Pest Management Evaluation Project

Pest Control Operator IPM Program Evaluation

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EXECUTIVE SUMMARY

The goal of this Pest Management Evaluation Project was to gather information on professional pest management in urban areas of California in order to identify the challenges and barriers to widespread acceptance of integrated pest management (IPM) among pest control operators (PCOs).

The project assembled a team comprising pest management consultants and members of the pest control industry, academia, private research organizations, environmental groups, professional organizations, and regulatory agencies. Together we explored IPM training and certification for PCOs in California and discussed strategies for promoting training and certification to PCOs as well as strategies for marketing IPM to their customers. We investigated pesticide use in urban areas of California, surveyed current pest management practices of the industry, and recorded reduced-risk practices for major urban pests. We also surveyed IPM course offerings in California and researched training and certification programs in other states.

Surface Water Contamination

With over 60 urban water bodies in California impaired due to diazinon and chlorpyrifos, clearly the public and the pest management industry need to be involved in better methods of managing pests if water quality improvements are to be achieved. We believe that the adoption of IPM practices is key to lessening our dependence on the pesticides that are of most risk to the environment and human health and safety.

Although the U.S. Environmental Protection Agency has restricted the use of diazinon and chlorpyrifos in urban areas, these pesticides will inevitably be replaced by other chemicals. These replacements, which will include pyrethroids and carbamates, may also cause environmental problems in the future if used to the same extent as diazinon and chlorpyrifos. At present it is unclear what environmental effects these pesticides will have, and we may not know until years after their use has expanded to fill the void left by diazinon and chlorpyrifos.

According to the California Department of Pesticide Regulation Pesticide Use Report for the Year 2000, the largest amounts of broad spectrum pesticides (these include diazinon and chlorpyrifos) were used for structural pests rather than landscape pests. Thus, concentrating efforts on changing structural pest management practices will have a greater effect on the level of surface water contamination from pesticides. Further, the pest of first priority should be ants. We estimate that ants account for greater than 14% of the total structural pesticide use in California, and surveys of both PCOs and the public indicate that ants are perhaps the major nuisance pest.

Barriers to Adopting IPM

Although some pest management professionals are concerned that IPM is just another way of limiting their access to tools (i.e., pesticides), in reality, adopting IPM will expand the range of options for attacking pests, options that are more effective in the long run. PCOs are already using many IPM methods without necessarily designating them as such. Techniques such as pest exclusion, cockroach baiting, and sanitation have been mainstays of their profession for years. Other proven IPM methods exist and could be more widely used.

Unfortunately, both the public and many pest management professionals lack a clear understanding of the principles of IPM. Because of this lack of understanding, along with inadequately trained technicians, lack of information on size of market and profitability, fear of losing customers who may not be satisfied, and lack of any regulatory mandate, there is little incentive to adopt IPM practices.

Strategies for Increasing Customer and PCO Acceptance of IPM

It will be necessary to develop the market for IPM services at the same time we try to increase the number of PCOs practicing IPM. Marketing IPM and educating the public can proceed through existing channels in the community such as homeowner associations, real estate transactions and associated inspections, unions, internal outreach within organizations and companies, and parent networks. We can also enlist the help of environmental activist groups, and public agencies, especially pollution prevention agencies, in publicizing the benefits of IPM and certified IPM providers.

IPM requires better trained employees which can lead to greater employee retention. Better trained personnel will increase respect for the industry. Pest prevention services and monitoring can be sold to the customer as "pest insurance," and pest exclusion services can often be performed during the winter when other pest management business is slow. A pest prevention assessment coupled with exclusion and other kinds of pest prevention could be offered as a yearly service. Most PCOs provide a regular monthly service to their customers. Switching to a quarterly service can save on fuel and allow technicians time to monitor for problems, educate the customer on reduced-risk practices, and perform preventive maintenance. Quarterly pest management visits could be more profitable for the PCO and, at the same time, satisfy customers who want more attentive service.

Barriers to Training and Certification in IPM

Without regulatory mandates, PCOs may be reluctant to invest the time in voluntary IPM training and certification, especially if they cannot see a financial advantage in doing so. Currently there is a shortage of enthusiastic, high quality IPM trainers who can inspire their students. There are few training programs that teach an IPM decision-making process or that encourage trainees to experiment with creative solutions to pest problems. The listing of courses approved by the Structural Pest Control Board shows relatively few on structural IPM, particularly for general audiences who might not be a part of an association or in-house training program. A limited review of some of the junior colleges in California revealed that no structural pest control courses, IPM oriented or otherwise, are being offered.

Strategies for Overcoming Barriers to Training and Certification

IPM certification is well underway in many states, and we can learn much from their successes and failures. Certification in California could also follow the historical path of the California Certified Organic Farmers which began as a voluntary process through a private organization and has progressed to legislation of organic standards at both the state and federal level. Standards for certification as well as training must be discussed and determined.

To increase the number of qualified IPM trainers and practical, hands-on training courses, apprenticeships could be sponsored with the best IPM trainers in the state. Funds can be secured to find potential trainers from among the most progressive PCOs and pest management consultants who would be willing to design IPM courses that meet the pre-determined standards.

Future Work

Future projects can develop a model for training PCOs in the practice of IPM and providing them with strategies to market IPM services to the public. Two priority markets for these services are commercial and public agency accounts that are mandating IPM, and property management groups seeking long term protection of real estate investments. Working to raise the level of existing licensing requirements and to add substantial numbers of IPM questions to licensing exams will also encourage better training for PCOs. More research is needed on IPM certification programs in other parts of the country to glean the best aspects of each to assist in designing a program that could meet California's needs. Developing standards for IPM certification and instituting a certification program will encourage adoption of IPM techniques and will increase the ease with which the public can hire IPM practitioners.

PROJECT BACKGROUND

INTRODUCTION

Integrated pest management (IPM) provides an alternative to conventional pest control and often leads to a reduction in pesticide use. In 1979, the federal government made IPM techniques a priority for management of government property. Since then, various federal agencies have been adopting the IPM approach. In 1989, the General Services Administration (GSA) established IPM programs in Washington, D.C. in more than 100 buildings. Facilities with IPM programs had an 89% reduction in service requests and a 93% reduction in the amount of pesticide applied (Greene and Breisch 2002). In 1997, the Bio-Integral Resource Center designed an IPM program for NASA Ames at Moffitt Field just south of San Francisco that resulted in a 95% reduction in applied pesticides and fewer pest problems (Daar 1997).

Current Trends in Pest Management

Taking the lead from the federal government, a number of municipalities in California have established IPM programs on municipal property. San Franciso, for instance, passed an IPM Ordinance in 1996. Municipal programs have been driven by strong community pressure to reduce or eliminate the use of the most acutely toxic pesticides and substitute alternatives that are perceived as less of a threat to public health and safety (Hom 1999).

Since the 1990s, community pressure has focused on reducing pesticide use in schools and implementing school IPM programs. The first state-wide school IPM law was passed in Texas in 1991. A number of other states followed with similar laws. California passed the Healthy Schools Act of 2000, which makes notification and posting of pesticide applications mandatory and makes implementation of full IPM programs voluntary. This legislation may lead to a greater need to hire trained professionals to implement reduced risk practices.

In the pest control industry itself, IPM is often viewed as a desirable ideal. For example, about one quarter of the talks and presentations at the Toronto Structural Pest Control Conference in September 2002 concerned some aspect of structural IPM. Pest control industry trade magazines such as *Pest Control* and *Pest Control Technology* frequently feature articles on structural IPM. For instance, in April 2002, *Pest Control* published two articles and an editorial on IPM.

Surface Water Contamination

Pesticide contamination of surface waters is of growing concern all over the nation (USGS 1999). Aquatic toxicity to *Ceriodaphnia dubia* and *Mysidopsis bahia* has been observed in urban creeks and rivers throughout California. These aquatic species are used as indicators of the health of the aquatic food web, and their decline may be one reason for the drastic decrease in coho salmon and steelhead trout populations.

Two commonly used organophosphates, diazinon and chlorpyrifos, have been found to cause aquatic toxicity to *C. dubia* and *M. bahia*. Officially, 62 water bodies in California have now been designated

impaired due to diazinon, and 15 are impaired due to chlorpyrifos. Additional water bodies are impaired due to "pesticides" and "toxicity" (often as a result of pesticide discharges). Total Maximum Daily Loads (TMDLs), which will regulate pesticide-caused toxicity, have been initiated in every major urban area of the state (Bailey et al. 2000; Schiff and Sutula 2001).

In the San Francisco Bay Area alone, 85 tons of diazinon was used in 2000, with 23 tons reported for structural pest control use. From studies conducted in Alameda County and projected for the rest of the Bay Area, it is estimated that the toxicity in Bay Area creeks is caused by only 0.2% or 0.25 tons of the diazinon applied moving off the target application site. Among the application sites pest management professionals legally treat are outdoor impervious surfaces surrounding buildings. Recent studies suggest that 11% of the diazinon applied to these surfaces can run off with the rainfall or irrigation (Scanlin and Cooper 1997).

Clearly, huge resources have been allocated to identify the sources of observed aquatic toxicity and to begin to address ways of solving the problem. Increased use of IPM methods by pest management professionals is seen by water quality agencies throughout California as key to reducing the problem.

Increased Demand for IPM Services

These converging dynamics have led to increased demand for IPM practitioners. Having a list of trained and certified IPM practitioners would make it easier for municipalities, schools, public agencies, and homeowners to find qualified personnel. A certification program coupled with strategic marketing could increase the willingness of pest control operators to add IPM services to their businesses.

The Pest Management Alliance

We have assembled a team comprising members from industry, academia, private research, consulting, environmental groups, professional organizations, and regulatory agencies. Together we have explored IPM training and certification for PCOs in California and delineated barriers to the acceptance of IPM by PCOs. As part of the evaluation, we have analyzed the latest California Department of Pesticide Regulation (DPR) Pesticide Use Report to identify which structural pests account for the highest use of conventional pesticides. We have also researched and identified IPM alternatives for those pests.

CURRENT PATTERNS OF PESTICIDE USE IN URBAN CALIFORNIA

Although pesticide use by the general public is hard to track, the California Department of Pesticide Regulation (DPR) keeps records of pesticide applications made by pest control professionals. Thus, the Pesticide Use Report (PUR) documents pesticides applied in structural pest control by pest control operators (PCOs) and by landscape contractors to California landscapes.

The PUR does not divide pesticide use by pest. By using several recently published surveys (Wilen 2001; Sacramento 2001; Pest Control 2001) along with general information, analysis of pesticide labels, and data in the PUR, we have roughly estimated the percentage of active ingredient used on the principal structural and landscape pests. This information is summarized below and displayed in Tables 1 and 2.

In a national survey of PCOs, about 80% said they received the largest number of calls for ants, 22% said termites, 20% said cockroaches, with about 4% saying other insect pests (Pest Control 2001). [Note:

The total is more than 100% because respondents were allowed to give high ratings to more than one pest.] In a survey conducted of the general public in Orange County, CA, about half the pesticide applications were for ants (Wilen 2001). A survey of Sacramento residents conducted by the City of Sacramento found that pesticide applications were split about evenly between the general public and professionals. About 84% of the self applied and 79% of hired professional applications were for ants (Sacramento 2001). Termites were not considered in the latter two surveys.

Pesticides Used in Structural Pest Control

According to the latest published data from DPR in the Pesticide Use Report (PUR) for the year 2000, 5,164,843 pounds of pesticide active ingredients were applied for structural pest control in California (DPR 2000).

Percentages Used in each Pesticide Category

- 52% of the total is structural fumigants used mostly for drywood termites.
- 19% is organophosphates, primarily diazinon (10%) and chlorpyrifos (8.3%).
- 16.9% of the total is reduced risk products, such as liquid nitrogen and borates. Most of this was used for termites.
- 8.3% is pyrethroids, mostly permethrin (4.7%) and cypermethrin (2.4%).
- About 3.8% of the total is miscellaneous materials including vertebrate poisons (0.13%), fungicides (0.44%), disinfectants (1.0%), and others.

Estimated Percentages Used for each Pest Category

- More than 70% of all pesticides applied were used to control termites (this includes fumigants, broad spectrum, and reduced risk materials).
- About 4% of the total was probably used as barriers for subterranean termites (this includes pyrethroids such as Dragnet and Demon, and organophosphates such as Dursban).
- About 27% of the total was broad spectrum organophosphates and pyrethroids. From surveys and other information, more than half of these broad spectrum materials (>14%) was probably applied for ant control (Wilen 2001; Pest Control 2001).
- Less than 12.2% of total use was for roaches, spiders, drywood termite local treatments, fleas, and other arthropods.

Table . Estimated* Percentages of Pesticide Active Ingredient Used on Principal Structural Pests in California in 2000.

Amounts are given in percent by weight of the total. A total of 5,164,843 pounds of active ingredients was reported.**

	PEST CATEGORY					
PESTICIDE	**Drywood Termite**	**Subterranean Termite**	**Ants**	**Other Arthro-pods**	**Misc. Pests**	**Reported** Totals for All Pests**
Fumigants (methyl bromide, Vikane)	52.0***	-----	-----	-----	-----	52.0
Chlorpyrifos	x	2.0* (Dursban)	x	x	-----	8.3
Diazinon	-----	-----	x	x	-----	10.0
Other Organophosphates, Carbamates	-----	-----	x	x	-----	0.7
Permethrin	x	1.2* (Dragnet)	x	x	-----	4.7
Cypermethrin	x	0.6* (Demon)	x	x	-----	2.4
Other Pyrethroids	x	x	x	x	-----	1.2
Reduced-Risk Pesticides	7.6% liq. N_2 0.3% other	5.8% (DOT) 0.5% baits & other	<1% limonene & baits	1.7% boric acid (roaches)	-----	16.9
Miscellaneous§	-----	-----	-----	-----	3.8§	3.8§
Estimated* Total for Each Pest Category	>59.9	>10.1	>14*	<12.2*	3.8§	100.0

*The distribution of pesticides cannot be deduced from the Pesticide Use Report. Estimates were based on surveys (Wilen 2001; Pest Control 2001; Sacramento 2001), inspection of labels, and other information. Note that about 27.3% of all pesticides applied for structural pest control were broad spectrum materials, mostly diazinon, chlorpyrifos, permethrin, and cypermethrin, which are used for ants, roaches, termites, spiders, flies, mosquitoes, wasps, fleas, ticks, and others. We estimate that about 4% of the 27.3% was used for termite ground barriers and more than half of the 27.3% was applied for ants.

**Data from the State of California Department of Pesticide Regulation, Pesticide Use Report for the Year 2000.

***A small amount was used for woodboring beetles.

x = These chemicals were used, but in unknown quantities.

§These materials include dyes, surfactants, bleach, and others.

Table . Percentages of Pesticide Active Ingredient Used on Principal Landscape Pests in California in 2000.

Amounts used are given in percent by weight of the total. A total of 1,395,420 pounds of active ingredients was reported.*

	PEST CATEGORY						
PESTICIDE	**Weeds**	**Fungi**	**Arthropods**	**Vertebrates**	**Slugs & Snails**	**Misc. Pests**	**Totals for All Pests**
Herbicides	55.5	-----	-----	-----	-----	-----	55.5
Fungicides	-----	17.0	-----	-----	-----	-----	17.0
Organo-phosphates	-----	-----	4.5	-----	-----	-----	4.5
Pyrethroids & Carbamates	-----	-----	1.4	-----	-----	-----	1.4
Reduced-Risk Pesticides	0.3 corn gluten meal	-----	7.8 soap, oil, boric acid & others	-----	-----	-----	8.1
Metaldehyde & other Molluscicides	-----	-----	-----	-----	0.9	-----	0.9
Strychnine & other Vertebrate Poisons	-----	-----	-----	1.8	-----	-----	1.8
Miscellaneous**	-----	-----	-----	-----	-----	10.8**	10.8**
Total for Each Pest Category	55.8	17.0	13.7	1.8	0.9	10.8**	100.0

*Data from the State of California Department of Pesticide Regulation. Pesticide Use Report for the Year 2000.
**These materials include dyes, surfactants, bleach, and others.

Pesticides Applied to Landscapes

According to the PUR, 1,395,421 pounds of pesticide active ingredients were used on landscapes in California in 2000.

Percentages Used in each Pesticide Category

- 55.5% of the total is herbicides. Fifty-one herbicides were reported, with glyphosate and 2,4-D accounting for about 24% of the total.
- 17.0% of the total is fungicides. Thirty-four fungicides were reported with mancozeb (3.0%), chlorothalonil (3.7%), and methyl bromide (3.7%) being used more than others. (Our including methyl bromide under the category of fungicide is arbitrary, as it is also used to kill weeds and nematodes in landscapes.)
- 8.1% is reduced risk materials such as soaps, oils, or selective insecticides. Most of this was mineral or petroleum oil (5.0%), imidacloprid (0.6%), soap (0.3%), borax (0.7%), boric acid (0.3%), and corn gluten meal (0.3%). Mineral or petroleum oil and soap was used probably for mites, scale, whiteflies, aphids and other soft bodied insects. Imidacloprid was probably used for beetle grubs. Boric acid was probably used to bait ants. The corn gluten meal was used as a herbicide.
- 5.9% is broad spectrum insecticides. 4.5% of that is organophosphates, with diazinon accounting for 1.8% and chlorpyrifos 1.0%.
- 1.8% is vertebrate poisons. Most of this was strychnine used for gophers and ground squirrels.
- 0.9% is slug and snail poisons.
- 10.8% of the total is miscellaneous materials including bleach (6.4%), petroleum distillates (1.2%), spreader-sticker (0.5%), dyes (0.4%), and surfactants (0.4%).

Estimated Percentages Used for each Pest Category

- About 72% of the pesticides used on landscapes was used to control weeds and plant disease.
- Only about 13.7% was used for arthropods. Of this, 5.9% was broad spectrum pesticides.

SUMMARY OF CURRENT PESTICIDE USE

Most of the broad spectrum insecticides applied (1,413,940 lbs) for structural pest control in 2000 were used on pests such as termites, ants, and cockroaches. This is more than 17 times the amount applied for aphids, grubs and other landscape arthropod pests (82,330 lbs). Diazinon was the most popular broad spectrum material and accounted for about 36% of the broad spectrum insecticides used in both structural and landscape pest control (519,119 lbs used for structural, 26,664 lbs used for landscape).

Excluding liquid nitrogen, the most popular reduced-risk materials used for structural pest control were boric acid (87,472 lbs or 1.7% of the total pesticides reported for structural use) and disodium octaborate tetrahydrate (DOT) (302,046 lbs or 5.8% of the total). Boric acid is used for cockroaches and ants. DOT is used as a wood treatment to protect against termites, and is sometimes used in ant baits. Very little boric acid (4,06l lbs or 0.3%) and negligible amounts of DOT were applied on landscapes. In landscapes, mineral oil (69,771 lbs or 5% of the total pesticides reported for landscapes) was the most popular reduced-risk material. It is used for mites, scales, whiteflies and other soft-bodied insects.

FUTURE TRENDS IN PESTICIDE USE

As noted above, diazinon and chlorpyrifos are organophosphate pesticides commonly used by pest management professionals. As a result of review by the U.S. Environmental Protection Agency (USEPA) under the Food Quality Protection Act, the availability of diazinon and chlorpyrifos to the general public and PCOs is being phased out. As the USEPA severely restricts the use of diazinon and chlorpyrifos, other chemical pesticides will take their place. Some of these pesticides have properties that would make their increased use a significant concern for water quality. Active ingredients that are likely candidates for substitution and may be cause for concern include malathion, pyrethroids (such as permethrin and cypermethrin), and carbamates.

To have the greatest impact on non-agricultural use of organophosphate and carbamate use and on urban pesticide use that affects water quality, projects should focus on structural pest control with a high priority on ants. (At this time it is unclear how herbicides affect water quality.) As will be seen in the next section, there are a number of reduced-risk alternatives for structural pests.

CURRENT PEST MANAGEMENT PRACTICES AMONG PCOS IN CALIFORNIA

The following are 10 common pest problems that urban pest management professionals are asked to control at their customer sites (residential and commercial). We have based the pests included here on a 1997 survey in Alameda County (Scanlin and Cooper 1997) and on information from our project's advisory team. Included are current professional pest management practices as well as examples of reduced-risk (Integrated Pest Management) practices.

Eric Paulsen, Technical Services Manager for the Pest Control Operators of California provided the majority of the information on current practices in the Structural Pest Control industry. The Bio-Integral Resource Center provided the majority of the information on IPM practices. In some cases current practices and IPM practices overlap indicating the pest management industry already employs some IPM concepts.

Note: The following list of control measures assumes that the pest has been correctly identified.

ARGENTINE ANT

Current Practices of the Pest Control Industry:

- Recommend sanitation and cultural practices

  Clean up after eating and preparation.
  Store food in sealed containers.
  Confine food to eating and preparation areas. (Keep food out of classrooms, offices, bedrooms, etc.)
  Eliminate leaking water pipes and faucets (indoors and outdoors).
  Trash:
  - — Clean indoor & outdoor trash receptacles and use trash bags to aid in this.
  - — Empty indoor trash daily.

- Recommend application of appropriate products (each of the following is used when and where appropriate):

  baits:
  - — Self enclosed baits indoors

- Self enclosed baits outdoors
- Bait granules outdoors on nests, trails, and structural foundation perimeter.

Other Insecticides:

- Indoors: application of contact and ingestion dusts in wall voids and other structural voids where the insects may be living and traveling.
- Indoors: application of contact liquid pyrethroid pesticides when necessary along trails (not done much)
- Exterior: application of liquid and granular pyrethroid pesticides on mounds, trails, and structural foundation perimeter.
- Some professionals may also treat plants for aphids as a means of controlling Argentine ants.

Reduced-Risk Practices:

- Educate customers about how their behaviors influence pest problems.
- Sanitation

  Limit food storage and eating to defined areas.
  Keep areas free of crumbs, grease spatters, food spills.
  Rinse recyclables before storing.
  Empty or seal garbage daily before nightfall.
  During periods of heavy invasion, keep food garbage isolated in sealed plastic bags or ant-proof containers.
  Keep indoor and outdoor garbage containers clean; use plastic liners to facilitate this.
  Keep food and pet food in ant/roach/rodent-proof containers.
  Keep sink clear of dirty dishes and run dishwasher regularly.

- Pest proofing

  Seal entry points.
  Install weather-stripping around doors and windows.

- Physical controls
  Vacuum up ant trails.
  Treat cracks and crevices or wall voids with boric acid or desiccating dusts.
- Cultural controls

  Remove plants harboring honeydew-producing insects from around the perimeter of structures (or control honeydew-producing insects on these plants).
  Use aromatic cedar mulch in landscaping near structures to discourage ants.
- Reduced-risk chemical controls

  Use self-contained baits with the following active ingredients:
  Boric acid, borax, borate
  Hydramethylnon
  Fipronil
  Sulfluramid

  Wipe up ant trails using a citrus oil cleaner.

APHIDS

Current Practices of the Pest Control Industry:

- Chemical controls

  Acephate
  Carbaryl
  Pyrethroids

Reduced-Risk Practices:

- Educate customers to tolerate aphids when circumstances allow
- Biological control

  Monitor for beneficial insects such as syrphid larvae, lacewing larvae, and lady beetle larvae.
  Allow time for beneficial insects to reduce aphid populations.
  Exclude ants from plants infested with aphids to allow beneficial insects to feed on aphids.
- Physical controls

  Prune away colonies of aphids from leaves and buds.
  Wash off honeydew with a forceful stream of plain water.
  Wash off aphids with a forceful stream of plain water.

- Cultural controls

  Use slow-release fertilizers to prevent spurts of new growth that are very attractive to aphids.
  Avoid excessive pruning that stimulates new growth.

- Reduced-risk chemical controls

  Insecticidal soap
  Horticultural oil

GERMAN COCKROACH

Current Practices of the Pest Control Industry:

For the German cockroach, the industry uses the practices listed under "Reduced-risk Practices" with the addition of crack and crevice pyrethroid treatments where appropriate.

Reduced-Risk Practices:

- Educate customers about how their behaviors influence pest problems.
- Sanitation

  Limit food storage and eating to defined areas.
  Keep areas free of crumbs, grease spatters, food spills.
  Rinse recyclables before storing.
  Empty garbage daily before nightfall.
  Keep dumpsters clean.
  Keep food and pet food in ant/roach/rodent-proof containers.
  Keep pet food and water dishes empty at night.
  Keep sink clear of dirty dishes and run dishwasher regularly.
  Repair dripping faucets and leaky pipes, especially in kitchen.

- Monitor with sticky traps to determine harborage, areas of highest population, population trends.
- Pest proofing

  Caulk cracks and crevices—begin in areas of highest populations.
  Install weather-stripping around doors and windows.
  Install screens on doors, windows, and vents.
  Install door sweeps.
  Seal runways along pipes, conduits, electrical wires, heating ducts.

- Habitat modifications

  Eliminate clutter (especially corrugated cardboard).
  Install roach-proof fixtures and appliances.
  Eliminate sources of water.

- Physical controls

  Vacuum up roaches, egg cases, and droppings from harborage.

- Reduced-risk chemical controls

  Treat cracks and crevices or wall voids with boric acid or desiccating dusts.
  Apply insect growth regulators and use in conjunction with baits.
  Use self-contained bait stations and gel baits with the following active ingredients:
    - Boric acid
    - Hydramethylnon
    - Fipronil

FLEAS

Current Practices of the Pest Control Industry:

- Identify source of fleas: pets; rodents, other wildlife.
- Have pets professionally bathed.
- Have pets treated for fleas by vet, or a pest management professional.
- If the source of fleas is identified as wildlife, implement pest management solutions to control the wildlife.
- Identify customer concern: are the fleas attacking people or are the fleas only on pets? If the fleas are found only on pets, an IGR maybe the only pesticide needed.
- Identify locations of fleas: indoors or outdoors or both.
- Recommend cultural and sanitation practices.

  Initially vacuum or shampoo all carpets and upholstered furniture paying special attention to carpet edges, the area under cushions on upholstered furniture, the areas immediately in front of furniture, and any areas where pets like to lie.
  Continue with daily vacuuming to stimulate fleas to emerge from their pupal casing
  Vacuum edges of hardwood floors or other areas where there may be accumulations of animal hairs.
  Wash or dispose of pet bedding

- Indoor pesticide application

  Treat carpets with an IGR when appropriate.
  When necessary, treat carpets with a registered liquid adulticide (this practice not used much).

- Exterior pesticide application

  When necessary treat shady areas where animals and fleas congregate.

Reduced-Risk Practices:

- Educate customers about how their behaviors influence pest problems,
- Inspect/monitor to determine areas of highest population and source of problem,
- Inspect for presence of wild animals or rodents in or under structure.
- Biological controls

  Use nematodes (*Steinernema carpocapsae*) outdoors in areas of highest flea population.

- Physical controls

  Remove wild animals or rodents.
  Seal structure to prevent animals from getting in.
  Confine pets to limited areas if infestation is severe or people are particularly sensitive to flea bites.
  Restrict pets to a regular sleeping space and concentrate cleaning in this area.
  Vacuum regularly, especially carpet, upholstered furniture, and cracks & crevices; during periods of heavy infestation, vacuum daily.
  Wash pets with pet shampoo and water, insecticidal shampoos are not necessary.
  Use washable pet bedding and wash weekly.
  Educate customers to use flea combs.

- Reduced-risk chemical controls

  For pets, give lufenuron orally or administer spot-on treatments containing fipronil or imidacloprid.
  Shampoo carpets and upholstery with a borate carpet treatment.
  Spot treat with insect growth regulators.
  Spot treat with d-limonene.

RATS AND MICE

Current Practices of the Pest Control Industry:

The description under "Reduced-Risk Practices" summarizes traditional rodent control, with these additions:

- There are many situations where indoor baiting is also appropriate.
- If the property is not rodent proofed, there will be an ongoing rodent problem, and the property will need maintenance. There are also many customers who will not cooperate with or directly refuse many of the sound pest management recommendations that are needed to control the pests. In these cases baiting is used. Anticoagulant baits are placed in (usually secured) tamper-proof bait stations.
- Many properties use perimeter baiting in secured tamper-proof bait stations to lower the native populations of rodents and reduce the rodent 'pressure' on structures in the vicinity.

Reduced-Risk Practices:

- Educate customers about how their behaviors influence pest problems.
- Sanitation

  Limit food storage and eating to defined areas.
  Keep areas clean.
  Reduce food availability (e.g., pet food dishes with food remains left outside).
  Use plastic liners for garbage cans with food wastes and seal before disposal.
  Empty garbage daily before nightfall.
  Remove pet waste promptly.
  Remove fallen fruit and nuts.
  Keep dumpsters and garbage cans clean.
  Keep lids on dumpsters and garbage can when not in use.
  Keep food, pet food, grass seed, and bird seed in ant/roach/rodent-proof containers.

- Pest proofing

  Keep the exterior skin of the structure in good repair to prevent entry.
  Seal holes down to the diameter of a pencil.
  Install weather-stripping around doors and windows.
  Install screens on doors, windows, and vents.
  Install door sweeps.
  Seal runways along pipes, conduits, electrical wires, heating ducts.
  Repair broken sewer pipes.
  Install drain caps.

- Trapping
- Habitat modifications

  Keep vegetation 12 to 18 inches away from buildings.
  Trim tree branches that might allow rodents access to the roof.
  Avoid low dense ground covers, especially ivy, that can provide covered runway.
  Eliminate clutter and debris.
  Eliminate sources of water.

SPIDERS

Current Practices of the Pest Control Industry:

- Exterior control:

  Sweep or vacuum spiders and spider webs from eaves, and other areas.
  Treat around windows, doors and eaves with a pyrethroid to minimize re-occurrence.
  When appropriate, treat shrubbery where spiders are located.
  Identify and eliminate food sources:
    - If source of food is insects attracted to exterior lights; possibly move lights to an exterior pole with the light illuminating the doorway.
    - Crickets and other insects are sometimes the food source.

- Interior control:

  Vacuum or sweep webs.
  Treat applicable areas with a liquid pyrethroid insecticide (typically in warehouse situations).
  Dust attics and sub areas with a dust insecticide where appropriate

Reduced-Risk Practices:

- Pest proofing

  Keep the exterior skin of the structure in good repair to prevent entry.
  Seal entry points.
  Install screens on doors, windows, and vents.
  Install weather-stripping around doors and windows.

- Habitat Modification

  Find and eliminate food sources.
  Change outdoor lighting to reduce numbers of insects attracted to lights, especially in problematic areas.

Clean regularly and eliminate clutter inside.
Remove debris piles and litter outside.
Seal cracks and crevices.

- Physical Controls

  Vacuum or sweep away spiders and webs both indoors and outdoors

WASPS

Current Practices of the Pest Control Industry:

- Educate consumer about the problem wasp.
- For wasps that establish nests in or on structures, in vegetation, or in the soil:

  Treat with a pyrethroid aerosol or professional fogger.
  Treat with a dust such as drione, or other registered product such as a pyrethroid.
  Remove nest.
  Wasp/bee proof the structure.
- For other outdoor nuisance wasps:

  Bait traps

Reduced-Risk Practices:

- Educate customers about how their behaviors influence pest problems and about how to avoid stings.
- Sanitation

  Limit food storage and eating to defined areas.
  If food is consumed outside, sugary drinks should have lids and straws.
  Keep areas clean.
  Outside garbage cans should have removable domed tops with vertical spring-loaded swinging doors.
  Use plastic liners in garbage cans.
  Empty outside garbage frequently enough to prevent garbage from impeding closure of the doors.
  Keep garbage cans and dumpsters clean, both inside the can and on the surface.
- Pest proofing

  Keep the exterior skin of the structure in good repair to prevent entry into wall voids.
  Seal entry points.
  Install screens on doors, windows, and vents.
  Install weather-stripping around doors and windows.
- Nest removal

  Vacuum wasps from nest (done by professionals using appropriate safety precautions) and dig out nest or dust with silica gel.
  Kill nest with pyrethrin aerosols followed by a dusting with silica gel.

- Trapping

  Set traps where they will attract yellowjackets away from areas of human activity. (This is most useful for short periods for specific outdoor events where nest removal has not been effective or is impractical. Traps should be removed after the event. In general, it is difficult to control yellowjackets by trapping.)

- Area-wide poison baiting

  Monitor in spring to determine population levels: 35 to 40 yellowjacket workers per trap in 4 hours indicates high populations and poison baiting may be necessary.

WEEDS

Current Practices of the Pest Control Industry:

- Physical/Mechanical controls

  Cultivation
  Mowing
  Hand pulling
  Mulch

- Chemical controls

  Glyphosate
  Oryzalin
  Various other herbicides

Reduced-Risk Practices:

- Educate customers to tolerate some weeds.
- Redesign landscapes to reduce weed habitat.
- Biological controls

  Plant-feeding insects for yellow starthistle and some other weeds

- Physical/Mechanical controls

  Cultivation
  Mowing
  Hand pulling
  Mulch
  Weed fabric; horticultural paper
  Steam
  Flaming

- Cultural controls

  Change irrigation and fertilization practices to reduce weeds.
  Raise mow height in turf to shade out weeds.

Improve drainage.
Keep areas of bare soil to a minimum; cover with dense plantings or mulch.
Limit the weed seed bank by cutting weeds before they flower and set seed.
Avoid introducing invasive plants into the landscape.

- Reduced-risk chemical controls

  Pelargonic acid
  Herbicidal soap

WHITE GRUBS (LARVAE OF MASKED CHAFERS)

Current Practices of the Pest Control Industry:

- Chemical controls

  Imidacloprid
  Carbaryl
  Triclorfon
  Chlorpyrifos
  Diazinon

Reduced-Risk Practices:

- Biological controls

  Apply beneficial nematodes (the species *Heterorhabditis bacteriophora*).

- Cultural controls

  Keep turf healthy and growing vigorously.
  Use warm-season grasses or turf-type fescues; they are more tolerant of white grub infestations.
  Correct poor drainage.
  Aerate regularly.
  Avoid compaction, install walkways on heaviest traveled areas.
  Keep thatch from accumulating by mowing frequently and removing only 1/3 of the leaf blade at any one time; leave clippings on lawn.
  Dethatch when necessary.

- Reduced-risk chemical controls

  Spot treat with imidacloprid.
  Spot treat with imidacloprid plus beneficial nematodes.

TERMITES

Current Practices of the Pest Control:

Drywood Termites:

- Local treatments vs. whole house fumigation

Where the colony is clearly limited to a local area and the wood members are accessible, a local treatment strategy may be appropriate along with the explanation that there may be other colonies, which will not be affected.
Where there are multiple colonies located in multiple sites throughout the structure, fumigation is appropriate.
Situations that don't fall under the first two descriptions, should be treated by fumigation; or a local treatment should be performed with the caveats that the treatment may not work, and there are likely other colonies which will not be affected.

- Fumigation

  Vikane or methyl bromide are most commonly used.
  In some situations heating the entire structure may also be effective.

- Local treatments

  A wide variety of local treatments may be used depending on the circumstances.

  Drilling into the termite galleries and injecting an insecticide
  Injecting a borate insecticide foam into the wall void
  Injecting liquid nitrogen insecticide into the wall voids
  Registered alternative devices: additionally there are a number of other strategies, which are often used in conjunction with local pesticide applications, or in some cases used alone. These devices are currently undergoing a registration process to document efficacy and proper use. These devices include:
  Microwaves
  Heat
  Electricity

Breakdown of treatments for drywood termites:

- Approximately 75% of treatments are local.
- Of the 75% local treatments, about 5+% are from alternative devices.
- The other 25% of treatments are fumigation.

Subterranean Termites:

When there is already an infestation:

- Local chemical treatment – a registered insecticide (pyrethroids and newer compounds) is injected into the soil in the areas where there is evidence of the termites entering the structure.
- Complete treatment: treatment of the local area, and treatment around the perimeter of the foundation, and piers with a registered insecticide (pyrethroids and newer compounds) to provide protection for the whole structure.
- Local or complete treatment with the addition of termite baits. This normally continues as a monthly baiting service until the consumer no longer desires the monitoring.

Preventive Controls:

- Inject soil with a registered termiticide (chlorpyrifos and other chemicals can be used) prior to laying the foundation
- Eliminate direct contact between soil and wood.

- Store wood piles as far from structure as practical.
- Remove all cellulose debris from under structure.
- Use termite baiting with monthly monitoring.

Reduced-Risk Practices:

Prevention for Drywood and Subterranean Termites

- Monitor structure periodically to detect termite presence or conditions that can lead to infestation.
- Reduce moisture level of wood in structure by:
  - fixing leaks, gutters, drains, downspouts, etc.
  - improving drainage around structure
  - improving ventilation
  - changing irrigation and landscape practices that cause water damage to structure or increase water collection near structure
- Eliminate direct contact between soil and wood.
- Replace damaged wood with borate treated wood.
- Replace wood with aluminum, concrete, or vinyl in areas most vulnerable to moisture.
- Remove stumps and other wood debris from under and around the structure.
- Store wood piles as far from structure as practical.
- Plant trees and shrubs away from buildings to insure proper air circulation and reduce moisture retention in building.
- Screen vents.
- Maintain buildings in good repair.

Dry Wood Termites:

Physical controls

- Fumigate with heat. This is usually as a spot treatment because whole house treatments are expensive.

- Spot treat with
  - Electricity
  - Microwaves
  - Liquid Nitrogen
- Treat wall voids with desiccating dusts such as silica gel.

Least hazardous chemical controls
- Borate-based wood treatments

Subterranean Termites:

Physical controls
- Use pre-construction barriers such as stainless steel mesh and sand.
- Treat wall voids with desiccating dust such as silica aerogel.

Reduced-risk chemical controls
- Borate based wood treatments
- Termite baits with the following active ingredients: (Note: to be effective, termite bait stations must be closely monitored)
  - Diflubenzuron
  - Hexaflumuron
  - Sulfluramid

ACCEPTANCE OF IPM AMONG PCOS: BARRIERS AND SOLUTIONS

Although some pest management professionals are concerned that IPM is just another way of limiting their access to tools (i.e., pesticides), in reality, adopting IPM will expand the range of options for attacking pests, options that are more effective in the long run. PCOs are already using many IPM methods without necessarily designating them as such. Techniques such as pest exclusion, cockroach baiting, and sanitation have been mainstays of their profession for years. Other proven IPM methods exist and could be more widely used.

Unfortunately, both the public and many pest management professionals lack a clear understanding of the principles of IPM. Because of this lack of understanding, along with inadequately trained technicians, lack of information on size of market and profitability, fear of losing customers who may not be satisfied, and lack of any regulatory mandate, there is little incentive to adopt IPM practices.

It will be necessary to develop the market for IPM services at the same time we try to increase the number of PCOs practicing IPM. Marketing IPM and educating the public can proceed through existing channels in the community such as homeowner associations, real estate transactions and associated inspections, unions, internal outreach within organizations and companies, and parent networks. We can also enlist the help of environmental activist groups, and public agencies, especially pollution prevention agencies, in publicizing the benefits of IPM and certified IPM providers.

IPM requires better trained employees which can lead to greater employee retention. Better trained personnel will increase respect for the industry. Pest prevention services and monitoring can be sold to the customer as "pest insurance," and pest exclusion services can often be performed during the winter when other pest management business is slow. A pest prevention assessment coupled with exclusion and other kinds of pest prevention could be offered as a yearly service. Most PCOs provide a regular monthly service to their customers. Switching to a quarterly service can save on fuel and allow technicians time to monitor for problems, educate the customer on reduced-risk practices, and perform preventive maintenance. Quarterly pest management visits could be more profitable for the PCO and, at the same time, satisfy customers who want more attentive service.

BARRIERS TO CUSTOMER ACCEPTANCE OF IPM

- The definition of IPM is unclear, and the focus in society has been on eliminating pesticides.

  IPM is more than just eliminating or reducing pesticide use.
  IPM is more than just using "softer" pesticides.
- Among potential customers, there is a poor understanding of what an IPM approach is.

  Customers want a quick fix—a silver bullet—because they fear pests, fear loss of property or property value, and often have been trying to solve the problem themselves for some time.
  IPM is perceived to be more complex than just using a pesticide and may take more time to implement.
  IPM may be perceived as less effective.

Monitoring may be perceived as "doing nothing" and therefore, customers may be unwilling to pay for it.

- Many customers are apathetic.

  They don't care how the pest problem is solved.
  They are unwilling to participate in the solution, although this is usually necessary to actually solve the problem.
  Finding a company that uses IPM may take more effort than a customer is willing to exert.
  Advertising IPM services is hampered because of regulations (can't use the term "safe" in any way).
- Fraudulent claims have been made about termite baiting systems. This type of fraud can have a negative effect on the acceptance of IPM.
- The marketing of IPM is often focused on how bad pesticides are, rather than on the nature of IPM solutions.

BARRIERS TO PCO ACCEPTANCE OF IPM

- The definition of IPM is unclear and the understanding of the IPM approach is low.

  The focus among many PCOs is the end solution and not the decision-making process that is IPM.
  PCOs may feel that IPM will limit their access to tools (i.e. pesticides) that they need to do their job.
  There may be a narrow understanding of pest problems and solutions.
- IPM requires an attitude change by owners and technicians.
- PCOs are concerned about losing customers who will not be satisfied with IPM.
- PCOs have a lack of skill in using the IPM decision-making process.

  Using an IPM approach takes more skill, patience, and experience and involves many new products.
  Using pesticides is easier.
- Technicians are inadequately trained.

  Technicians may lack knowledge of pest I.D. and pest biology.
  Technicians may lack knowledge of alternatives that already exist.
  Technicians may lack creativity to "think outside the box."
  Current training focuses on traditional methods.
  A comprehensive source for IPM training is lacking.
- Information comes primarily from the suppliers of traditional pesticides and from chemical companies.
- Funding for research on innovative tools or techniques for IPM is lacking.
- The economics of IPM hinders its acceptance.

  Few studies have been done on the profitability of IPM.
  There is no model of a large company profitably switching to IPM.

The profit margin for PCOs is small.
Labor costs make up a large part of a PCOs operating budget. Pay is low and turnover high.
Labor costs would increase for IPM services because technicians would have to be better trained and would have to spend more time per client.
There are other costs, such as equipment and training, associated with adding IPM services.
IPM can be profitable for long-term clients, such as commercial accounts, homeowner associations, and public agencies. It is unclear whether or not IPM can be profitable in the current system for homeowners who are often one-time clients and comprise 80% of the market.
In situations where the lowest bidder is always chosen, it is impossible to do IPM.
There is a market for IPM, but it is unclear how large it is. PCOs perceive IPM to be profitable only in "niche" markets.

- No regulatory incentives for adopting IPM exist.
- Advertising regulations make it difficult for PCOs to let people know they provide IPM.
- Health Department standards may not be consistent with IPM solutions (e.g. a restaurant may be closed down if one roach is seen in a monitoring trap).

SOLUTIONS AND STRATEGIES FOR INCREASING CUSTOMER AND PCO ACCEPTANCE OF IPM

- Help PCOs to view IPM as a creative, problem-solving approach.
- Make PCOs aware that if they don't adopt IPM now, legislation may force them to later. Legislation could stifle creative solutions and innovations. Marketing IPM to PCOs in that way may increase adoption.
- Educate PCOs and the general public to view IPM as an activity that engages the customer in the effort of pest management. There are no "silver bullets" in pest management and long term solutions cannot be implemented without the help of the customer.
- Educate PCOs to move away from focusing on the end result (the quick solution) and, instead, to focus on the IPM process which will result in a long term solution.
- Have PCOs plan on spending more time with new customers in the beginning, emphasizing prevention and explaining the IPM approach, but not necessarily using the term IPM.
- The supply of IPM service providers must be developed at the same time that the demand for IPM services from customers is promoted.
- Market IPM and educate the public through existing channels in the community. Provide information and education through the following:

  Realtors, real estate transactions, and associated inspections
  Homeowners' associations
  The work place
  Unions
  Internal outreach within organizations and companies
  Parent networks and groups

- Look for other advocates to help sell IPM, such as public agencies and environmental activists organizations.
- Develop fact sheets, sample contracts, and handouts that can be used in marketing and customer education.
- Educate PCOs and the general public to consider IPM as pest prevention.
- Have PCOs market IPM to customers as prevention/insurance (hiring the PCO to prevent pests, not only to kill them).
- Have PCOs market IPM services to property management entities to protect real estate investments.
- Begin with a pilot program to show PCOs that IPM can be profitably incorporated into their existing business structure. More research is needed on whether it is best to start with the homeowner market or larger commercial and public agency accounts. Homeowners are 80% of the market, but they are more likely to be one-time clients. The amount of driving time involved with homeowner accounts is greater, and the current price per stop is quite low. All these factors make it harder for PCOs to make a profit in this sector. In addition, there are few compelling incentives for customers to change to IPM. Two reasons for change are fear of pesticides and their effects on family health a desire to "do the right thing" environmentally.

Commercial and public agency accounts are a smaller percentage of the market, but the potential is there for PCOs to charge a premium for IPM services. More and more municipalities and public agencies are instituting policies requiring IPM. These clients are long-term and selling preventive services should be easier. Furthermore, driving time and therefore fuel costs are lower for this market.

Develop a model, particularly for larger companies.
Start with larger, long-term customers.
Don't ignore the homeowner market since it provides the majority of the business.
Use termite baiting as one example of conversion to IPM and find other examples of successes.
Market to public agencies and other "niche" markets.
Market IPM services to schools. They may be receptive because of the Healthy Schools Act.

- Raise the level of existing licensing requirements.
  - Increase the difficulty of licensing exams to encourage better training.
  - Include a substantial number of questions on licensing exams that will test knowledge of IPM.
  - Raise standards in IPM contracting (in the commercial market).
- Transform the industry.

  Have PCOs market themselves as pest control consultants and not as pesticide applicators.
  Help PCOs look at the long-term opportunities/trends of the market, including the future regulatory framework that may mandate IPM.
  Provide comprehensive IPM training programs coupled with certification.
  Focus on the practices of IPM rather than just using the term IPM.
  Move away from the notion that pesticides are "evil." Generate demand among consumers and credibility with PCOs by focusing on the benefits of IPM.
- Use the following selling points to PCOs to encourage inclusion of IPM services in their businesses:

  IPM requires better trained employees, which means better employee retention.

Better trained personnel means more respect for the industry.
Switching to quarterly service visits can save on fuel and allow the technician more time with the customer to monitor for problems, educate the customer, and perform preventive services.
IPM gets the customer involved, makes them happier (because the problem is solved and they have received personal attention), and makes them more likely to be a long term client.
IPM means more profit potential (this will have to be proven).
Preventive services and monitoring can be sold as "pest insurance" to the customer.
Pest exclusion can be added to the PCO's list of services. Exclusion services can often be performed during the winter when other pest management business is slow. A pest prevention assessment coupled with exclusion and other kinds of pest prevention can be offered as a yearly service.
A niche market for IPM exists already and can be exploited. All trends indicate that this market will grow.

- Consider how products are marketed to consumers.

  Cultural differences may affect what consumers choose (e.g. pictures and/or language on labels).
  It is important to educate consumers at the retail supplier (e.g. at the store where alternative products could be available).

- Work to integrate IPM into the biology and health curricula of all educational levels.

IPM TRAINING AND CERTIFICATION: BARRIERS AND SOLUTIONS

Without regulatory mandates, PCOs may be reluctant to invest the time in voluntary IPM training and certification, especially if they cannot see a financial advantage in doing so. Currently there is a shortage of enthusiastic, high quality IPM trainers who can inspire their students. There are few training programs that teach an IPM decision-making process or that encourage trainees to experiment with creative solutions to pest problems. The listing of courses approved by the Structural Pest Control Board shows relatively few on structural IPM, particularly for general audiences who might not be a part of an association or in-house training program. A limited review of some of the junior colleges in California revealed that no structural pest control courses, IPM oriented or otherwise, are being offered.

IPM certification is well underway in many states, and we can learn much from their successes and failures. Certification in California could also follow the historical path of the California Certified Organic Farmers which began as a voluntary process through a private organization and has progressed to legislation of organic standards at both the state and federal level. Standards for certification as well as training must be discussed and determined.

To increase the number of qualified IPM trainers and practical, hands-on training courses, apprenticeships could be sponsored with the best IPM trainers in the state. Funds can be secured to find potential trainers from among the most progressive PCOs and pest management consultants who would be willing to design IPM courses that meet the pre-determined standards.

BARRIERS IN PROVIDING/CREATING IPM TRAINING FOR PCOS

- PCOs are reluctant to commit the time necessary for IPM training.
- There is a shortage of high quality IPM trainers.
- Much of the existing training is from chemical suppliers who have no incentive to advocate/train for something that will decrease sales of their current products.
- Many PCOs cannot see IPM as the wave of the future; they see it only as a small niche market.
- There is a perception that IPM is not as profitable as conventional pest control.
- It is easier to do what has been done in the past.
- There is a lack of a commonly agreed upon standards for what constitutes IPM; therefore it is unclear what kind of training is needed and how much.

ISSUES AND SOLUTIONS FOR PROVIDING/CREATING IPM TRAINING

- Convene a panel of experts to discuss what might constitute a thorough IPM training course.
- Design workshops with hands-on exercises involving real life problems and employ the best teachers so the training will be more attractive to PCOs.

- Secure funds to develop training programs. Seek potential trainers from among the most progressive PCOs and pest management consultants and ask them to design training programs that conform to the determined standards. This is one way to increase the pool of IPM trainers.
- Sponsor apprenticeships with the most skilled IPM trainers in California.
- In designing training, consider who is being trained and understand their roles in a pest control company. The technician/applicator provides the basic service and the field representative assesses the biological/ecosystem issues.
- In targeting training, one strategy is to do initial trainings for operators/owners, who would then direct their company personnel to attend training in IPM.
- Potential IPM training topics include the following:

  The IPM decision-making process and how to apply it to any situation
  How to make an IPM plan for a client
  Monitoring: why it should be done, how it should be done, and how to sell it
  How to find the cause and source of problems and what to do to prevent future problems
  Rodent and insect biology that is directly related to management
  Pest exclusion methods and products
  Reduced-risk products and how and when to use them
  Landscape pest management, especially those aspects that have effects on structural pest management such as managing honeydew-producing insects on plants near structures to reduce ant invasions and keeping vegetation away from buildings to reduce problems with rodents, birds, and moisture.
  Marketing IPM services
  Customer relations
  Communication skills
  Hiring and training IPM technicians: some of the characteristics of an ideal technician are self-motivation, good communication skills, a willingness to experiment, knowing when to ask questions, and the ability to make the customer feel comfortable and to inspire confidence in IPM.

SURVEY OF CURRENT IPM TRAINING

To understand the kind of IPM training currently being offered, we undertook a survey of both the California Structural Pest Control Board and the Department of Pesticide Regulation approved IPM continuing education courses. The list of courses is presented in the Appendix A. Courses were included in the list when it was obvious from their titles that an IPM topic was presented. Only urban IPM courses were included. No doubt many additional courses contained valuable IPM information, but this could not be discerned from the title. The complete course listings can be viewed at the following web sites: www.pestboard.ca.gov/ceaa2.pdf and www.cdpr.ca.gov/docs/license/classes.htm.

There seem to be relatively few structural IPM courses approved, particularly for general audiences who might not be part of an association or an in-house training program. A limited and informal review of some of the junior colleges in California found that there were no structural pest control courses, IPM oriented or otherwise, being offered. Fresno City College had apparently developed a course but since

not enough students showed interest, it was dropped. A review of their course listings did not show any offerings for pest control professionals.

BIRC has developed and offered an IPM workshop for PCOs and public agency personnel that was sponsored by the Central Contra Costa Sanitary District and pollution prevention agencies around the San Francisco Bay. Taught by PCOs who are experts in their field, the day-long workshop concentrates on IPM strategies for ants, cockroaches, and spiders along with exclusion techniques for all pests. The workshop has at various times also included a session on marketing IPM services presented by Dr. John Ball, a professor at South Dakota State University.

BARRIERS TO DEVELOPING A CERTIFICATION PROGRAM

- PCOs may not be willing to invest the time and may not see the value in participating in a voluntary certification program.
- There are issues of legitimacy and practicality:

  What entity should take the lead?
  Who/what entity has the credibility to take the lead?
  Certification needs to be current and updated regularly.

ISSUES AND SOLUTIONS FOR DEVELOPING A CERTIFICATION PROGRAM

- Evaluate the economic benefits of developing a certification system. This study could provide an incentive for developing certification and could be conducted by the PCO industry.
- "Stakeholders" – community and non-governmental interest groups – could work with industry to help them initiate discussions on developing an IPM certification program.
- Decide who will be certified, the individual or the company.
- Convene a panel of experts to determine standards for IPM certification (see below).
- Ideally, certification should be mandatory, but this may take a very long time to accomplish.
- PCO certification could follow the model of organic grower certification, which began as a voluntary process through a private organization and has progressed to organic standards legislation at both the state and federal level.
- Potential elements of a certification program could include:

  A standard test
  A continuing education requirement
  Several tiers of certification depending upon the knowledge and experience of the PCO

CREATING STANDARDS FOR IPM SERVICES

The American Society for Testing and Materials (ASTM), a not-for-profit corporation organized in 1898, manages the development of standards and related technical information for materials, products,

systems, and services (www.astm.org). It provides a legal, administrative, and publications forum within which producers, users, ultimate consumers, and representatives of government and academia can meet on a common ground to develop standards that meet the needs of all concerned.

A written request, which describes the need for the proposed activity and lists individuals, companies, and organizations that might have an interest in it, must be submitted to ASTM headquarters. The ASTM staff then researches the project to assess whether there is adequate interest, to discover if parallel activities exist in other organizations, and to determine where the activity would appropriately fit within the ASTM structure. Standards are written by volunteer committee members guided by an ASTM facilitator. Time needed to complete a set of standards is usually about two years.

ASTM recently assisted the biocontrol industry in the development of standards for natural multi-cellular biological control organisms.

SURVEY OF CURRENT CERTIFICATION PROGRAMS IN THE UNITED STATES

Certification programs around the country can provide useful information for developing IPM certification for California PCOs. Certainly components of other certification programs and lessons learned in their development can guide further work on this project.

IPM certification programs in the U.S. are divided among the following groups:

- Structural pest control professionals, including separate IPM certification or IPM training requirements as part of standard licensing
- Landscape and turf management professionals
- Inspectors of IPM practices by individuals, businesses and institutions
- Schools and public buildings

This review is not intended to be exhaustive but we feel it is comprehensive enough to represent different areas of the country. Much emphasis is being placed on school IPM around the country. For example, 16 states have provisions that either require or recommend that schools develop and implement IPM programs.

We begin with organic certification for agricultural products in California as a possible model for IPM certification for PCOs and continue with IPM certification programs in other states.

California Certified Organic Farmers (CCOF)

In 1973 a group of 90 California organic farmers came together to develop organic farming standards and inspection requirements. Marketplace fraud was becoming a major concern, and as the organic produce market expanded, customers needed assurance that produce was indeed farmed organically. Initially, organic farmers themselves performed farm inspections, but now inspectors licensed by the Independent Organic Inspectors Association (IOIA) complete the initial inspections and a committee from the CCOF reviews the inspection reports. Standards are carefully enforced. A recent CCOF newsletter listed three farms whose certification had recently been suspended.

CCOF's newsletter along with its 15 local chapters give growers an opportunity to learn more about organic farming and network with colleagues. Today there are 600 grower members of CCOF with more than 70,000 acres under organic cultivation.

The steps involved in certification are as follows:

1. Complete the application available on line at www.ccof.org.which includes a three year land use history.
2. Read the CCOF manuals (also available on line) which contain a list of the organic standards such as soil humus content and length of period pesticides have not been used.
1. Register with the County Agricultural Department.
2. Pay an application fee.
3. The application is reviewed by CCOF staff and assigned to a local CCOF chapter. An inspector calls for a site inspection and an inspection fee is paid.
4. The local chapter and the CCOF reviews the inspection report and assigns a certification status. Organic grower certification or certified transitional can be assigned along with conditions.

Marin Organic Certified Agriculture (MOCA)

Marin County is one of the first counties to offer organic certification through its Agricultural Commissioner's office. MOCA offers certification to organic operations that meet the requirements of the Organic Foods Act of 1990 and the National Organic Program regulations (www.ams.usda.gov/nop/). Areas of operation in which applicants may seek certification are crops, wild crop harvesting, livestock, and handling. Each applicant must complete an application and submit an application fee. On-site inspection is scheduled, and inspection and mileage fees paid. Once the applicant is certified, an annual membership fee is due. Operators must apply annually for certification renewal which includes an organic system plan update questionnaire and an on-site inspection.

Arizona Structural Pest Control Commission

The Arizona Structural Pest Control Commission (ASPCC) is embarking on a project to introduce IPM training as part of the PCO certification and continuing education program (http://ag.arizona.edu/aes/mac/education). Final products of the of the project will include a PCO training CD and internet delivered reference materials. The multi-year project will result in a web delivered, interactive teaching aid providing PCOs with on-line continuing education units and certification. Faculty from the University of Arizona and the ASPCC will combine efforts in generating content for the project. The project strives to have IPM training materials available to PCOs before legislation makes IPM certification mandatory. The objective is to reduce the incidents of improper and excessive pesticide use.

In addition to the above training materials, another project will provide a pest identification service for homeowners and PCOs. Arthropod samples will be submitted to county extension offices with a "bug information" sheet. Samples and the information sheets will be sent to the appropriate identification clinic if the county agent is not able to identify the specimen. Information on specific arthropod biology and IPM recommendations will be provided to the submitting client. The service will be promoted through school newsletters, county extension offices, and retail stores such as Home Depot.

New England Pest Management Association

The New England Pest Management Association (NEPMA) has developed an IPM Registry which educates, tests, evaluates, registers, and promotes practitioners and businesses that practice IPM (www.nepma.org/pages/registryconsumer). The Registry grew out of two years of work by structural pest control professionals to define what it means to practice structural IPM.

Training sessions are held on the underlying principles of IPM, inspection, monitoring, cultural recommendations, appropriate treatments, and record keeping. In the past year, 61 professionals and 24 businesses met the qualifications for the IPM Registry. The IPM Registry requires that businesses provide proof of inspection and monitoring, cultural recommendations, appropriate treatments, consumer education, and record keeping.

Registered practitioners and businesses receive patches, vehicle decals, and certificates to promote their membership. The Registry is promoted to the pest management industry in various ways. A consumer brochure, explaining the concepts of IPM and the IPM Registry was produced and distributed to Registry members for them to distribute to their customers.

Washington State University IPM Certification Program

The Washington State University (WSU) IPM Certification Program promotes ecologically sound pest management practices through education and certification of landscape and turf maintenance professionals (www.pep.wsu.edu/ipmcert.htm). Landscape professionals are provided training on the cultural requirements of the plants being grown and the biology of the pest problems. They are trained to develop a site survey and IPM plan, improve plant health through cultural strategies, monitor pest populations, maintain records, and determine when pesticide use is appropriate in an integrated approach.

WSU IPM Certification can be obtained by completing 30 hours of IPM training offered through WSU Cooperative Extension. In addition to basic IPM instruction, participation in hands-on IPM workshops is required. Courses certified in the program must:

- Contain research-based information with practical application
- Promote minimizing harmful environmental effects of pest control
- Outline IPM strategies which use cultural practices, biological pest controls, and resistant varieties when available

South Coast (Santa Barbara) Green Gardener Certification Program

The Green Gardener Certification Program (www.greengardener.org) is a regional program designed to offer education, training, certification, and promotion of participating gardeners and landscape contractors to:

5. Improve resource efficiency and reduce pollution landscape sites
1. Improve the health, appearance, and value of landscapes for customers and site managers
2. Provide economic incentives to program participants, both gardeners and their clients

In order to be certified, gardeners attend an 8 hour training session covering topics on sustainable landscaping practices including water efficient landscape principles, green waste reduction, and minimizing runoff of pollutants. They must pass an exam given at the end of the class. The training is

held twice a year in both English and Spanish. Annual renewal requirements are met by attending a specified number of continuing education classes and submittal of customer feedback forms.

Program administration is by the Community Environmental Council. Certification is for an individual, however a certification listing includes the individual's company name. Promotional materials to clients include a brochure, an informational packet, and a self-critique check list to review current gardening practices. Several public agencies provide a list of certified gardeners to the public on request. A Green Gardener logo is provided to gardeners for self promotion.

IPM Institute of North America

The IPM Institute is a non-profit organization formed in 1998 (www.ipminstitute.org). The Institute's programs are designed to educate consumers and pesticide users about IPM, encourage self-evaluation by IPM users and provide verifiable certification for products and services meeting the highest standards for safe and effective pest management. The Institute offers services to participating organizations and certifies categories of IPM inspectors and IPM managers. Participating organizations are members of the IPM Institute and use IPM as a qualifying requirement for participants in the organization's IPM program.

Inspector classifications include Community IPM and Agricultural IPM and they verify compliance with the participants in the organization's IPM program. IPM manager is a classification available to professionals providing IPM consulting services, but not product sales, to clients.

Participating organizations agree that verification of participant compliance will include a site visit, review of IPM, pesticide, and other records as needed, and an interview with the participant. A summary report is prepared by the inspector and given to the participating organization. Participant verification is annual the first three years and may be reduced to every three years thereafter. IPM Managers are certified at the same frequency by checking records and conducting site visits to at least 10% of the IPM Manager's clients.

Participating organizations also agree to provide oversight of certified inspectors and managers working with participants by independently spot checking at least 2% of the participants or clients. A complaint and disciplinary action process is also part of the Institute's guidelines for certification.

The Institute provides periodic training of certified inspectors, has minimum standards for education and experience, and requires at least 12 hours of approved training every 3 years.

Massachusetts Department of Food and Agriculture

In 1998 the Massachusetts Department of Food and Agriculture mandated IPM in all State owned buildings (www.massdfa.org/pesticide.htm). A procedure was implemented to qualify all pest control contracts for these buildings. In order to qualify to bid on the contract, bidders must attend a scheduled "walk-through" of a selected state facility. After the "walk-through" bidders submit a Mock Initial Inspection Report and an IPM based Pest Management Plan. These are used to evaluate the bidders' general understanding of IPM. If the submittals are acceptable, the bidder is placed on a Statewide Pre-Qualified list. As of November 2001 there were 21 pest control companies on the list. Facility managers of all State-owned buildings will use this list to solicit pest control services. Contractors are subject to random audits.

New Jersey Department of Environmental Protection

The New Jersey Department of Environmental Protection certifies and licenses pesticide applicators (www.state.nj.us/dep/enforcement/pcp/). In order to take the certification exams to become licensed to use pesticides in New Jersey, an applicator must satisfy approved training requirements for basic pesticide safety and on-the-job training for any categories to be licensed. Pesticide training specifically must provide an understanding of the principles of IPM. Rutgers University Cooperative Extension Pest Management Office (www.pestmanagement.rutgers.edu/PAT/index.htm) provides training for applicators.

An example of two IPM courses offered by Rutgers are IPM in Schools, and Landscape IPM. The Schools course includes topics such as designing and implementing an IPM program in your school, step-by-step review of cafeterias, locker rooms, student lounges and grounds, insect identification, and non-chemical solutions. The Landscape IPM course is six days and includes topics such as using IPM in weed management, monitoring landscape ornamentals, diagnosing disease in turf and ornamentals, IPM and pesticide regulations, understanding soils and soil/plant relationships, setting up an IPM program, and applications and limitations of biological controls.

Michigan Department of Agriculture

Regulations adopted in 1994 by the Michigan Department of Agriculture require that before a pesticide application is made in a school, public building, or health care facility, two things must take place:

3. A pesticide applicator must attend a Michigan Department of Agriculture approved IPM Training Program.
1. A verifiable IPM Program must be in place for each building.

The PCO must provide the IPM program and initial service inspection record to the building manager at the time of the initial service (www.michigan.gov/mda).

Other Certification Programs

The PCOC's Master Termite Certification and Dow Chemical's Commitment to Excellence for termite baiting may offer some useful models. The Master Termite Certificate has been promoted by the PCOC since 1991. A correspondence course along with reference material has been developed. To date, 30 individuals have received the certificate. Dow's program requires that 80% of the licensees in the company pass an exam. The company needs to also have appropriate equipment in the field. Dow, in return, provides some advertising for the company and offers prizes and bonuses.

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APPENDIX A

CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION APPROVED IPM CONTINUING EDUCATION CLASSES, JULY 2001 TO SEPTEMBER 2002

Class Title	Sponsor	CEUs	Phone
IPM and Monitoring, Back to Basics with New Technology	Assn. Of Applied Insect Ecologists	16	530/758-8909
Current IPM Issues for Trees and Vines	Assn. Of Applied IPM Ecologists	5	707/265-9349
Urban IPM Conference and Trade Show	Assoc. of Applied Insect Ecologists	6.25	916/685-2579
IPM for the Landscape in Bay Area Schools	Bio-Integral Resource Center	8	510/524-8404
Structural IPM for Bay Area Schools	Bio-Integral Resource Center	3	510/524-8404
Sustainable Landscaping Seminar	Cal. Landscape Contractors Assn.	6	650/261-1858
IPM System Update	CAPCA/Woodland	4.5	916/776-2113
BT Manufacturing and Application (offered 3 times)	Certis USA	2	559/280-9336
Green Gardener Certificate Program: Advanced Series IPM	City and Co. of Santa Barbara/Community Environmental Council	4	805/963-0583
Green Gardener Certificate Program: Basic Series English IPM	City and Co. of Santa Barbara/Community Environmental Council	2	805/963-0583
Green Gardener Certificate Program: Basic Series Spanish IPM	City and Co. of Santa Barbara/Community Environmental Council	2	805/963-0583
Green Gardener Certificate Program: 5 Star Advanced Series	City and County of Santa Barbara/Community Environmental Council	4	805/963-0583
IPM	CSUS Fresno	36	559/278-2861
11th Annual Urban Pest Management Conference	Dept. of Entomology, University of Cal. Riverside	5.5	907/873-3718
Healthy Schools Act of 2000	Fairfield Suisun USD	4	707/425-6494
IPM Entomology Update	Gowan	1.5	916/681-4631
IPM for Winter (offered 7 times)	Marc Merman	8	877/263-7626
Make Money with IPM	Marc Merman	8	877/263-7626
IPM Makes Sense-Here's How	Marc Merman	8	877/263-7626
User Friendly IPM	Marc Merman	8	877/263-7626

Southern Coast IPM	Marc Merman	8	877/263-7626
North Coast IPM	Marc Merman	8	877/263-7626
IPM Works	Marc Merman	8	877/263-7626
Coastal IPM	Marc Merman	8	877/263-7626
Fall IPM (offered 4 times)	Marc Merman	8	877/263-7626
IPM Solutions (offered 2 times)	Marc Merman	8	877/263-7626
IPM for Every Day	Marc Merman	8	877/263-7626
IPM Time is Here	Marc Merman	8	877/263-7626
Spring: Time for IPM (offered 9 times)	Marc Merman	8	877/263-7626
Capitol City IPM	Marc Merman	8	877/263-7626
IPM for Santa Rosa	Marc Merman	8	877/263-7626
IPM for Napa	Marc Merman	8	877/263-7626
IPM for Summer	Marc Merman	8	877/263-7626
IPM for Fall (offered 6 times)	Marc Merman	8	877/263-7626
NPS IPM 2002	National Park Service	4	415/561-4831
Complying with the Healthy Schools Act	NOCCD-REBRAC	4	714/695-1501
IPM	REBRAC	4	714/695-1501
IPM	REBRAC-TDI	4	714/695-1501
School IPM Symposium	Sac. Co. Ag. Commission	3.5	916/875-6603
IPM Workshop	Sac. Stormwater Program/UCIPM	3	916/264-8260
Pest Management Using IPM	San Francisco Chapter of CAPCA	6	408/277-5729
Annual IPM and Safety	San Francisco Dept of Environment	4	415/454-9615
6th Annual San Francisco IPM Conference	San Francisco Dept. of Environment	6	415/554-6399
IPM and Worker Safety (offered 2 times)	San Francisco Dept. of Environment	4	415/454-9615
Worker Safety and Weed IPM	San Francisco Dept. of Environment	4	415/454-9615
Green Flamer Use and Safety	San Francisco Dept. of Environment (offered 2 times)	3	415/454-9615
Pesticides/Greenwaste Reduction Using IPM	San Joaquin Co. Solid Waste	4	
IPM for Schools	San Luis Obispo Co. Ag. Dept.	2	805/781-5907
IPM for Schools	San Luis Obispo Co.Ag.Dept.	3	805/781-5907
Stormwater Pollution IPM Workshop	San Mateo Co. Dept. of Ag./Parks and Rec. IPM	3	650/363-4700
Integrated Roadside Vegetation Management	Sonoma Co. Waste Management	4	707/565-3687
Practical Landscape IPM	Sonoma Co. Waste	4	707/565-3687

	Management Agency		
Weed IPM Workshop	Strybing Arboretum Society	4	415/608-5725
Implementing a Successful Insect IPM Program	Superior Chapter Cal. Nurserymen/Sac. Valley Chapter Landscape Contractors Assn.	1	916/652-9261
Effective Use of Biological Control in Nursery and Landscape IPM Programs	Superior Chapter Cal. Nurserymen/Sac. Valley Chapter Landscape Contractors Assn.	1	916/652-9261
IPM and Techniques for Food Distribution Warehouses	Technical Directions	14	256/355-8104
IPM in the 21st Century	U.C.	1	559/646-6515
Turfgrass IPM	U.C. Davis Extension	6	530/752-7692
IPM Seminar	U.C. Intermountain Research Extension Center	36	530/667-5117
Fall Turf and Landscape IPM Conference	UCCE Fresno Co.	7	559/456-7554
Tree and Vine IPM Update Breakfast Meetings (offered 8 times)	UCCE Stanislaus Co.	1.5	209/525-6800
IPM for Public Agencies Conference	UCIPM	8	530/752-7692
A Vision for the Future of IPM in California	University of California	1	559/646-6515
A Comprehensive IPM Approach to Rodent Control	Vopak	2	916/849-2671
IPM	Yuba College	3	530/741-6925

APPENDIX B

CALIFORNIA STRUCTURAL PEST CONTROL BOARD APPROVED IPM CONTINUING EDUCATION CLASSES, 1997 TO 2002

Class Title	Sponsor	CEUs	Phone
IPM Expo	Applied Insect Ecologists	5.5	916/685-3764
IPM and Baiting for Control of Ants and Roaches	Bayer	2	214/484-6326
IPM 2000	Bayer	3	619/261-2440
Putting IPM in to Practice	Bio-Integral Resource Center	5	510/524-8404
Urban IPM	Community Environmental Council	10	805/963-0583
IPM Workshop – Preventive Flea Management	Dewey Pest Control	4	818/568-9448
IPM in Schools and Other Sensitive Areas	Dewey Pest Control	2	626/568-9248
IPM Treatment Strategies, Pesticide Formulations and Safety	Dewey Pest Control	2	626/568-9248
AB 2260- Healthy Schools Act of 2000 Innovative Pest Management/ IPM	Dewey Pest Control	2	626/568-9248
CCR and Pesticide Worker Safety and Principles of IPM in Residential and Commercial Accounts	Dewey Pest Control	4	626/568-9248
SPCA IPM Protocols for Residential/Commercial Accounts	Dewey Pest Control	4	626/568-9248
Use of IPM in Restaurants	Fume A Pest Termite Control	1	213/658-5779
Regulation for Food Safety as it Applies to IPM	Fume A Pest Termite Control	2	213/658-5779
IPM Principles of Trapping and Baiting	Fume A Pest Termite Control	1	213/658-9448
Low Risk IPM Rodent Control Program	PCOC	1	
Pest Ed 2002 – Termite Data Research, Developing an IPM Program for Argentine Ants and Other Ant Baiting Research	PCOC	3	

IPM and Baiting for Control of Ants and Roaches	Premier Sales and Marketing	1.5	817/441-8050
Advanced Level Urban and Industrial IPM – Branch 2	Purdue University	22	317/494-2748
Annual Conference: Urban Pest Management (7 entries)	U. C. Riverside	6.5	909/787-3718
IPM for Public Agencies Conference	U.C. Davis	6.5	530/752-7692
Low Impact Pest Control	Vopak	2	213/881-7229
IPM	Vopak	1	805/444-4743
IPM	Western Exterminator	1	949/261-2440
Pheromones in Pest Control	Western Exterminators	1	949/261-2440
IPM for Ant Control	Whitmire Micro Gen	1	800/777-8570
IPM for the Control of Flying Insects	Whitmire Micro-Gen	2	800/777-8570
Fly IPM Control Techniques	Whitmire Micro-Gen	2	480/507-8020
Developing an Integrated Program for Controlling Fleas	Zoecon	1	714/493-6766
Total IPM Approach to Flea Control	Zoecon	2	714/493-6766