states have laws requiring parental notification prior to pesticide applications, as well as posting pesticide application warnings at applications sites (Owens 2010).



*Ineffective pest control can lead to staff resorting to over-the-counter pesticides to try to resolve persistent problems. In this case, staff frustrated with flies in a loading dock area have hung a pesticide strip (dichlorvos). Cleaning the organic matter out of loading dock drains, and keeping them clean, eliminated the breeding site and the flies.*

## An IPM Program Can:

- ▶ **Prevent an infestation from ever happening** – In 2000, Auburn City Schools in Alabama cut pest complaints by 90% using IPM (Gouge *et al.* 2006).
- ▶ **Cut unnecessary costs** – In 2000, Kyrene Schools in Arizona decreased pesticide application costs in three schools. On average only one pesticide application per school was needed per year, compared to 12 or more applications prior to IPM implementation (Gouge *et al.* 2006).
- ▶ **Protect student health** – In 1998, two students in California were exposed to pesticide drift, causing one student to have an asthma attack. A year after the incident, a group of community stakeholders, led by the mother of the two students, successfully persuaded the school district to implement a safer pest control policy (Kucher 2003).



*Dirty floor drains, a common deficiency in food service areas, provide a breeding site for drain and fruit flies and food for rodents, ants and cockroaches. Bacteria, including Listeria, can be carried by pests from the drains to food and food preparation surfaces.*

## Could IPM Have Prevented This?

In April of 2011, kitchens and cafeterias in 22 schools in Orange County, Florida were inspected and found to be infested with cockroaches. The district provided students with pre-packed lunches and served them outside under lawn tents. Unfortunately, many parents found out about the problem only when they saw the lunch tents outside (Butler 2011).



## Benefits of IPM in Green Schools:

- ▶ **Fewer missed school days** for students and staff from better indoor air quality and fewer pests and pest-related allergens.
- ▶ **Lower teacher turnover** resulting from higher quality indoor environments, including air quality, lighting and school maintenance.
- ▶ **Increased productivity** as a result of healthier, more comfortable students and school staff.

## Green Schools Means IPM

*The Quick & Easy Guide to Green Cleaning in Schools*, created by the Healthy Schools Campaign, lists IPM as one of five steps toward successful green cleaning. IPM can help improve indoor air quality and contribute to better health, fewer absences and higher quality of education for students. To get your copy, visit <http://www.healthyschoolscampaign.org/publications/greencleaning/>

The US Environmental Protection Agency's *Indoor Air Quality (IAQ) Tools for Schools* highlights IPM as one of six key elements of a strong IAQ management program. For more info, visit <http://www.epa.gov/iaq/schools/pdfs/kit/framework.pdf>.

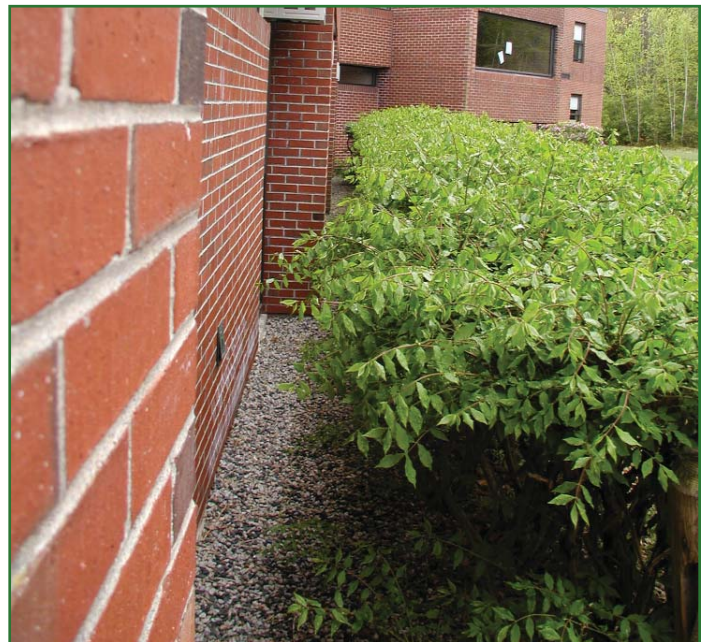
### Green schools by the numbers

**Asthma** – In most states, school districts receive funding from the state based on attendance rates. At the Northeast Independent School District in San Antonio, Texas, a 1% increase in average daily attendance is worth \$3.4 million to the school district. The district's asthma reduction program has earned the district millions of dollars each year (Rhodes 2011).

**Teacher Retention** – A 2005 Washington State report, prepared by Paladino and Company, Inc., estimated a 5% decrease in teacher turnover when schools go green (Washington State Department of Ecology 1999). Estimated costs of turnover can be 25% to 200% of a teacher's annual salary plus benefits (Texas Center for Educational Research 2000), providing a strong case to retain teachers through investing in workplace environment.

## Green Schools and IPM

According to the 2006 report, *Greening America's School: Costs and Benefits* (Kats), green-building practices yield savings of around \$70 per square foot in energy costs, greater staff productivity, and improved student and staff attendance. Incorporating IPM into green schools is a natural fit contributing to lower costs and higher productivity.



*Vegetation is trimmed away from the building to prevent ants and other pests from travelling onto the structure. A concrete or stone mulch strip placed along the perimeter excludes ground vegetation that can conceal pests and pest activity.*

### Salt Lake City, Utah

In 2009, Gregg Smith, director of facility services at the Salt Lake City School District, examined IPM program costs for the 2007-08 school year.

#### First-year IPM start-up costs:

Tools and training: \$2400

Exclusion: \$2000

#### Ongoing costs after first year:

Monitoring supplies: \$1500-\$1800/year

Exclusion: \$1000-\$2000/year

Pesticides for structural pests: \$0/year

Professional development: \$1500/person



## Reducing Asthma with IPM in Schools

In a study of California youth (Salam *et al.* 2004), children exposed to cockroach allergens or pesticides during infancy were two-times more at risk for childhood asthma. IPM can cut cockroach-related asthma triggers to insignificant levels in schools (Nalyanya *et al.* 2009).

### Asthma burden

- ▶ Twenty-two percent of US high school students reported having asthma in 2009 (Centers for Disease Control and Prevention 2009). In an average class of 25 students, that means five will have asthma.
- ▶ In US schools, there are more than 12 million asthma-related missed school days per year (Centers for Disease Control and Prevention 2007).

### Asthma price tag

- ▶ From 2002-2007, the incremental direct cost of asthma per person in the US was \$3,259 (Barnett and Nurmagambetov 2011).
- ▶ Each year, missed school days cost \$301 per worker and \$93 per student in the US (Barnett and Nurmagambetov 2011).
- ▶ An average hospital stay for a child (age 0-17) for allergic asthma is \$7,987 (Brett and Stillman 2009).
- ▶ Providing healthcare to children with asthma costs almost three times that of children without (Kats 2006).

## Pest and Pesticide Complaints

In 1999, a group of parents from Anchorage, Alaska were concerned about the school district's pesticide use. After filing a Public Records Act request, what they found out was not reassuring. The records showed that the school district made regular pesticide applications and had no system to notify parents prior to the application (Miller 2003).

In 2011, a New Orleans, Louisiana school faced student protests and parent complaints following an uncontrolled bat infestation. Local media highlighted the fact that one student hit her head on a wall to avoid a flying bat (WDSU News 2011).

A school IPM program can reduce pest complaints similar to the ones in Louisiana by over 90% by taking preventive measures before problems occur.

## An Asthma Case Study

A national study of 937 children conducted by the Inner-city Asthma Study Group (Morgan *et al.* 2004) evaluated the effectiveness of environmental interventions in the home. Both cockroach and dust-mite allergens were dramatically reduced using IPM practices. These same IPM techniques can be applied in schools to reduce any allergens present. In this 2004 study, the following residential economic and health benefits were earned that could potentially be multiplied with IPM in schools:

- ▶ Compared to the cost of asthma medications, the \$1000 to \$2000 spent per child on IPM was cost effective, not to mention the immeasurable increase in quality of life for these children.
- ▶ On average, each child experienced 2.1 fewer unscheduled emergency department visits.
- ▶ Children averaged 21.3 fewer asthma-symptom days per year.
- ▶ With 4.4 fewer missed school days a year, IPM saved parents, teachers and students the hassle of altering their daily schedules and the associated costs of missed work and school.





## Contract Out or Use School Employees for IPM: Which Should My District Choose?

When making the decision whether to contract with a pest management professional (PMP) or hire or train staff to implement an IPM program, a number of factors come into play including the size of the district, number and qualifications of in-house staff, liability issues and the ability of PMPs in the area to deliver high-level IPM. Either way, the important outcome is that high-level IPM is implemented by qualified experts.

### IPM using contracted PMPs

Nash County, NC – A study conducted in nine North Carolina elementary schools compared IPM to conventional pest control practices. All of the schools used contracted PMP services. After five months, PMPs in five of the nine schools began using IPM and through monitoring and inspection, determined that pesticide applications could be reduced simply by not treating when pests were not present (Williams *et al.* 2005).

### IPM program

Monroe County, IN – The Monroe County Community School Corporation was investing about \$34,000 per year in contracts with PMPs, or \$1800 per building. When an IPM coordinator was hired at \$28,000 per year to serve as an in-house PMP, the contracts were eliminated, saving the district \$6000 every year (Safer Pest Control Project 1998).

## Reducing Pesticide Use

For over two decades, schools have been using IPM to reduce pesticide use and associated costs. In 1985, the Montgomery County Public Schools in Maryland made 5000 pesticide applications. Just three years later, after transitioning to IPM practices, only 600 pesticide



*Any pesticides kept on school grounds should be stored in locked areas accessible only to properly trained and licensed professionals.*

applications were needed (Forbes 1991). More recently, in Indianapolis in Pike Township's first year of IPM, they bought just \$168 worth of pesticides and reported using only \$11 worth midway through the school year (Moore 2010).

## IPM on School Athletic Fields

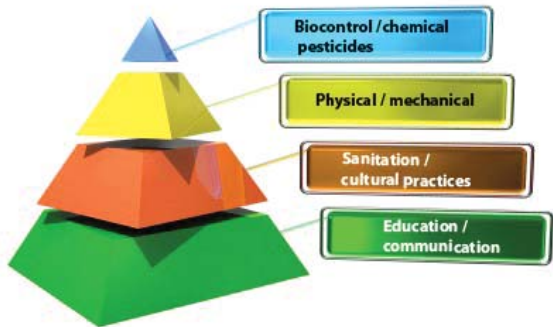
The best defense against pests on athletic fields is maintaining healthy turf through proper mowing, aeration, fertility, irrigation and overseeding practices (Sherratt and Street 2005). Healthy turf is an essential preventative measure for student athlete safety and pest prevention.

A recent report showed that in addition to removing hazardous chemicals from school facilities, switching from conventional pesticide-based management to a healthy turf management-led to an average annual savings of more than 25% after five years (Osborne and Wood 2010).



## IPM Program Costs

Converting from conventional pest-control practices to an IPM program can seem complicated at first. However, by taking proven steps and using existing tools and information, any district can transition to the IPM track.



*The foundation for high-level IPM is education, sanitation and physical controls, leading to fewer problems and little need for intervention.*

**IPM coordinators** work for the school district to provide day-to-day oversight of the IPM program. Duties include maintaining and implementing an IPM plan and policy, conducting inspections, working with contracted PMPs, keeping records and deciding on a course of action when pest issues arise.

### Who can be an IPM coordinator?

An IPM coordinator has decision-making responsibilities for day-to-day implementation of the IPM policy and plan. This individual can be a facilities manager, head custodian or other school district employee.

**Education** for facility managers, teachers, staff and IPM coordinators provides the knowledge and skills necessary for a successful IPM program at all levels. For example, by understanding that mice can squeeze through a gap as small as your index finger (1/4"), maintenance staff will be more aware of the need to completely seal plumbing, electrical or other penetrations through exterior and interior walls.

**Program startup** expenses for new equipment and materials may include door sweeps, screens, sealant, monitoring devices, flashlights and pest field guides.

**Site assessments** in school district facilities determine the extent of current pest problems and pest-preventing conditions. The findings during "crawl-throughs" are used to set priorities.

**Two to three schools** in a district can serve as initial IPM demonstration pilots. After success is achieved in the pilots, the IPM program can be expanded to other schools within the district using the initial school trainees as trainers.

Investments in IPM processes, training and supplies return big benefits in the long-run. Schools across the country have taken steps to successfully implement an IPM program and you can too!

## Help to Balance Budgets for Years to Come

By using common sense techniques, IPM can reduce costs and pest-related complaints.

### Schools that are saving

In New York, Susquehanna Valley Central School District saved \$1000 per year using IPM while continuing to maintain attractive facilities (Safer Pest Control Project 1998).

In Maryland, Anne Arundel County School District reduced its annual pest control costs from \$46,000 to \$14,000 (Washington State Department of Ecology 1999).

In Indiana, Pike Township schools saved more than \$5000 per year using in-house IPM practices (Moore 2010).

In North Carolina, the Union County School District has saved \$18,000 in fire ant treatments alone with the implementation of an IPM program in 2002 (North Carolina Public School Maintenance Association 2011).



*An IPM coordinator is a wise investment in a healthier, safer community.*



## Available Tools and Resources

**Communication** is critical. A monthly Pest Press newsletter is an easy way to keep school staff, parents and students informed, including practical information and seasonal pest issues such as preventing ants in the spring or mice in the fall. Distribution of Pest Presses can be through school email lists, in staff lounges and at school events. To read Pest Presses from around the country visit: [http://www.extension.org/pages/School\\_IPM:\\_Online\\_Newsletters\\_and\\_Pest\\_Presses](http://www.extension.org/pages/School_IPM:_Online_Newsletters_and_Pest_Presses)

An introductory guide to school IPM can be found at: <http://ag.arizona.edu/pubs/insects/az1234.pdf>.

The **IPM Cost Calculator** is a free, online tool that allows schools to assess their pest risks. Using geographic location, current pest problems and facility condition, the calculator estimates the overall pest risk in a school. Future versions of the IPM Cost Calculator will allow schools to predict pest management costs. Go to [www.IPMCalculator.com](http://www.IPMCalculator.com) to set up an account for your school.

### The Monroe Model for IPM in Schools

Initially implemented in ten school districts, the Monroe Model dramatically reduced pesticide applications. Eight of the ten school districts showed at least 50% reduction in pesticide applications, with five of the eight districts above an 80% reduction (Gouge *et al.* 2006). These reductions can represent significant cost savings over the long term (Kubista-Hovis and Lame 2004). Today, dozens of school districts across the country have benefited from the Monroe Model approach, including hundreds of schools in Alabama, Arizona, Indiana, Missouri, Nevada, Ohio, Oregon and Utah.



**IPM Star® Certification** helps schools prioritize action steps on the way to a verified, high-level IPM program. To learn how your school district can become IPM Star Certified, visit <http://www.ipminstitute.org/ipmstar.htm>.

For tips on implementing school IPM with a contracted PMP, go to [http://www.extension.org/mediawiki/files/2/25/schoolipm\\_contracting\\_with\\_PMP\\_3.23.pdf](http://www.extension.org/mediawiki/files/2/25/schoolipm_contracting_with_PMP_3.23.pdf).

For a comprehensive list of school IPM resources and information, visit [http://www.ipminstitute.org/school\\_ipm\\_2015/resources.htm](http://www.ipminstitute.org/school_ipm_2015/resources.htm).

### Texas Integrated Pest Management Affiliate for Public Schools (TIPMAPS)

TIPMAPS serves 1030 school districts, making Texas the first state in the country to have an organization dedicated to supporting and educating school IPM coordinators. As a statewide affiliate chapter under the Texas Association of School Business Officials, TIPMAPS provides school IPM coordinators a venue for peer-to-peer communication and efficient information sharing. The first TIPMAPS annual conference attracted 200 IPM professionals from over 100 districts across the state.

## IPM: Investing in the Future

Montgomery County Public Schools in Maryland made an initial investment of \$9300 in an IPM program which included monitoring practices, supplies and training for staff members. That investment saved the district \$17,100 per year (Forbes 1991).

## References

- AgriLIFE Extension. 2011.** *IPM Cost Calculator*. <http://www.ipmcalculator.com/>
- Barnett, S.B.L. and Nurmagametov, T.A. 2011.** Costs of asthma in the United States: 2002-2007. *J. Allergy and Clinical Immunology* 127 (1): 145-152.
- Beyond Pesticides. 2003.** *Health Effects of 48 Commonly Used Toxic Pesticides in Schools*. Washington D.C. 3 pp. <http://www.beyondpesticides.org/schools/publications/48%20School%20Pesticides.pdf>
- Brett, M. and Stillman, L. 2009.** *The Role of Pest Control in Effective Asthma Management: A Business Case*, Asthma Regional Council of New England for the Boston Public Health Commission. Boston, MA. 8 pp.
- Butler, S. 2011.** Schools Tackle Cockroach Infestation. Fox 35 news. April 2011. [http://www.myfoxorlando.com/dpp/news/orange\\_news/042911-Schools-tackle-cockroach-infestation#ixzz1MoGBF0Dy](http://www.myfoxorlando.com/dpp/news/orange_news/042911-Schools-tackle-cockroach-infestation#ixzz1MoGBF0Dy)
- Centers for Disease Control and Prevention. 2007.** *Featured data & statistics: Statistics on asthma-related absences*. <http://www.cdc.gov/datastatistics/archive/asthma-absences.html>
- Centers for Disease Control and Prevention. 2009.** Youth Risk Behavior Surveillance — United States, 2009. *Morbidity and Mortality Weekly Report*, June 4, 2010 / Vol. 59 / No. SS-5. <http://www.cdc.gov/mmwr/pdf/ss/ss5905.pdf>
- Forbes, W. 1991.** From Spray Tanks to Caulk Guns: Successful School IPM in Montgomery County, MD. *J. Pesticide Reform* 10(4): 9-11.
- Green, T.A. and D.H. Gouge, eds. 2008.** *School IPM 2015: A Strategic Plan for Integrated Pest Management in Schools in the United States*. 286 pp. <http://www.ipmcenters.org/pmsp/pdf/usschoolspmsp.pdf>
- Gouge, D.H., M. L. Lame and J. L. Snyder. 2006.** Use of an implementation model and diffusion process for establishing Integrated Pest Management in Arizona schools. *American Entomologist* 2006: 190-196.
- IPM Institute. 2009.** *Verified IPM Performance*. <http://www.ipminstitute.org/ipmstar.htm>
- Kats G. 2006.** *Greening America's Schools: Costs and Benefits*. Capital E. Washington, DC. 12 pp.
- Kubista-Hovis, K. and M. L. Lame. 2004.** The economics of school integrated pest management: An analysis of the Monroe IPM model in Bloomington, Indiana. *National Schools Update*. US EPA, BPPD 1(3): 5-7.
- Kucher, Y. 2003.** Los Angeles Unified School District. In *Safer Schools: Achieving A Healthy Learning Environment Through Integrated Pest Management*. P. 16. School Pesticide Reform Coalition and Beyond Pesticides. <http://www.beyondpesticides.org/schools/publications/IPMSuccessStories.pdf>
- Miller, P. 2003.** Anchorage School District. *Ibid*. P. 14.
- Moore, J.D. 2010.** *From Pest Treatment to Pest Prevention: A Case Study of Integrated Pest Management at The Metropolitan School District of Pike Township*. Improving Kids' Environment. Indianapolis, IN. 25 pp.
- Morgan, W.J., Crain, E.F., Gruchalla, R.S., O'Connor, G.T., Kattan, M., Evans, R., Stout, J., Malindzak, G, Smartt, E., Plaut, M., Walter, M., Vaughn, B. and Mitchell, H. 2004.** Results of a Home-Based Environmental Intervention among Urban Children with Asthma. *New England J. Medicine*. 2004. 351:1068-1080
- Nalyanya, J., Gore, C., H. Linker, M. and Schal, C. 2009.** German cockroach allergen levels in North Carolina Schools: Comparison of Integrated pest management and conventional cockroach control. *J. Medical Entomology*. 46(3): 420-427.
- Neltner, T. 2003.** Broad Ripple High School, Indianapolis Public Schools. In *Safer Schools: Achieving A Healthy Learning Environment Through Integrated Pest Management*. P. 19. School Pesticide Reform Coalition and Beyond Pesticides. <http://www.beyondpesticides.org/schools/publications/IPMSuccessStories.pdf>
- North Carolina Public School Maintenance Association. 2011.** School IPM: Good community support means fewer pest problems. *The Maintenance Beacon*. 48(7): 2-3.
- O'Donoghue, S. 2011.** Parent anger follows Duval roaches, West Hamlin taping. *The Lincoln Journal, Inc.* February 2011. <http://lincolnjournalinc.com/parent-anger-follows-duval-roaches-west-hamlin-taping-p6300-1.htm>
- Osborne, C. and Wood, D. 2010.** *A Cost Comparison of Conventional (Chemical) Turf Management and Natural (Organic) Turf Management for School Athletic Fields*. Grassroots Environmental Education. <http://www.grassrootsinfo.org/pdf/turfcomparisonreport.pdf>
- Owens, K. 2010.** Schooling of state pesticide laws: 2010 update. *Pesticides and You*. Vol. 29, No. 3, Fall 2009: 9-20. <http://www.beyondpesticides.org/report/Schooling2010.pdf>
- Paladino and Company, Inc. 2005.** *Washington High Performance School Buildings: Report to the Legislature*. 67 pp. [http://www.paladinoandco.com/files/PaladinoandCompany\\_WhitePaper\\_WashingtonHighPerformanceSchoolBuildings.pdf](http://www.paladinoandco.com/files/PaladinoandCompany_WhitePaper_WashingtonHighPerformanceSchoolBuildings.pdf)
- Rhodes, D. 2011.** *Implementing Tailored Environmental Interventions – Maximizing Effectiveness of your Community Asthma Care System*. National Asthma Forum. Washington, D.C. Presented on 9 June 2011.
- Safer Pest Control Project. 1998.** *Cost of IPM in Schools*. Chicago, IL. 4 pp.
- Salam, M.T., Li, F.Y., Langholz, B., and Gilliland, F.D. 2004.** Early-life environmental risk factors for asthma: Findings from the children's health study. *Environmental Health Perspectives* 112(6): 760-765.
- Sherratt, P.J. and Street, J.R. 2005.** Standard Guide for Maintaining Sports Field and Recreational Turf in Ohio. *Extension Factsheet*, SPT-2-05. The Ohio State University. <http://ohioline.osu.edu/srt-fact/0002.html>
- Smith, G. 2009.** *The Cost-Benefits of IPM from a Facility Director's Perspective*. [PowerPoint Slides] 16 pp. [http://www.ipminstitute.org/school\\_ipm\\_2015/Cost-Benefits\\_of\\_IPM\\_SLCSD.ppt](http://www.ipminstitute.org/school_ipm_2015/Cost-Benefits_of_IPM_SLCSD.ppt)
- Sorensen, A.A. 1992.** *Proceedings of the National Integrated Pest Management Forum*. American Farmland Trust Center for Agriculture in the Environment, Dekalb, IL. 86 pp.
- Texas Center for Educational Research. 2000.** *The Cost of Teacher Turnover*. 40 pp. [http://www.tcer.org/research/documents/teacher\\_turnover\\_full.doc](http://www.tcer.org/research/documents/teacher_turnover_full.doc) (Word Doc)
- United Press International. 2011.** *Cockroach Infestation hits Florida schools*. UPI.com. April 2011. [http://www.upi.com/Top\\_News/US/2011/04/29/Cockroach-infestation-hits-Florida-schools/UPI-37961304104811/](http://www.upi.com/Top_News/US/2011/04/29/Cockroach-infestation-hits-Florida-schools/UPI-37961304104811/)
- US Department of Education, National Center for Education Statistics. 2005.** *Digest of Education Statistics: 2005*. <http://nces.ed.gov/programs/digest/d05/>
- US Department of Education, National Center for Education Statistics. 2007.** *Public Elementary and Secondary School Student Enrollment, High School Completions, and Staff from the Common Core of Data: School Year 2005-06*. <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2007352>
- Washington State Department of Ecology. 1999.** *Calculating the True Costs of Pest Control*. Publication No. 99-433. <http://www.ecy.wa.gov/pubs/99433.pdf>
- WDSU News. 2011.** *Students, Parents Protest Over Bat Problem At School: McDonogh 35 Students Unhappy With School Board Response*. WDSU.com. <http://www.wdsu.com/news/26918673/detail.html>
- Williams, G.M., Linker, H.M., Waldvogel, M.G., Leidy, R.B. and Schal, C. 2005.** Comparison of conventional and Integrated Pest Management programs in public schools. *J. Economic Entomology*. 98(4): 1275-1283.

## Authors

Prepared by Kelly Chambers, Thomas Green, Dawn Gouge, Janet Hurley, Tim Stock, Zach Bruns, Mark Shour, Carrie Foss, Fudd Graham, Kathy Murray, Lynn Braband, Sherry Glick and Matt Anderson. September 2011.

This publication was developed under Cooperative Agreement No. X8-83483101-0 awarded by the U.S. Environmental Protection Agency. It has not been formally reviewed by EPA. The views expressed in this document are solely those of the authors and EPA does not endorse any products or commercial services mentioned in this publication. [http://www.ipminstitute.org/school\\_ipm\\_2015/ipm\\_business\\_case.pdf](http://www.ipminstitute.org/school_ipm_2015/ipm_business_case.pdf)