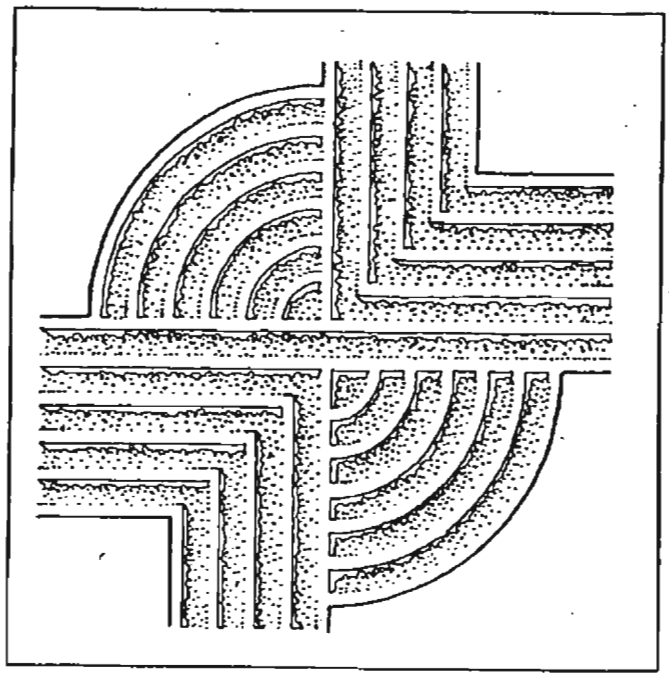
INTEGRATED PEST MANAGMENT IN PRESERVATION AND RESTORATION



RESEARCH CONTRIBUTION 126

INTEGRATED PEST MANAGEMENT IN RESTORATION AND PRESERVATION

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CHICORA RESEARCH CONTRIBUTION 126

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Pest control is a multi-million dollar industry in the United States. We face cockroaches and silverfish in collections, powderpost beetles and dermestids in furniture, termites and carpenter ants in buildings. America's preoccupation -- some would characterize it as a fear -- with pests has lead to the "Rambo" or "Robo-Exterminator" approach. We want immediate gratification -- we want to see that cockroach drown in highly toxic pesticide. We want our entire home, museum, or workplace fumigated to destroy every last living creature. We want furniture doused with highly toxic lindane to destroy those powderpost beetles.

In the handouts for this session there are several sheets which provide you with information on the toxic effects of various fumigants -- simply to point out that use of pesticides can have a wide range of effects on collections, buildings, and of course people. Equally troubling handouts could have been prepared on many of the other common, restricted used pesticides.

Compounding these problems most architects, builders, and even conservators, are not specialists in pest control technology. Most often when there is a problem the first person called is the local "bug buster," who may, or may not, be sensitive to the special needs of old houses, museum collections, or archives. The thousands of pounds of pesticides used monthly in this country offer mute testimony that relatively few pest control operators are seeking innovative solutions to old problems.

There is a better way -- *integrated pest management* or IPM. This approach is not new to the pest control industry, although its application to structural pests, and particularly its use in museum or restoration settings, is not as common as it deserves to be. An IPM approach to pest control minimizes -- and in some instances may actually eliminate -- the use of chemicals, in their place emphasizing cultural, mechanical, and biological controls.

Also in your conference notebook there is a short article which outlines the four major components of a successful IPM program:

- monitoring pest populations,
- assessing the acceptable pest population and level of acceptable damage,
- identifying control methods, and
- evaluating the success of the process and making modifications.

IPM programs, unlike conventional squirt and spray applications, are not static. They are constantly being adjusted and refined, based on the results of the monitoring program. The primary advantages are that stable, long-term control of most pest populations is possible and the use of chemicals is minimized. This last feature is often the first to be noticed -- where previously an institution or homeowner would have a pest control firm come in monthly and spray "something," with IPM these visits can often be reduced to once every 3 or 6 months.

But there is down side to IPM. The approach requires a greater commitment from the home owner or museum director. No longer are pest problems simply turned over to a pest control firm. The owner/operator/director/curator must be an active participant in the process.

The first step in an active IPM program is monitoring. This most often involves the use of sticky traps to collect a representative sample of the pest population, allowing you evaluate numbers, life stages, and locations. Monitoring will also include increased vigilance for insects -- including periodic inspection of collections for signs of damage, examining the building for signs of termites or other wood damaging pests, looking for evidence of either droppings or frass, and maintaining a relatively stable temperature and humidity.

Ten years ago sticky traps were hard to find. The good news is that today there are at least a dozen different manufacturers providing baited and unbaited traps of all sizes and descriptions. For most museum or house settings a product like the Catchmaster™ works very effectively. Capable of being folded into a triangle to offer harborage, or being laid flat adjacent to walls, such sticky traps maximize the potential to monitor a wide range of pest populations. Of course, to be effective, sticky traps must be used in sufficient numbers, and placed where the pests are most likely to be found. Likewise, they must also be periodically inspected, and replaced. Monitoring large institutions can be a nearly full-time job.

The second step is to determine what level of insect activity will cause implementation of control mechanisms. Remember -- the pests were here first and will likely out survive us all. We are the invaders -- not them. The decision must be based on a knowledge of pest behavior, the nature of the collections, and the level of "acceptable damage." For most situations the presence of a single American Cockroach is not sufficient to implement chemical control, although the presence of a carpet beetle is probably of concern in a textile collection. Understanding species and life cycles can avoid costly mistakes. For example, the various flatheaded borers which occur in structural timbers and logs do not reinfest old wood. Even the Bostrichid beetles, found in molding, flooring, and even furniture, rarely reinfest old wood.

The third step involves treatment. One of the most effective approaches is to ensure that pests do not achieve a toehold in your house, building, or collection. There

are two fundamental goals:

- build them out -- eliminate easy access, and
- starve them out -- deny food sources.

Both cultural and mechanical approaches are essential in making an IPM program work. Obviously, it is often difficult to eliminate food sources, although increased cleanliness, improving trash removal practices, and installing drain plugs on dumpsters are examples of both cultural and mechanical modifications which will have an impact. Building pests out include good construction practices, as well as developing landscape programs that deny pests harborage adjacent to buildings. Switching exterior lighting to sodium vapor will reduce the number of pests attracted to the light.

The final step in the IPM plan is continued surveillance to determine population level reductions and the need for additional treatment. If chemical treatments are necessary, an IPM approach helps identify the best chemical to attack the target pest without harming building, contents, or people. An IPM philosophy also mandates changes in the way we deal with pest control firms:

> Ask your applicator what chemicals are being used and why these particular items were selected.
>
> Obtain from your applicator a copy of the labels and the material safety data sheets for all pesticides being used.
>
> Be present during the applications (where safe to do so) to provide some degree of oversight.
>
> Require written documentation of each application, specifying the pesticide used, at what dilution rate, what quantity, and where applied.

When pesticides are necessary they should target the problem as narrowly as possible. For example, if cockroaches are the problem, rather than simply spraying with a broad spectrum pesticide, such as Ficam® or Dursban®, try the use of an insect growth regulator or IGR, such as Gentrol™, to prevent the population from breeding. Or use a bait, such as Siege™ or Avert® where the population is the densest. These products often are not used by commercial pest control firms since they are more costly and require greater attention to the problem (you have to know where to apply the bait, for example). Using an IPM program you are able to require such approaches.

It is also wise to be suspicious, or at least cautious, of the approaches suggested by commercial pest control firms to handle typical problems. One recent article in a professional pest control journal suggested heating or microwaving items infested with

carpet beetles, as well as dry cleaning or hanging decorative items outside in the sun. Another article suggested treating powderpost beetles in furniture by heating the object to 140° F for six hours (longer if the wood is over 2 inches thick). And while commercial firms, and the industry in general, promote the use of mouse and rat poisons (either as baits or tracking powders), this approach can cause a host of additional problems such as odor from the dead rodent in a wall void and increased levels of dermestids attracting to the decaying rodent.

One of the major goals of the IPM program is to "build pests out," and it is perhaps here that architects, craftsmen, and contractors can have the greatest impact. It requires attention to detail and liberal use of the punch list to correct problems.

Certainly the first opportunity we have to control pests is during the site work. Keeping the site area clean of scrap wood and eliminating organic materials from fill will significantly reduce the threat of subterranean termites (common as far north as Pennsylvania and Massachusetts). Other IPM techniques include maintaining at least 18 inches between the soil and wood timbers (24 to 36 inches in the Southeast), avoiding excessive moisture through drainage improvements and the use of vapor barriers, and keeping crawl spaces clear of organic material.

Unfortunately, termites are one pest which must be fought using both IPM and pesticides. To ensure the job is done correctly means using the appropriate termiticide application techniques, and the correct dilution and application rates. While recent tests suggest that the termiticides which replaced chlordane have a reduced lifespan, there are documented cases in which the low bid was less than the cost of the termiticide to treat the structure -- giving rise to the suspicion that an inadequate job was performed.

Powderpost beetles, like termites, often require not only cultural and mechanical control, but also chemical. Non-chemical controls include the use of only kiln dried and inspected wood, replacement of infested wood, control of moisture, and use of adequate ventilation. Many powderpost infestations are introduced through improperly stored lumber and the most serious problems can often be traced back to the use of lumber which was "salvaged" from a barn or similar structure. Where the active infestation (as evidenced by fresh frass) is localized, simply replacing the wood may be an option. Keeping wood moisture levels below 14% during the spring and summer will create an environment generally unsuitable for beetle development and reinfestation.

Recently the use of various sodium borate products, such as Tim-Bor® or Bora-Care®, has been advanced for the control of termites, carpenter ants, wood destroying beetles, and wood decay fungi. Applied as a spray, these products can provide upwards of 40 years of protection to wood which is protected from the elements. Penetration can vary from less than a quarter inch (which offers little protection) to near complete penetration (typically achieved when the moisture content is over 15%). While boron compounds are highly toxic, when diluted for application to structural timbers, the

toxicity is limited. Certainly such products are safer than those frequently used in the past, such as lindane or chlordane.

Moving back to mechanical modifications, make sure that all exterior doors have fitted gaskets and sweeps to minimize entry. Remember that an opening as small as a dime will allow a mouse to gain entry and a hole the size of a quarter is sufficient for a rat. Windows must close tightly and any which intend to be open must be fitted with a 20 mesh screen to exclude small flying insects, such as carpet beetles. Utility openings must be caulked or otherwise sealed. Air intake vents for HVAC air handlers or other vents must be screened. Eves and ledges, where possible, should be eliminated from designs to exclude perching and nesting areas for birds. If eves and ledges are included in the design they should be screened or otherwise protected to deter birds. Weep holes and wall vents should be screened to prevent insect access. Cracks and crevices, particularly around baseboards, should be sealed with caulk to deny egg laying or pupation sites to insects.

Builders should consider using a pesticide dust in wall voids during construction or renovation. Products which combine an silica aerogel and pyrethrin, such as Drione™, provide long-term protection from a wide variety of insect pests which inhabit wall voids, while keeping the pesticide away from people and collections. It is also possible to install small plastic tubes in the walls, such as the product Insider™, to allow periodic re-treatment of these voids once construction is complete.

Too often the potential for rot and the pest problems associated with the accompanying moisture and mold are ignored by builders. Wood in areas with a high potential for rot, such as around plumbing, in outdoor contact with concrete, and so forth, should be treated for rot and decay resistance. Gutters, downspouts, and scuppers would be operable and channel water at least 10 feet away from the building. Water should never be allowed to collect next to the foundation. Porches, loading docks, entranceways should be sloped away from the structure to promote adequate drainage.

The environmental controls within the structure will also have an impact on the pest population. Insects typically like the warm, moist environments offered by inadequate ventilation, poor dehumidification, and limited cooling. Many pests, ranging from book lice to silverfish to cockroaches, can be at least partially controlled through environmental modifications. Increasing attic and basement ventilation can help reduce moisture accumulation and lower the threat of termite, carpenter ant, and beetle infestations.

Plants adjacent to the building should be trimmed back so that no branches touch the structure. This will reduce moisture build-up, lessen the potential for rat infestations, and help control carpenter ants. Reducing mulch and other organic material adjacent to the building will reduce cockroach and scorpion population levels. Dead trees and even stumps within 50 feet of the structure should be removed to decrease the potential for

wood destroying insects.

Moving from the building to its contents, we are often called for advice on the treatment of museum and archival material. In most cases, the safest way to treat such material is to hand clean the item -- carefully vacuuming that which can be vacuumed and brushing everything else. This gentle manipulation dislodges insects and crushes eggs. Unfortunately, it is time consuming and labor intensive.

Too often institutions, and even home owners, have turned to fumigation as an alternative to either improved storage conditions or hand cleaning of limited infestations. Not only is fumigation a highly toxic approach which can cause extensive damage to collections, but it is often conducted without understanding the importance of following a carefully defined protocol. I recall one institution that, faced with a powderpost beetle infestation, decided to fumigate their entire collection using temporary tractor trailers provided by the pest control firm. After hours of moving collections in and out of these temporary fumigation chambers, providing extra round the clock security, and picking up the dead birds overcome by the fumigant, the institution found that six months later they still had a powderpost beetle problem. The fumigant concentration, or duration, was adequate to kill the adults and larva, but not the eggs.

When fumigation using either Vikane® or methyl bromide is proposed, we should be sure that the materials can, in fact, be safely fumigated. When the fumigation is being conducted on a client's house, it is important to ensure that items in the house, such as photographs, silver, or heirloom furniture, won't be damaged. It is also essential to identify a firm which not only has experience in fumigation, but which also has the equipment to perform the work properly. This typically means not only the eqipment to introduce and vent the fumigant, but also the equipment to test its concentration both during the fumigation process and afterwards, when the building is supposed to be clear. Fumigation should be approached with extraordinary caution and undertaken only when other methods of control have either failed or are not possible.

Recently the Getty Conservation Institute has developed provisional protocols for fumigation in a nitrogen atmosphere (with less than 0.1% oxygen). Using simple enclosures, nitrogen, and an oxygen scavenger such as Ageless™, it is possible to achieve a 100% kill of most species in less than 96 hours, although certain stages, such as the eggs of the cigarette beetle, require an exposure time of 8-days to achieve a complete kill. The Getty studies have also suggested that increasing the temperature above their 78°F set point, or lowering the relative humidity below 55%, would likely reduce the exposure time necessary. Obviously, the appropriateness of temperature and relative humidity levels will be object specific. This appears to be an exceedingly safe approach which deserves more attention.

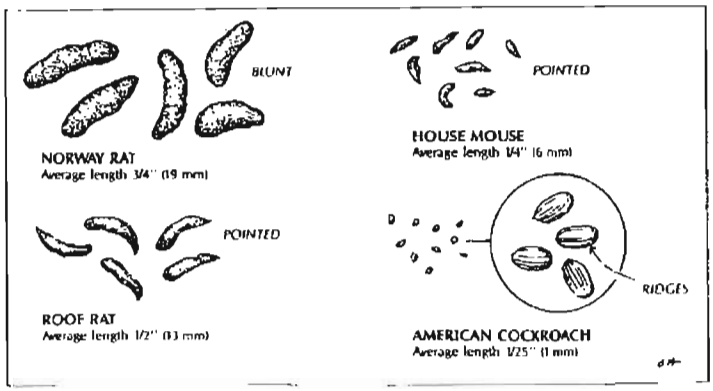
If nothing more, I hope that my few comments have encouraged you to take a more active role in overseeing pest control activities. IPM is a sound, practical approach

capable of ensuring that chemicals are used only when necessary, that the chemicals are carefully selected on the basis of the target pest and level of acceptable toxicity, and that the application is appropriate. In other words, IPM is very much common sense -- it simply strips our away our irrational fondness for "nuking" pests and replaces it with a more rational approach of careful selection and application. In the long-term such an approach is good for the environment, good for the collection and building, and good for the budget.

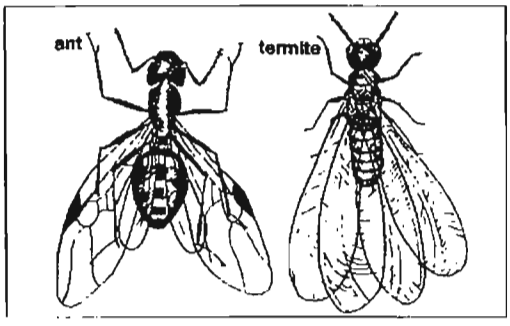
Key to Identification of Woodboring Beetles from Exit or Entry Holes

Wood Type	Wood Age	Wood Location	Frass in Tunnels	Shape & Size of Holes (inches)	Insect	Reinfest Old Wood
Softwood & Hardwood	New	Structural timber, logs	None	1/50-1/8	Ambrosia beetles	No
Hardwood	New & Old	Molding, flooring, furniture	Fine, flour-like, loosely packed	1/32-1/16	Lyctid beetles	Yes
Woods with bark on surface	New	Structural timbers, logs	Coarse, bark-colored	1/16-3/32	Bark beetles	No
Softwood & Hardwood	New & Old	Crawl space timbers, flooring. furniture	Fine powder & pellets loosely packed in softwood, no pellets & tightly in hardwood	1/16-1/8	Anobiid beetles	Yes
Hardwood & bamboo	New	Molding, flooring, furniture	Fine to coarse, tightly packed	3/32-9/32	Bostrichid beetles	Rarely
Softwood & Hardwood	New	Structural timber, logs	Coarse to fibrous or absent	1/8-3/8	Cerambycids (sawyers)	No
Softwood & Hardwood	New	Structural timber, logs	Sawdust-like tightly packed	1/8-1/2	Buprestids (flatheaded) borers	No
Softwood	New & Old	Structural timber, siding, logs	Very fine powder. tiny pellets tightly packed	1/4-3/8	Oldhouse borer	Yes

Physical characteristics of feces
(courtesy J.T. Eaton & Co., Inc.)



Major differences between ants and termites (note antenna, wings, and body shape)



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