NEPMA

New England Pest Management Association

WDI REGISTRY

Training Manual

THIRD EDITION

Forward to NEPMA Manual on WDI Inspection Registry
Third Edition 2024

For many years there have been many unanswered questions and too many "gray areas" in the pest inspection industry of New England. There were far too few training opportunities in WDI inspection and they generally did not fully give the answers we require to do our jobs in a competent manner. Few, if any, regulations gave us, the WDI inspector, any guidelines as to what we should or in some cases more importantly not be doing and saying. To this end the New England Pest Management Association Inc. has formalized a registration program that offers pest management professionals, professional home inspectors and others with interest in our industry the opportunity to receive formal wood destroying insect inspection training and recognition for successfully completing our training program and following our standards and continuing education requirements. NEPMA is proud of our WDI Registry and those who earn a place on it.

The WDI committee works long and hard to develop and maintain this program and training manual. If you do notice any typos, problems or have questions, please contact our association's office. The association website is www.nepma.org. In addition to maintaining your place on the WDI Registry we encourage your company to become a member of NEPMA to stay current with all pest management topics.

Many people put in copious hours and others helped with comments and financing so that we could have this fine program. They took time from their businesses and more importantly they took time from their families as they labored in this endeavor. It is with great pride that this manual and training program are dedicated in memory of a loving wife and mother, an educator herself Linda Moran.

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CHAPTER 1

INTRODUCTION TO WOOD DESTROYING ORGANISMS AND INSPECTIONS

All wood destroying insect and/or organism (WDI/O) inspections require a knowledge of the insects and organisms that can cause damage to structures and are commonly found in New England. The inspector is expected to make accurate identification so that correct recommendations for control can be made. If a pest or evidence left by the pest is misidentified the result could lead to inappropriate steps taken to correct the problem or that the customer will be dissatisfied with the Pest Management Professional's (PMPs) service, possibly resulting in legal ramifications or regulatory investigation.

The art and technical merits of an inspection are in knowing what to look for and being able to see it. Arthropod (insect) pests present some difficult challenges. There are about 90,000 arthropod species in the United States. Of this number only a few genera of these insects can damage wood. Many are small, their identifying characteristics hard to see, and many undergo a total change in appearance and habits as they progress through their life cycle.

Wood destroying fungi and other fungi may also be part of an inspection. To the PMP these organisms offer a new pest problem. Fungi are plants and in a few cases can be a serious problem to structures if conditions exist for their development. In some ways, wood destroying fungi are far more damaging than insects, because they affect the strength of the wood more directly. Only a few species of fungi are capable of this and will be discussed.

BASIC CLASSIFICATION AND NAMING OF ORGANISMS

Classification There are millions of species of insects and plants in the world and even today we are finding new species. To avoid confusion there needs to be some system of naming and classifying these organisms. This allows for the efficient storage and retrieval of information. Organism classification is based primarily on the physical appearance or structure of the organism (morphology). This places organisms with similar appearance, parts or structure into similar groups.

The animal and plant kingdoms are divided into groups called Phyla (singular Phylum); each phylum is divided into classes; each class into orders (names often end in -aptera = wings); each order into families (names end in -idae); families into genera (singular, genus); and genera into species (singular and plural).

Species is the basic category, one kind of plant or animal. It consists of similar individuals that can interbreed and produce offspring, but who do not normally interbreed with other organisms.

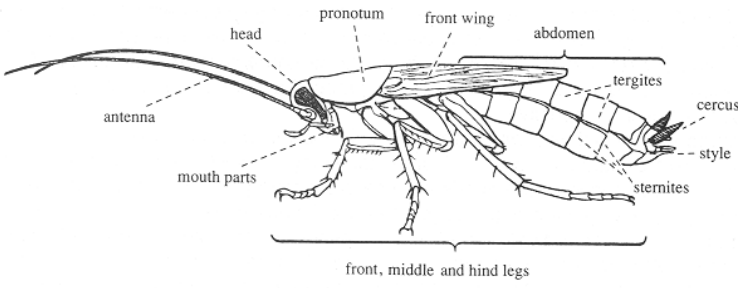
As an example, following are the classifications for the Eastern Subterranean termite, Human, and a Brown Rot fungus:

	Eastern Subterranean	Human	Brown Rot
Kingdom	Animalia	Animalia	Plantae
Phylum	Arthropoda	Chordata	Mycota
Class	lnsecta	Mammalia	Basidiomyctae
Order	lsoptera	Primata	Polyporus
Family	Rhinotermitidae	Hominidae	Polyporaceae
Genus	*Reticulitermes*	*Homo*	*Goloephylium*
Species	*flavipes*	*sapiens*	*saeplaiium*

Naming (Nomenclature) Every formally described animal has a scientific name and it is the same throughout the world whereas, the economically important and or more frequently encountered animals usually have a common name(s). Often the same animal or organism may be known by several different common names depending on its geographical location. FOR EXAMPLE the American Cockroach is also known as the Palmetto Bug in the southern USA

In the pest control industry, only a few orders of insects and plants cause WDI/O problems. The major insect orders that we are concerned with are: Isoptera = termites, Coleoptera = beetles and Hymenoptera = bees, wasps and ants. In the plant kingdom we are concerned with Fungi; and only a few classes like the Basidiomycetae, Ascomycetae and Fungi imperfecti.

THE STRUCTURE OF INSECTS



A general knowledge of insect structure is essential in order to understand the descriptions of insects and the characters that are used to distinguish the different insect groups, as well as to understand insect control.

The insects and insect-like pests we are concerned with are also referred to as Arthropods are characterized by having the following external features: (1) paired, jointed appendages; (2) a chitinous (hard) exoskeleton; (3) bilateral symmetry; and (4) a segmented body with segments grouped into 2 or 3 body regions.

Insects are characterized or separated from other Arthropods by having: (1) the body segments grouped into three body regions (head, thorax (three segments), abdomen, (multiple segments); (2) one pair of antennae; (3) three pairs of legs, one pair on each segment of the thorax; and (4) wings when present are usually 1 or 2 pairs. The insect body is essentially a segmented, elongate tube with appendages; the larvae of insects also adhere to this symmetry.

The head This is the first region of the insect and it is the site of sensory reception (eyes, antennae, etc.) and food ingestion (mouthparts).

Insects usually have two kinds of eyes, compound and/or simple. The two compound eyes are located in the front but towards the sides of the head, are composed of many facets, and can perceive images.

The antennae, loaded with sensory receptors, are typically located on the front of the head. Antennae vary greatly in form and the number of segments composing them and may be used to identify a particular insect species.

The Thorax This is the second and middle body region. It is the site where the legs and wings are attached, if present. This region is divided into 3 segments: Prothorax (towards the head), mesothorax (middle segment), and metathorax (towards the abdomen). Each segment bears 1 pair of legs and in adults the mesothorax and metathorax usually each bear a pair of wings located one on each side near the top. Some adult insects have only 1 pair of wings (flies), usually borne on the mesothorax , and some are wingless (Fleas, Head Lice, Bed Bugs etc.)

The development of wings is such an important feature of insects, that many insects order names end in -aptera (Greek for wing). Wings vary in number, size and texture, pattern of the veins (venation), and in their position at rest. The wings of insects are very characteristic to species and can be used to identify the insect even though the insect's body is not present.

The Abdomen This is attached to the thorax on the end opposite the head (see the figure on page 2). It is the site of digestion, excretion, and reproduction. The number of abdominal segments may vary.

The Exoskeleton In insects, the body wall also serves as its skeleton. It is the hard part which gives form and support, serves as sites for muscle attachment, and protects soft internal organs. The exoskeleton provides the insect with protection and strength.

The exoskeleton covers the entire insect. It varies from being very hard to being a flexible membrane at joints to permit movement. It is periodically shed and renewed as the insect grows. This process is known as molting.

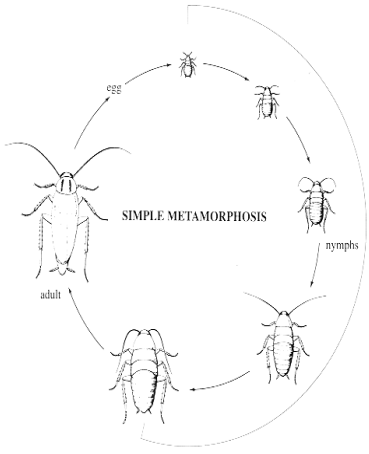
INSECT GROWTH AND DEVELOPMENT

Growth Wood destroying insects all lay eggs. Upon hatching, these immature insects go through several distinct stages. The insect's growth in each stage is limited by the amount of space within its exoskeleton. As the insect develops, a new exoskeleton is formed directly beneath the old one. Then, the old body wall splits and the new stage emerges and expands its new exoskeleton before it hardens. This process is called molting and is typically-repeated 4-8 times before adulthood is reached, but may be repeated as many as 13 times in termite workers.

This "growth" in insects is restricted to the immature stages. But there are exceptions, for instance a termite worker may stay the same after every molt for it's lifetime, but can also molt to a different stage such as a soldier, or a secondary reproductive.

The insect stage between molts is called an instar. Thus, we commonly refer to immature forms as the first, second, third instar, depending on the number of molts having occurred.

Metamorphosis. As the insect grows/molts, it changes seometimes in form and sometimes in size, as well as other features. This process of change is called metamorphosis (meta=change; morph=form; osis=process). Although there are several variations in the metamorphosis occurring in insect groups, these variations can be grouped into 2 general kinds, simple and complete.

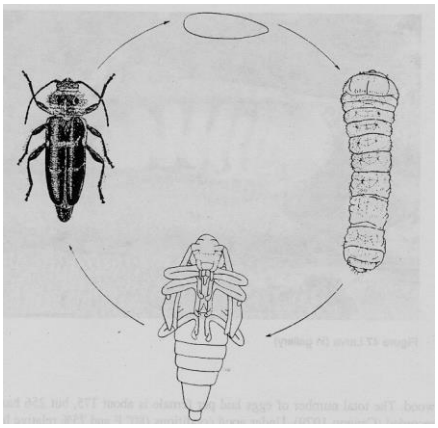


● *Simple metamorphosis* : The life stages of simple metamorphosis are: egg, nymph, and adult. After hatching the nymphs show characteristics of the adult. As the nymphs develop through their instar stages they will develop external wing pads and compound eyes if these are present in the adults.

There is no prolonged inactive stage after the last molt into an adult. Adults may over-winter.

Simple metamorphosis to the PMP means: (1) only 1 pest form to recognize because immature stages and adults are similar in appearance; (2) only one kind of habitat to inspect because they eat the same foods and live in the same places; (3) only 1 kind of damage to be recognized because immature stages and adults cause the same damage. Termites have incomplete or simple metamorphosis.

- *Complete metamorphosis* : The life stages of complete metamorphosis are: egg, larva (with several instars), pupa (resting stage), and adult. The wings (if present in the adult) develop internally during the immature stages, compound eyes are never present in immature stages although they may have ocelli, and there is a prolonged inactive or resting stage (pupal) before the last molt into the adult.



Complete metamorphosis to the PMP means: (1) there are 3 pest forms to be recognized and associated because larvae, pupae, and adults are dissimilar in appearance; (2) there are often 2 kinds of habitats to inspect because larvae and adults usually eat different foods and live in different places; (3) there are often 1 or 2 kinds of damage to be recognized and associated, one done by larvae and the other done by adults, but sometimes only 1 stage causes damage; and (4) usually different control measures are required to control the larvae and adults because of their dissimilar habits. With the exception of termites all other WDIs have complete metamorphosis.

Life history Most wood destroying insects in the United States have but one generation per year and they may over-winter in a dormant state as larva, pupa or the adult. For some species a period of dormancy at low temperatures is required to complete the life cycle; e.g. many moths.

Termite and ant colonies lay eggs that can hatch periodically during the year within the colony. Other wood destroying insects have one complete generation per year.

Developmental time (egg to adult) varies from about 8 days for small fruit flies *(Drosophila* spp.) to about 17 years for periodical cicadas *(Magicicada* spp.). Adults are usually present for only a few days to a few weeks, unless they are in the over-wintering stage and then it can be for several months.

Fungi

The common plants we see every day have one particular feature that makes them capable of living and thriving in the world. Their cells contain chlorophyll. This enables plants to manufacture the food they need and drive the biological process for reproduction and growth. However, fungi do not contain chlorophyll; they are referred to as achlorophyllis, which means lacking chlorophyll.

These plants are fungi. They may be colored by pigments, or produce spores that are different colors, but they usually derive their energy from parasitizing or feeding off of organic matter.

Fungi grow by producing small, microscopic strands called hypha. When this hypha become numerous they appear as mats or white growth covering a surface. We refer to these mats as mycelia.

Fungi reproduce by producing spores. These microscopic "seeds" of the fungi are produced on specialized structures called sporophores. In some cases, depending on the genus or the family of the fungi, the spores are produced on the surface. These fungi, often called molds or mildews, will appear to have different colors ranging from black to green and blue. Other fungi produce even more specialized sporophores such as mushrooms, toadstools and other specialized structures. These are constructed of masses of specialized mycelia and produce billions of spores.

Spores can be carried by wind and water, or physically by animals or insects to surfaces of various materials or substrates. When conditions are right, the spore will "germinate" producing a single strand of hypha. This single strand branches, penetrating the substrate it is on, and digesting the food resources of the substrate to obtain nutrients – the "food" it needs.

The fungi that destroy wood have powerful enzymes that break down the cellulose and lignin, substances that provides strength to wood, eventually destroying the cell structure of the wood.

BASIC WOOD TERMINOLOGY

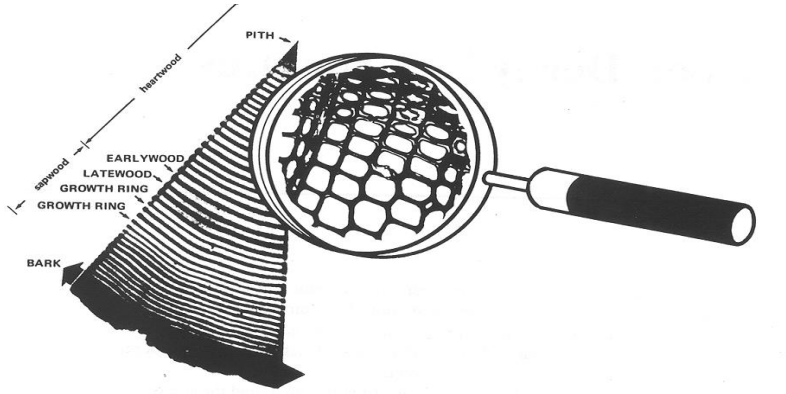
In order to talk about insect and fungal damage caused to wood, there are a few terms which describe the various characteristics of wood that must be understood.

Hardwood vs. softwood For commercial purposes, woods are typically separated into two groups, softwoods and hardwoods. Softwood lumber comes from conifer trees (those which bear cones, have needles or scale-like leaves, and for the most part, remain green throughout the year), such as pines, firs, cedars, etc. Hardwood lumber comes from deciduous trees (those which have

broad, deciduous leaves which are usually shed every autumn), such as oaks, maples, cottonwood, etc.

The terms softwood and hardwood do not refer to a wood's density or hardness and are therefore, misnomers. Both groups contain wood which is soft (white pine and cottonwood) and wood which is hard (southern yellow pine and oak). They are used because these terms are convenient and commercially accepted.

Springwood vs. summerwood Each year, trees grow by adding new layers of cells just to the inside of the bark. In the spring, they grow more quickly because water is abundant and temperatures are warm but not hot. This results in larger but relatively thin-walled cells in which sugars, starches, and proteins are stored; these cells tend to be light in color. During the summer, these cells will grow slowly because of lower rainfall and higher temperatures. This results in smaller, thick walled cells containing lignin, a substance which provides strength to the wood; the extra lignin makes these cells dark. These two groups of cells make up the annual growth rings of trees.



Sapwood vs. heartwood As a tree continues to grow year after year, adding growth ring after growth ring, other changes occur in/to the wood. The newer growth which is closest to the bark and usually almost white in color is called the sapwood. This is because it is physiologically active, it is the part of the stem/tree through which sap flows and where food is stored. The sapwood typically contains a fair portion of living cells. As the sapwood ages and these cells die, extractives are deposited in these cells. As this process continues, the former sapwood is gradually changed into heartwood. Hence, the wood closest to the center of the tree becomes the heartwood; the original center is called the pith. In general, heartwood is darker than sapwood. As the tree ages, the proportion of the trunk which is heartwood increases and in a mature tree, heartwood composes most of the trunk with only a narrow band of sapwood closest to the bark.

Seasoned vs. unseasoned wood In general, wood is considered seasoned when the wood moisture content (percent of moisture in the cell walls) is at or below 19%. Unseasoned wood is freshly felled timber that still contains liquid sap and moisture levels which approach 100 %.

THE INSPECTION PROCESS

This has been a quick review of some of the pertinent facts about insects, fungi and wood that can be important to the person performing wood destroying organism inspections. Every day we inspect structures for evidences of these organisms. We only need to recognize a relatively few insects and fungi that can infest and damage wood. The major groups include:

Beetles – Coleoptera spp
Termites – Isoptera spp
Bees and ants – Hymenoptera spp
Brown and white rot fungi – Basidiomyces spp

There are some incidental pests that can damage wood or may leave evidence in wood for us to find. We need to be able to identify these for the purpose of determining re-infestation possibilities.

All these organisms are important because of the damage they can do to wood. Some are worse than others in their destructive capabilities. However, left alone, uncontrolled, all can do damage that could cost significant money to repair or even cause structural failure.

The inspection process may be fairly simple, **but often** it is complicated by the way the structure is constructed or furnished, which may hide evidences of WDI/O infestation(s) and damage(s). Simply put, inspections are performed to determine the presence of **visible** evidence of wood destroying organism(s) in the structure. To a lesser extent these inspections can also determine if conducive conditions are present that could lead to an infestation of insects or fungi. Inspectors should be aware of conducive conditions because they can aid in finding evidence of WDI/Os, and/or complicate the proper treatment.

The inspection process should be the same no matter what reason the inspection was ordered. A vast majority of inspections are performed for real estate transactions, then, the new "customers" who think they have termites or carpenter ants, and finally your existing customers that may have continuing problems with infestation or a re-infestation. In any case, knowledge of structural components, insect and fungal pests and conditions favoring infestation, is the basis for a professional and competent inspection.

Introduction to wood destroying organisms and Inspections Study Questions

1. Why is correct identification of WDI/O pests so important?
2. What distinguishes insects from other arthropods?
3. Discuss the insect's life cycle and types of metamorphosis. How does the type of metamorphosis influence the control of these insects?
4. Compare and contrast hard wood vs. softwood, spring wood and summerwood and heartwood and sap wood.
5. How do fungi survive without chlorophyll?
6. What are the keys to the inspection process?
   (The insect's body regions have sensory and other features important to their survival. Discuss the features of each body region and how these aid in the insect's survival.)

CHAPTER 2

RE-INFESTING WOOD DESTROYING INSECTS

Contents:

INTRODUCTION: There are several insects that will attack season wood we use in structures, as a food source or for nesting. These insects can be damaging to the structural timbers and therefore the structural integrity of the building or to the particular wood they attack. For this reason they are considered economically damaging pests and are required to be reported when inspections are performed by Pest Management Professionals (PMPs).

We will discuss these in order of importance to the homeowner and our industry.

TERMITES

CLASS/ORDER: Insecta/lsoptera

FAMILY: Various

METAMORPHOSIS: Simple

INTRODUCTION. Termites have been around for over 250 million years. They are social insects and live in colonies which may be located in the ground or in wood depending on the species. Termites feed on cellulose from wood and wood by-products such as paper. They attack/damage thousands of structures each year. They are worldwide in distribution with about 2,200 described species, about 40 species occur in the United States.

Termites are usually divided into 3 groups based on the location of their colony: the

subterranean, the drywood, and the dampwood termites. The biology and habits of

each group are different, so a detailed knowledge of each is necessary for developing an effective inspection and control regimen.

The most common and most economically important members of these 3 groups can be summarized as follows. Subterranean termites - the eastern subterranean; drywood termites - southeastern drywood and the powderpost/furniture termites. In New England, it is important to be able to recognize the termites in two of these groups. Subterranean (the most common and damaging) and Drywood termites, as there have been infestations found in New England.

RECOGNITION. Three body regions (head, thorax, and abdomen) **broadly joined** with no constrictions as found in ants. Antennae **moniliform**, composed of a series of beadlike segments; not elbowed as found in ants.

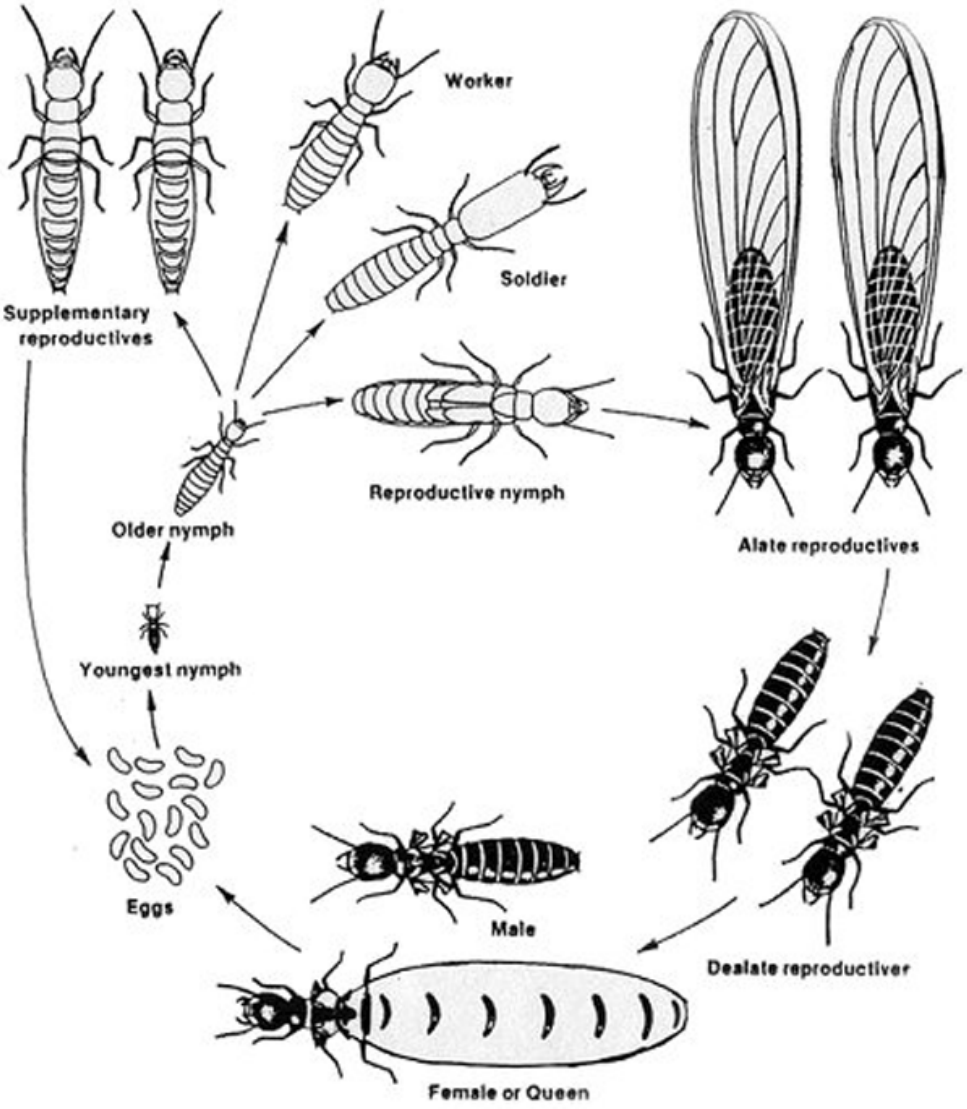
Workers creamy white with head slightly darker. No compound eyes or ocelli (simple eyes) present; workers of some species of drywoods with pigmented areas where eyes are typically located. Wings absent.

Soldiers creamy white except for dark and much-enlarged head. Head with large pair of mandibles. Compound eyes absent, but some with pigmented areas. Usually with a **fontanelle** (porelike opening to the frontal gland) on top of head. Wings absent.

Swarmers (**alates** or winged/primay reproductives) can be reddish brown to black, depending on the species. Compound eyes present, some species also with pair of ocelli. With a **fontanelle** (porelike opening to the frontal gland) on top of head. Two pairs of wings nearly equal in length and width, which lie flat over abdomen when not in use. Wings almost clear to smoky black. Wing veins usually darker; their number and position used to identify groups. Wing base with fracture line where wings are broken off after swarming, leaving a small basal portion called the wing scale.

IDENTIFICATION. It is necessary to know which termite, drywood or subterranean , is causing the problem. Each group is quite different biologically and therefore requires different control methods.

BIOLOGY. Termites have simple metamorphosis: egg, nymph, and adult. They are social insects and the colonies contain castes or groups of individuals who share the same body form and job description. Subterranean termites have three **castes**: worker, soldier and reproductive. Drywood and dampwood termites lack a true worker caste, and their functions are performed by nymphs which ultimately develop into soldiers or reproductives.



Workers are/can be separated into two groups: true workers who are sterile, and functional workers who are either male or female. **Pseudergates** are functional workers who have the ability to molt back into nymphs, which can then develop into soldiers, swarmers, or secondary reproductives, depending on the colony's needs. Workers maintain the colony, construct and repair the nest, and forage, build tubes and feed the

colony. Later instar nymphs also forage and help care for the young.

Soldiers are sterile and have one function, to protect the colony. The enlargement of the head and mandibles is such that they must be fed by workers or nymphs. They are present in far fewer numbers than workers or nymphs. Protection is rendered by plugging a small hole in the tube or carton with the head, or if the opening is wide, by waiting with open mandibles to fend off invaders such as ants or other insects.

In subterranean species, the reproductive stage include the primary reproductives and secondary reproductives. The primary reproductives are the king and queen which were the swarmers that started the colony. The king and queen mate periodically, and the queen may live up to 30 years. More males are produced within the colony.

Secondary reproductives are produced in more mature colonies. They do not, nor have they ever had wings (but may have wing buds if they developed from a nymph) and their body may be either lightly or darkly pigmented. Their egg production makes possible the rapid increase in size of older colonies. If something happens to the primary reproductives, they can serve as replacements.

New colonies can be started either by a founding pair of swarmers or by isolation of a portion of a large colony. Workers of subterranean termites typically build definite masses of mud, called swarm castles, or construct tubes that have openings in them, from which swarmers are released. Swarmers are weak fliers, a male and female will pair up after the swarming flight. Mated queens lay few eggs the first year, as few as 0-22 or possibly more if 1 or 2 additional egg batches are laid. At the end of the first year, a subterranean termite colony may number as many as 75 individuals. As the colony grows and expands more mating will occur, secondary reproductives will be present and more eggs will be produced. In a few years thousands of termites may be present.

Termites cannot actually digest the cellulose they ingest. Instead, they have single-celled animals called protozoa in their guts which convert the cellulose into usable nutrients.

New colonies can also be started by isolation or division. This typically happens when a new food source is located and a subcolony is formed to exploit this source. If the continuous exchange of individuals with the main colony is cut off, this subcolony can then produce the needed reproductives from either functional workers or nymphs. Other than the introduction of colonies via infested wood or wood products, this is probably the principal method of new colony formation in northern areas.

In some instances, segments of colonies may be isolated above ground inside a structure. In these cases, if there is a moisture source the colony can maintain itself and may form new secondary queens to assist is maintaining the colony. There are also instances where subterranean termite colonies have been initiated without soil contact. Most of these have occurred from roof top infestation in commercial buildings.

The question is often asked as to how many years are required before a newly-constructed building will show signs of a subterranean termite infestation. If a colony is started by a pair of subterranean termite swarmers at the time of construction, at least 3 or 4 years are required before even a few swarmers will be produced. Evidence of damage may take longer. However, if the structure is built over or close to a strong existing colony, hundreds of swarmers may appear within a year. Also, in this latter situation, substantial damage might be noticed within a year.

EASTERN SUBTERRANEAN TERMITE

COMMON NAME: Eastern subterranean termite

SCIENTIFIC NAME: *Reticulitermes flavipes* (Kollar)

CLASS/ORDER/FAMILY: Insecta/Isoptera/rhinotermitidae

soldier head capsule

swarmer (reproductive, alate)

INTRODUCTION. This is the most common and widely distributed termite in North America. It occurs south of the line where the average annual minimum temperature is -22F (-30C). This includes Ontario, Canada, and southward through the eastern United States and into Mexico and west to Arizona and Utah.

RECOGNITION.

Swarmer. *About 3/8"* (10 mm) long including wings. *Body dark* brown to almost black. *Fontanelle* (frontal gland pore) present, may be inconspicuous. *Wing with 2 dark,* heavily sclerotized (hardened) *veins* in front portion, other veins unpigmented except for basal third. *Wing translucent* (slightly milky) *to slightly smoky, with a few barely visible hairs. Front wing scale distinctly larger* than hind wing scale, may overlap basal portion of hind wing scale.

Soldier. *Head rectangular* in shape, not narrowed toward front, *length about 1.5 times width;* head length with mandibles equal to or greater than 2.8 mm. *Fontanelle* (frontal gland pore) *dorsal. Mandibles lack teeth*; points. Pronotum flat, almost as wide as head.

DAMAGE. Subterranean termites eat only the springwood and leave the lignin-containing summerwood which they cannot effectively digest. Hence, damaged wood appears to be layered. Also, soil is typically found in the galleries. A typical mature colony may consist of 60,000 to several hundred thousand workers. Sixty thousand workers can/may eat 5 grams or 1/5 ounce of wood each day. At this rate, such a colony could completely consume 2 1/3 linear feet of a pine 2"x 4" board in 1 year. However, there may be several colonies associated with a single building.

Typical (classic) damage from Subterranean termites note soil in between layers of uneaten wood

BIOLOGY. Eastern subterranean termites have 3 castes: worker, soldier, and reproductive (primary and secondary). Colony founding via alates or swarmers proceeds with the swarmers associating in pairs, breaking off their wings, and burrowing into the soil. Here they mate and only a few eggs are produced the first year. When the queen is mature she will produce about 5,000-10,000 eggs a year. The queen may live up to 30 years and workers may live up to 5 years.

Several years are required before the colony reaches the typical mature size of 60,000 or more workers. Under ideal conditions a few alates/swarmers may be produced after 3 or 4 years. Swarming typically occurs during the spring but it may possibly be followed by one or more smaller swarms until winter. Swarming occurs during the daytime, typically during the morning of the day following a warm rain.

HABITS. Eastern subterranean termite colonies are usually located in the ground. Location is usually below the frost line, but above the water table and rock formations.

Mud tubes are built to cross areas of adverse conditions between the colony and food sources. They can enter structures through cracks less than 1/16" (1-2 mm) wide. Typically, they periodically return to the soil for moisture but it has not been determined

just how often. However, if a constant source of moisture is available (like leaky pipes), colonies (called secondary colonies) can exist above ground and without ground contact. Also, true aerial colonies (no ground contact ever existed) are known to exist.

SOUTHERN SUBTERRANEAN TERMITE

COMMON NAME: Southern subterranean termite

SCIENTIFIC NAME: *Reticulitermes virginicus* Banks

CLASS/ORDER/FAMILY: Insecta/Isoptera/Rhinotermitidae

METAMORPHOSIS: Simple

INTRODUCTION. This termite is frequently encountered. It is smaller than most other species of *Reticulitermes* termites. It occurs from New York south to Florida and west to Oklahoma and Texas.

RECOGNITION.

Swarmer. *About 1/4-3/8"* (7-9.5 mm, usually 7-8 mm) long including wings. Head and body *black.* Fontanelle (frontal gland pore) present, may be inconspicuous. *Front wing with 2 dark*, slightly sclerotized (hardened/pigmented) *veins* in front portion, other veins unpigmented except for near base. *Wing almost transparent, almost colorless. Ocellus* (simple eye) *less than its diameter from compound eye*. Front wing scale distinctly larger than hind wing scale, may overlap basal portion of hind wing scale.

Soldier. *Head rectangular* in shape, not narrowed toward front, *length of head and mandibles less than or equal to 2.7 mm*. Fontanelle (frontal gland pore) dorsal and indistinct. *Mandibles lack teeth* and with tips, especially left, incurved at about 70-90ø angle; blade of right mandible with distinct and gradual inward curvature. Pronotum flat, almost as wide as head,

DAMAGE. Subterranean termites eat mostly the springwood and leave the lignin-containing summerwood which they cannot effectively digest. Hence, damaged wood appears to be layered. Also, soil is typically found in the galleries.

BIOLOGY. Southeastern subterranean termites have similar biology as the eastern Subterranean termite. They do appear smaller then the more numerous eastern sub.

HABITS. Swarming usually occurs **later** then eastern subs in May - June time of the year but may also sometines occur in the autumn.

SOUTHEASTERN DRYWOOD TERMITE

COMMON NAME: Southeastern drywood termite

SCIENTIFIC NAME: *Incisitermes snyderi* (Light)

CLASS/ORDER/FAMILY: Insecta/lsoptera/Kalotermitidae

Soldiers of drywood termites are larger then Subs and their mandibles have "teeth"

INTRODUCTION. The common name refers to its southeastern United States distribution and to the fact that it lives in wood which has a very low moisture content (12% or less). It is also found in the Bahamas and Bermuda. However, it can readily be transported outside this area in infested furniture, pictures frames, etc.

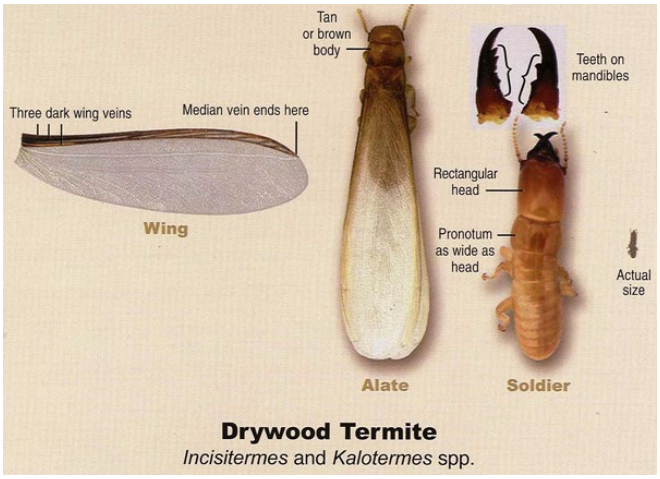
RECOGNITION.

Swarmer. About 7/16-1/2" (11-12 mm) long including wings; head width 1/32-1/16" (1.20-1.35 mm). Head and body *pale yellowish brown to pale reddish brown,* wing with sclerotized (hardened and pigmented) veins pale yellowish brown in outer half of wing. Head with 2 ocelli almost round. Antenna with 11-14 segments. *Front wing with 3 dark, heavily sclerotized veins* in front half/portion; *median vein (M) unsclerotized, running midway between sclerotized veins above and unsclerotized cubitus (Cu) below, and ending near wing tip* even if branched along its length; *not hairy.*

Soldier. *Forehead slopes down gradually from top of head,* head flattened in side view, and *head orange to reddish brown with eye spot whitish. Mandibles with an unequal number of teeth* on each member of pair. *Antenna* with 11-14 segments. *Pronotum as wide as or wider than head* (dorsal view), about 1/16" (1.3-1.6 mm) wide.

DAMAGE AND SIGNS OF DRYWOOD TERMITE INFESTATION. Drywood termites eat across the wood grain and make chambers and/or galleries connected by tunnels. Their gallery and tunnel walls are velvety smooth, and no soil is present. Usually there are fecal pellets present which are hard, less than 1/32" (1 mm) long, elongate-oval with rounded ends, and have 6 concave sides. Signs of infestation include swarmers, shed wings, piles of pellets, termite plugs which seal all openings in infested wood, and surface blisters caused by older enlarged galleries very close to the wood surface.

BIOLOGY. Drywood termites are non-subterranean termites, they do not live in the ground, require no ground contact, and do not build mud tubes.



Drywood Termite
Incisitermes and *Kalotermes* spp.

Their colonies are located in the wood they eat and are of small size when compared to subterranean termite colonies, usually numbering about 3,000 individuals after 15 years. There is no worker caste and the immatures/nymphs perform all tasks typically done by workers.

Swarming takes place at night, peaking between 8 and 10 pm, and swarmers are attracted to lights. Swarming occurs primarily from March to mid-August, peaking from late May through mid-June, but may occur any time of year.

HABITS. Swarming southeastern drywood termites fly into structures and infest wood directly. They typically first infest exposed wood such as window/door frames, trim, eaves, attics, etc. When swarming, they often re-infest the same structure.

These termites are often distributed by human activity, commonly by transporting infested furniture, pictures frames, and wood to new areas. However, they have not become established outside of their normal southeastern and mostly coastal range.

POWDERPOST/FURNITURE TERMITE

COMMON NAME: Powderpost or Furniture Termite

SCIENTIFIC NAME: *Cryptotermes spp.*

CLASS/ORDER/FAMILY: Insecta/lsoptera/Kalotermitidae

Note the appearance of the soldier for this species of drywood

INTRODUCTION. The common name powderpost comes from the small fecal pellets these termites produce and furniture because they commonly attack the wood of furniture. These are drywood termites, they infest relatively dry wood (12% or less wood moisture content), require no ground contact, get needed moisture from the infested wood, and are found primarily in humid coastal areas. In the United States, they are found in Florida, the Gulf and Atlantic coasts of the south, and Hawaii.

RECOGNITION.

Swarmer. About 3/8—7/16" (10-11 mm) long including wings. Head and body dull brown; wing membrane uncolored or faintly yellowish brown. Front wing with 3 dark, heavily sclerotized (hardened/pigmented) veins in front half / portion; not hairy.

Soldier. Head short and thick in front, front surrounded by a flange (appearing scooped out and front part nearly black. Mandibles recurved under front of head, with an unequal number of teeth on each member pair.

DAMAGE AND SIGNS OF INFESTATION. Powderpost termite damage is identical to that of other drywood termites. They eat across the grain and make chambers and/or

galleries connected by tunnels. Their gallery and tunnel walls are velvety smooth, and no soil is present. Usually there are fecal pellets present, which are hard elongate-oval with rounded ends, and have 6 concave sides. Signs of infestation include swarmers, shed wings, piles of pellets, termite plugs which seal all openings in infested wood, and surface blisters caused by older enlarged galleries very close to the wood surface. Occasionally they may build shelter tubes of pellets cemented together to bridge over to an adjacent piece of wood.

BIOLOGY. Powderpost termites are non-subterranean termites, they do not live in the ground, require no ground contact, and do not build mud tubes. Their colonies are located in the wood they eat and are of small size when compared to subterranean termite colonies, however over time there can be numerous colonies within a structure causing significant damage. There is no worker caste and the immatures/nymphs perform all tasks typically done by workers.

The tropical rough-headed powderpost termite (*C. brevis*) mostly swarms near sunrise or after sunset, from April to July. The smooth-headed powderpost termite (*C. cavifrons*) swarms in the evening year-round, but especially in the spring. Evening and night-time swarmers are attracted to lights. Night swarms usually contain dozens, occasionally hundreds of alates/swarmers. A single colony may produce 5-20 swarms over a 6-week period.

HABITS. Swarming powderpost termites fly into structures and infest wood directly. They typically first infest exposed wood such as window/door frames, trim, eaves, attics, etc. When swarming, they usually re-infest the same structure. Multiple colonies are often found in a structure or single infestation site.

Note: The tropical rough-headed powderpost termite (*C. brevis*) is often distributed by human activity, commonly by transporting infested furniture, picture frames, and wood to new areas. The tropical rough-headed powderpost termite has been found as far north as Belleville, Ontario, Canada, and as far west as Los Angeles, California. It has not become established in northern or dry western areas, it has been found in structures, but never outdoors.

Termites
Study Questions

1. Discuss the three characteristics (body construction, antennae, and wings) used to separate termite and ant swarmers. How are they used to separate termites from ants?

2. Termites are social insects and have a caste system. Discuss what is meant by a caste system in termites? What is unique about the worker caste and what great advantage is this to the termite colony and its survival?

3. In terms of recognition, compare and contrast worker, soldier, and swarmer subterranean termites.

4. Discuss how specimens of the swarmers and soldiers of drywood termites can be separated from those of subterranean termites.

5. Discuss the two ways new termite colonies are started. How fast do new colonies grow in size? How is it possible that older termite colonies can increase is size much faster?

6. Compare and contrast drywood termites to subterranean termites in terms of general biology, castes present, and habits.

7. Given a newly constructed house, discuss how long it takes for the appearance of the first swarmers and visible damage for subterranean termites and why.

WOOD-DESTROYING BEETLES
(COLEOPTERA)
GENERAL

CLASS/ORDER: Insecta/Coleoptera

FAMILY: Various

METAMORPHOSIS: Complete

INTRODUCTION. Wood-infesting or wood-boring beetles function in nature to help reduce dead wood into a form that can be utilized as plant food. However, those attacking preseasoned or seasoning wood, but especially those which attack seasoned wood, can be very destructive to wood that humans either use or intend to use in their structures and/or as furnishings. Of the more than 30,000 U.S. species placed in about 112 families, about 12 families represented by probably less than 100 species that are commonly encountered as pests of wood found in structures and/or their furnishings.

RECOGNITION. Adult beetles with elytra (front wings; appear as wing covers of hind wings) horny (hardened) or leathery, of same texture throughout, without veins, usually covering entire abdomen, meeting in straight line down back. Hind wings membranous (like cellophane), usually longer than body, folded beneath and concealed by elytra when at rest.

Larvae yellowish white with dark mandibles (jaws), some species with other dark areas or structures. Head capsule (hardened head) present, mouthparts chewing. Most with thoracic legs, lack abdominal prolegs. Usually with abdominal spiracles. Refer to the treatment of the individual pests/groups for help in identification.

SIGNS OF INFESTATION. Because adults and/or larvae of wood-infesting beetles are not often encountered, diagnosis of the cause of the problem is usually based on the evidence left behind. One must use all of the evidence available because rarely will one characteristic, such as exit hole size, be conclusive. Therefore, the identification/conclusion will be based on the following evidence (in addition to adults and/or larvae, if present):

1. Type of wood damaged: softwood (evergreens/conifers) or hardwood (deciduous/broad-leaf trees; all others).

2. Age of the wood: new (10 years or less) or old (over 10 years).
3. Type of product being damaged: structural/dimension lumber (at least 2x4"/4.9x9.8 cm), lumber/boards (1"/25 mm thick or less), or manufactured products (i.e. millwork, flooring, furniture).
4. Exit holes: size and shape.
5. Frass: texture and how packed in tunnels/galleries.
6. Wood moisture content: moisture meter required.

IDENTIFICATION. It is necessary to be able to determine at least which family of beetles is involved. In some cases, such as with the old house borer, species identification is required. As a quick reference and summary of the signs of infestation and characteristics listed above, refer to the comparative chart at the end of this introduction to the wood-infesting beetles.

BIOLOGY. Beetles have complete metamorphosis: egg, larva, pupa, and adult. Eggs of wood-infesting beetles are usually laid in surface cracks or crevices, and/or in wood pores, but bark beetles (Scolytidae) require and almost all flatheaded wood borers (Burprestidae) require bark for egg laying. The larvae are always found within the wood. Larval tunnels/galleries are usually found in the sapwood and run primarily with the wood grain. These tunnels increase in diameter with each larval molt and are usually packed with a combination of wood fragments and fecal material, commonly called frass. Pupation usually occurs near the surface and often in a pupal cell.

Once the adult emerges, it bores directly to the surface and leaves the wood via an exit/emergence hole; old house borers have their exit hole pre-bored by the larva and may wait several months before exiting. Adults usually live only a matter of days or weeks. Some adults are attracted to light and may be found at windows, etc. Developmental time (egg to adult) may be as short as about 50 days but may be 10 years or longer, depending on the species and the temperature, wood moisture content, and nutritional value of the wood.

ANOBIIDS/DEATHWATCH BEETLES/FURNITURE BEETLES

COMMON NAME: Anobiid, deathwatch beetle

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Anobiidae

METAMORPHOSIS: Complete

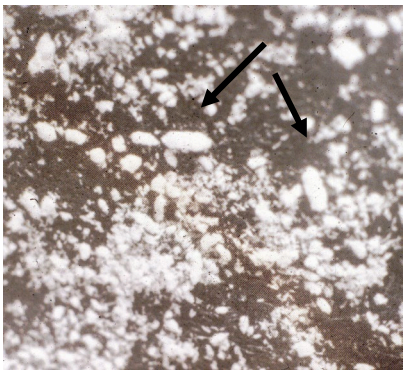
INTRODUCTION. Anobiids are the most commonly encountered of the powderpost beetles, Iyctids and bostrichids being the other 2 groups. They get their common name of anobiids from the beetle family to which they belong. For some species, the name of deathwatch beetle comes from the tapping sound adults make by striking their mandibles (jaws) against the wood surface of their tunnel as a mating call. Heard in the quiet of the night, when people were sitting up with an ill person, this tapping was superstitiously believed to indicate that death was near. They are worldwide in distribution, with about 310 species occurring in the United States.

RECOGNITION. Depending on the species, adults about 1/32-3/8" (1.1-9 mm) long but those attacking buildings range from 1/8-1/4" ***(3-7 mm)*** long. Shape variable but usually ***elongate, cylindrical.*** Color reddish brown to nearly black, sometimes with lighter areas of pale setae (hairs). ***Prothorax hoodlike,*** nearly always ***enclosing head, concealing it*** when viewed from above. ***Antenna with club not symmetrical, last 3 segments*** nearly always ***lengthened and expanded*** or simply lengthened; sometimes serrate (sawtoothed) or pectinate (comblike). Punctures/pits on elytra (wing covers) in or not in rows.

Depending on the species, mature larvae range up to about 1/2" (11 mm) long. Color nearly white. Form C-shaped but with thorax enlarged/swollen. Antenna short, 2-segmented

SIMILAR GROUPS. (1) False powderpost beetles (Bostrichidae) have short antenna with compact club, pronotum with rasplike teeth at front. (2) Powderpost beetles (Lyctidae) with body flattened, head visible from above. (3) Bark and ambrosia beetles (Scolytidae) have antenna elbowed, with a symmetrical club. (4) Dermestid beetles (Dermestidae) with symmetrical antennal club.

DAMAGE AND SIGNS OF INFESTATION. Exit holes are round and, depending on the species, range from 1/16-1/8" (1.6-3.2 mm) in diameter. Another indication of an infestation is the accumulation of piles of powdery but gritty frass beneath the exit holes or streaming from them. The "grittiness" of the frass is due to the small pellets within the frass



BIOLOGY. Female anobiid beetles lay their eggs (usually 20-60; maximum 121) on wood under surface splinters, in cracks, or in old exit holes. After hatching, the larvae bore straight into wood for a short distance, and then make a right-angle turn and bore with the wood grain. As they bore, the larvae pack their frass and fine wood fragments into the tunnel behind them. If a softwood (evergreen/conifer) is being attacked, this loosely packed mixture feels gritty due to the lemon or bun-shaped fecal pellets whereas, if a hardwood (broad-leaf tree) is being attacked, this mixture is tightly packed and does not feel gritty. When the beetle is ready to emerge, the larvae bores straight to the wood's surface and creates its pupal chamber there, and when the beetle is ready to emerge, it bites through the thin outer surface and exits/emerges. Adults usually emerge in the spring or early summer and do not feed, but actively seek a mate. Under very favorable conditions, developmental time (egg to adult) may require only 1 year, but it usually requires 2-3 years indoors and sometimes longer. Although most Anobiids are strong fliers, females tend to lay their eggs on the wood from which they emerged.

HABITS. Anobiids attack both softwoods and hardwoods, and mostly the sapwood. They attack structural timbers, lumber, and manufactured products. In structures, only wood older than 9 but usually older than 10 years is attacked; however, *E. peltatus* will also attack freshly seasoned wood. The wood moisture content required for beetle development is 13-30%. Because of this high moisture requirement, they are a major problem in the southeastern states, especially in crawl-space type construction, and in coastal states where the relative humidity is high and it is warm. Adults are active only at night and those of some species are attracted to light while others are not.

The larval and adult activity vary considerably during the year based primarily on beetle biology and wood moisture content. For *Euvrilletta peltatus*, probably the most destructive species in the east, this activity can be summarized as follows:

1. December-January-February. Larvae are inactive; no new frass or exit holes.
2. March-April-May. Larvae resume feeding during March and feed for 1-2 months New exit holes and adults are present by mid-May (Atlantic Coast).
3. June-July-August. New exit holes and adults present. The number of adults may start to decrease during June.

4. September-October-November. Usually no visible signs of activity but larvae feeding within wood; larval chewing cannot be heard.

Note: There is one report of adult emergence from April through October.

LYCTIDS/POWDERPOST BEETLES

COMMON NAME: Lyctid or true powderpost beetle

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Lyctidae (Lyctine)

METAMORPHOSIS: Complete

INTRODUCTION. Lyctids are commonly known as (true) powderpost beetles because their larvae produce a very fine, powderlike frass in their galleries (vs. bostrichids/false powderpost beetles and anobiids, whose larvae produce coarser frass which also contains fine wood fragments or pellets respectively). They are worldwide in distribution, with about 11 species occurring in the United States.

RECOGNITION. Depending on the species, adults about 1/32-1/4" (1-7 mm) long. *Body elongate, narrow, flattened,* almost *parallel-sided;* head, pronotum, and elytra (wing covers) about equal in width; *pronotum somewhat wider at front; head* and often mandibles visible when viewed from above. Color reddish brown to black. *Antenna with abrupt 2-segmented club. Elytra* (wing covers) often *with rows of hairs* (setae). First abdominal segment ventrally much longer than other segments.

Depending on the species, mature larvae up to about 1/4" (6 mm) long. Color nearly

white. Body C-shaped but with enlarged thorax. Antenna short, 4-segmented. *Spiracle* of 8th (last) abdominal segment 3 times larger than other abdominal spiracles.

DAMAGE AND SIGNS OF INFESTATION. Exit holes are round, and depending on the species, range from 1/32-1/16" (0.8-7.6 mm) in diameter. Another indication of an infestation is the accumulation of piles of very fine powderlike dust beneath the exit holes or on the wood. This dust/frass contains no pellets (like anobiid's) and falls easily from the hole instead of being packed in (like anobiids and bostrichids).

BIOLOGY. Female Iyctids lay their eggs (15-50) in exposed wood pores, cracks, or crevices. Eggs are never deposited in/on waxed, polished, painted, or varnished surfaces. The larvae tunnel only in the sapwood and usually tunnel with the wood grain. As they bore, the larvae tightly pack their tunnels with very fine powderlike dust (like talcum powder or flour). After several molts requiring 2-9 months, the mature larva bores to near the surface and constructs a pupal chamber and pupates. When the adult emerges, it bores straight to the wood's surface and exits/emerges. Under very favorable conditions, developmental time (egg to adult) usually requires 9-12 months, but may be as short as 3-4 months or as long as 2.5-4 or more years. Although some Iyctids are strong fliers, most tend to lay eggs in the wood from which they emerged. Since Iyctid larvae cannot digest cellulose, they feed only on the cell contents which is primarily starch, but also sugar and protein.

HABITS. Lyctids attack the sapwood and only that of hardwoods, usually less than 10 years old. They attack both lumber,examples incldue oak, maple Ash and other hardwoods and manufactured products, including cabinetry, flooring and even ornametal furnishings. The wood moisture content required for beetle development is 8-32%, with greatest activity at 10-20%. Adults are active at night, readily fly, and are attracted to light.

Lyctids are usually brought into structures in wood which contains their eggs and/or larvae. This wood is typically infested during drying time or storage. Finish on wood prevents egg laying.

They usually attack oak, hickory, and ash but will attack other native and tropical hardwoods. Lyctids often attack bamboo.

OLD HOUSE BORER

COMMON NAME: Old house borer

SCIENTIFIC NAME: *Hylotrupes bajulus* (Linnaeus)

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Cerambycidae

METAMORPHOSIS: Complete

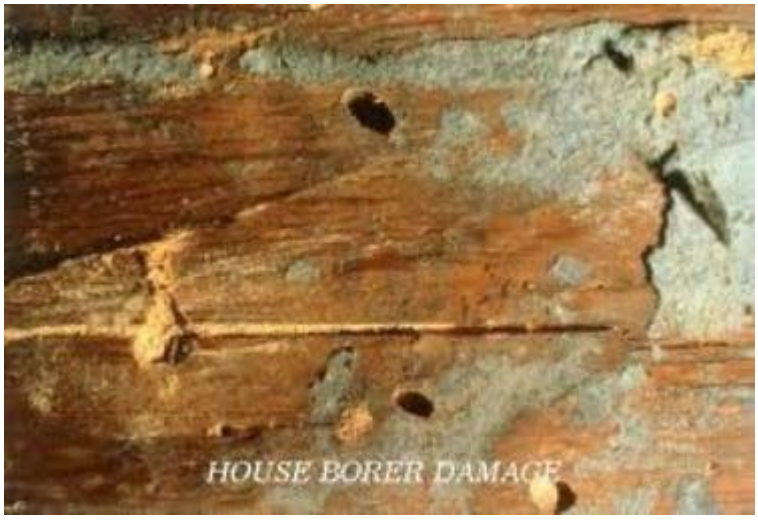
INTRODUCTION. The old house borer apparently gets its common name from its ability to attack or reinfest well-seasoned wood found in old structures, although it usually attacks wood less than 10 years old. Of north African origin, it has been distributed through commerce to many parts of the world. In the United States, it is found in and eastward of those states going north to south, Michigan, Indiana, Illinois, Missouri, Arkansas, and Texas, and it is found as far north as central Maine.

RECOGNITION. Adults about *5/8-1 "* (15-25 mm) long. Body *elongate, slightly flattened* in form. Color *brownish black* to black but *covered with gray pubescence* (numerous short hairs/setae) which often *forms transverse bands on elytra* (wing covers). *Pronotum with a shiny ridge down its middle and a shiny raised knob/bump to either side.* Eyes usually notched to inside and antenna often attached/inserted in these notches. *Antenna 1/3 body length* or more.

Mature larvae are usually about 1 1/4" (31 mm; range 20-40 mm) long. Color nearly white. Thorax slightly wider than abdominal segments, abdomen constricted between segments. Head with 3 black ocelli (simple eyes) in a row on each side to outside of antenna. Legs short, 4-segmented. Note: other species of cerambycids boring in softwoods have no more than 1 ocellus (simple eye) on each side of their head.

SIMILAR GROUPS. (1) Other cerambycids or longhorned beetles (Cerambycidae) differ in size, coloration, pubescence pattern, and/or shiny area pattern on prothorax.

DAMAGE AND SIGNS OF INFESTATION. Exit holes are oval and range from 1/4-3/8" (6.5-10 mm) maximum diameter, with edges often ragged. From the surface, the exit tunnel goes inward about 1-2" (2.4-4.9 cm) and then curves; larval tunnel with ratio of minimum to maximum diameter about 1:2. Another indication of an infestation is the appearance of piles of frass on the wood around the exit hole and/or on the floor below. Their frass consists of very fine powder and tiny (1/16"/1.1-1.2 mm long) elongated, blunt-ended, barrel-shaped pellets which often split lengthwise when dry. This frass is tightly packed in the tunnels/galleries. The surface of most galleries has a rippled pattern which other structural borers do not make. Before any external signs are visible, the presence of a rhythmic rasping or clicking sound indicates the presence of larger larvae feeding. However, such sounds do not indicate what species of wood borer is present, only that borers are present and active.



BIOLOGY. The adult female lays about 40-50 eggs (up to 150-200) in cracks and crevices in the wood, over about a 5-day period. The eggs usually hatch in about 9 days (up to 3 weeks) and the larvae bore into the sapwood. Larval development may depend on several factors generally the larvae stay active in the wood for 3-5 years then pupate, however under very dry conditions such as in attics, 12-15 years may be required. During the winter months of December, January, and February, there is a marked decline in feeding activity. The mature larva (weight about 200 mg) bores the oval exit/emergence hole of the adult and plugs it with frass and wood fibers before pupation. Pupation occurs near the wood's surface in the spring, and lasts about 20 days. Adults usually emerge during June, July, and August but sometimes remain in the wood for 7-10 months before emerging sometime during the summer. Although the adults are strong fliers, they often reinfest the wood from which they emerged. Under ideal conditions, adult females live about 10 days, males about 15 days.

HABITS. Old house borers attack only softwoods, primarily pine, and only the sapwood. They attack both structural timbers and lumber. In structures, primarily wood less than 10 years old is attacked but they can and do reinfest much older wood. The optimum wood moisture content for beetle development is 10-28%.

The larval and adult activity vary considerably during the year based primarily on beetle biology and wood moisture content. It can be summarized as follows:

1. December-January-February. Larvae do little or no feeding; chewing sounds are rare, no fresh frass or new exit holes.
2. March-April-May. Chewing sounds heard regularly in March and/or April , but stop in May. New exit holes and adults may appear in May in the south, but rarely so.
3. June-July-August. New exit holes with frass and adults common. Chewing sounds heard during the day in basements and interior walls and more often at night (lower temperatures) in attics and exterior walls.
3. September-October-November. Chewing sounds of 2-3-year-old larvae may be easily heard from several feet away, with sounds often more frequent in October and November.

Wood-Destroying Beetles
Study Questions

1. Anobid and lyctid beetles make up the powderpost beetles. Discuss how one can distinguish the adult beetles of each group from one another.

2. The old house borer is the largest of the wood-destroying beetles. How can the adult and larva be distinguished from the adult and larva of other large beetles which may be found around a structure, usually coming into lights at night or brought in with firewood?

3. Since the adult beetles are not commonly encountered, a diagnosis of which beetle is causing the problem in the wood must be made based on one or more of six kinds of evidence left behind. Discuss these kinds of evidence and what they mean.

4. Discuss why almost always more than one of the six kinds of evidence must be used/evaluated in order to make an accurate identification as to which beetle is causing the problem.

5. Larval chewing sounds have often been used as positive evidence that old house borers are present and causing the damage to the structure. Why may this not be true?

6. Discuss the year-long activity cycle for anobiid beetles in the New England region. Why is this knowledge so important when doing an inspection and report for a real estate transaction?

7. Discuss the year-long activity cycle for wood boring beetles in New England. Why is this knowledge so important when doing an inspection and report for a real estate transaction?

8. Discuss why the time of year is important to determining active infestations of wood borers.

9. Discuss the different areas of the structure that can be attacked by wood borers.

WOOD-DESTROYING ANTS AND BEES (HYMENOPTERA)
GENERAL

Abdomen connected to thorax by 1 or 2 slender abdominal segments called nodes which form the pedicel (ant's waist); enlarged rear portion of the abdomen is the gaster. Females with 2 nodes have a stinger.

Bees (Anthophoridae)**.** Body with base of abdomen constricted, sometimes stalked. Body hairs feathered (need 20x magnification). Wings 4 in number, with front wings little longer than hind wings; wings with relatively few veins. Antenna moderatley long, females 12-segmented and males 13-segmented. Tarsi 5-segmented. Mouthparts chewing but sometimes modified into tonguelike sucking structure. Females with a well-developed ovipositor modified into a stinger.

IDENTIFICATION. It is necessary to know which ant species you are encountering because ants vary widely in their food preferences and living habits. Preliminary identifications can be made by using the pictorial key which follows this section.

For bees, recognition of the carpenter bee is necessary.

BIOLOGY. Ants and bees have complete metamorphosis: egg, larva, pupa, and adult. Ants are social, live in colonies, and have a caste system composed of workers (sterile females), queen(s), and males. Carpenter bees are solitary and do not live in colonies.

CARPENTER ANTS

COMMON NAME: Carpenter ants

SCIENTIFIC NAME: *Camponotus* spp.

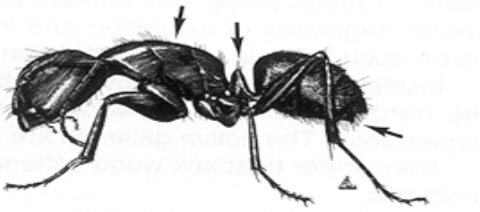
CLASS/ORDER/FAMILY: Insecta/Hymenoptera/Formicidae

METAMORPHOSIS: Complete

INTRODUCTION. The black carpenter ant, *Camponotus pennsylvanicus* (DeGreer), is a native species and the common species in the east. These ants get their common name from their habit of hollowing out galleries in pieces of wood for nesting purposes. This nesting habit can result in structural damage. Carpenter ants are found throughout the United States.

Although carpenter ants do not sting, their bites can be quite painful, especially when they inject formic acid into the wound.

RECOGNITION. Workers polymorphic (different sizes), large (1/8-1/2" or 3.5-13 mm) but vary greatly in size; queens about 1/2-5/8" (13-17 mm) long. Color black, combinations of red and black, or completely red or brown. Antenna 12-segmented, without a club. ***Thorax*** lacks spines, ***profile evenly rounded*** on upper side. ***Pedicel 1-segmented. Gaster with*** anal opening round, surrounded by ***circlet of hairs***. Stinger absent. Workers capable of emitting a strong formic acid odor.

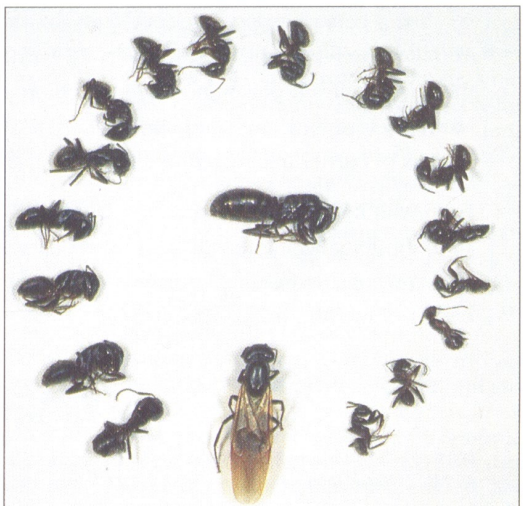


Camponotus pennsylvanicus with workers about 1/4-1/2" (6-13 mm) long and completely black except top of gaster with long, pale yellowish hairs pressed against its surface.

SIMILAR GROUPS. (1) Dark field (*Formica* spp.), larger yellow (*Acanthomyops interjectus*), and Allegheny mound (*F. exsectoides*) ants have profile of thorax not evenly rounded, with distinct impression(s); in addition dark field ants with front and hind margins of node steeply or equally sloped.

DAMAGE. When these ant nest in wood, often the only external indication of infestation other than the presence of workers, frass and/or swarmers is the appearance of small openings or windows on the surface of the wood. Through these, the workers expel debris which consists of sawdust-like shavings and/or fragments of insulation and insect body parts. The accumulation of such debris below such holes is a good indication of an infestation.

Inside, the galleries follow the softer spring wood with numerous connections through the harder/dark summer wood. The gallery walls are smooth, with a sand-papered appearance. The active galleries are kept clean of debris.



When they nest in wood they prefer to attack wood softened by fungus and can be associated with moisture problems.

BIOLOGY. Black carpenter ant colonies are of moderate size, usually containing over 3,000 workers (up to 10-15,000 including satellite nests) when maturity is reached in about 3 to 6 years. Developmental time (egg to adult) for workers takes at least 60 days. Workers are polymorphic, with majors, minors, and intermediates present in a mature colony there could be as many different sized workers within a colony. There is usually only one functional queen per colony. Swarmers are not produced until the colony is more than 2 years old, usually 3.5-4 years old for *C. pennsylvanicus.* Swarmers appear from May until August in the east.

HABITS. Most carpenter ant species establish their first nest in decayed wood and later expand or enlarge this into sound wood. Inside, nests are located in wood (preferably softened by fungus rot), in insulation, and/or in wall voids. Workers are a nuisance when out searching for food but are destructive to timbers utilized for nesting activities. Outside, nests are typically located in rotting fence posts, stumps, old firewood, dead portions of standing trees, and under stones or fallen logs.

The presence of a carpenter ant nest is sometimes indicated by a rustling sound coming from wall voids or from wood where the colony is located. Otherwise, the emergence of swarmers indoors may be the first indication of an indoor colony.

Carpenter ants feed primarily on insect honeydew, plant and fruit juices, insects and their larvae, and other arthropods. Inside, they will also feed on sweets, eggs, meats, and grease.

The workers forage for distances of up to 300 feet (91.4m) from the nest. They typically enter buildings around door and window frames, eaves, plumbing and utility lines, and shrub and tree branches in contact with the building. Although some workers are active during the day, most activity is from dusk till dawn, with peak activity between 10 pm and 2 am.

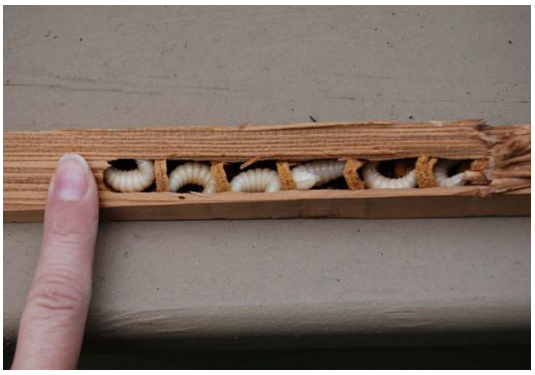
CARPENTER BEE

COMMON NAME: Carpenter Bee

SCIENTIFIC NAME: *Xylocopa virginica* (Linnaeus)

CLASS/ORDER/FAMILY: Insecta/Hymenoptera/Anthophoridae

METAMORPHOSIS: Complete



INTRODUCTION. Carpenter bees get their common name from their habit of boring into wood to make galleries for the rearing of young. These are worldwide in distribution with 7 species occurring in the United States. The carpenter bee, *X. virginica* (Linnaeus), is the most common eastern species and its range extends westward to Kansas and Texas.

RECOGNITION. Adult body length about *1"* (25 mm); robust in form, ***resembling bumble bees, but with top surface of abdomen largely bare, black, and shining;*** male with yellow face, female with black face. Hind tibiae with apical spurs. Front wing 2nd submarginal cell triangular; hind wing with a small jugal lobe (lobe on rear margin near body).

SIMILAR GROUPS. (1) Bumble bees (Apidae) have hairy abdomen with yellow markings, (2) Giant Resin bees similar in color and size may nest inside old carpenter bee hole and galleries.

BIOLOGY. Carpenter bees are not social insects and do not live in nests or colonies. The adults overwinter, typically in abandoned nest tunnels. In the spring, the survivors

emerge and feed on nectar. Then mating begins and extends into 1 cell per day. Developmental time (egg to adult) is about 36 days. The mated female may either reuse an old gallery, construct a new one by lengthening an old gallery, bore an entirely new one, or extend a gallery from a common entrance hole. Females of the carpenter bee will nest in a wide range of woods, but prefer weathered and unpainted wood. The female typically bores a circular hole (same diameter as her body) straight into the wood across the wood grain for a distance equal to her body length. Then the gallery takes a right-angle turn, usually with the grain of the wood and parallel to the outer longitudinal surfaces. New galleries average 4-6" (10-15 cm) long but galleries developed/used by several bees may extend up to 10 feet (3 m).

The female provisions each gallery cell starting at the closed end of the gallery with a mass of pollen and regurgitated nectar upon which she lays a single egg. This portion of the gallery is then sealed off with a chewed wood-pulp plug, making a chamber or cell. This process is repeated until a linear series of 5-6 cells is completed

HABITS.

Male carpenter bees tend to be territorial and often become aggressive when other males or animals approach, including humans, sometimes hovering a short distance in front of the face or buzzing one's head. Since males have no stinger, these actions are merely show. However, the female does have a potent sting which is rarely used.

Note: carpenter bee "nests" are often found by woodpeckers which can cause more damage then the bee.

Wood-Destroying Ants and Bees
Study Questions

1. How can one distinguish worker carpenter ants from the workers of all other structural-infesting ants?

2. How can one distinguish swarming carpenter ants from the swarmers of all other structural-infesting ants?

3. Discuss the area of a structure vulnerable to carpenter ant attack.

4. Discuss how time of year is important to determining ant activity.

5. How can the damage caused by carpenter ants be destinguished from that caused to wood by other insects and rodents?

6. Although carpenter bees resemble bumble bees in appearance, how can they be told apart? What behavioral aspect of carpenter bees is distinctive?

7. How can the damage of carpenter bees be distinguished from that of carpenter ants and wood-boring beetles?

8. Carpenter bee infestation may lead to other problems — what are those possibilities.

9. Discuss where carpenter bees can be found infesting structures.

Re-infesting Beetles Chart

Damage By Common Wood-Boring Beetles

Insect Type	Wood Type	Age Of Wood[a]	Shape & Size Of Holes			Reinfestation[b]
Anobiid Beetles	Soft & Hard	New & Old	Round	1/16"	1/8"	Yes
Bostrichid Beetles	Soft & Hard	New	Round	3/32"	9/32"	Rarely
Lyctid Beetles	Hard	New & Old	Round	1/32"	1/16"	Yes
Old House Borer	Soft	New & Old	Oval	1/4"	3/8"	Yes

[a]New wood is freshly cut or unseasoned lumber. Old wood is seasoned or dried lumber.
[b]Many other wood-boring beetles can initially infest new wood in homes, but their damage is limited and they do not rein-

Exit Holes	Type of borer	Wood attacked		Recognition of damage			Reinfestation
		Part and type	Condition	Exit holes	Galleries (tunnels)	Frass	
 Round Holes 1/16" to 1/6"	Anobiid powderpost beetles	Sapwood of hardwoods and softwoods; rarely in heartwood	Seasoned	Circular, 1/16 to 1/8 in (1.6 to 3 mm) diameter	Circular, up to 1/8 in (3mm) diameter; numerous random	Fine powder with elongate pellets conspicuous; loosely packed[1]	Yes
 Round Holes 1/16" to 5/16"	Bostrichid powderpost beetles	Sapwood of hardwoods primarily; minor in softwoods	Seasoning and newly seasoned	Circular, 3/32 to 9/32 in (2.5 to 7 mm) diameter	Circular, 1/16 to 3/8 in (1.6 to 10 mm) diameter; numerous random	Fine to coarse powder; tightly packed, tends to stick together	Rarely
 Round Holes 1/32" to 1/8"	Lyctid powderpost beetles	Sapwood of ring- and diffuse-porous hardwoods only	Newly seasoned with high starch content	Circular, 1/32 to 1/16 in (0.8 to 1.6 mm) diameter	Circular, 1/16 (1.6 mm) diameter; numerous; random	Fine, flourlike, loose in tunnels	Yes
 Oval to Round Holes 1/4" to 1/2" or larger	Round-headed borers (general)	Sapwood of softwoods and hardwoods; some in heartwood	Unseasoned logs and lumber	Oval to Circular, 1/8 to 3/8 in (3 to 10 mm) long diameter	Oval up to 1/2 in (13 mm) long diameter, size varies with species	Course to fibrous; may be mostly absent	No
 Oval Holes 1/4" to 3/8"	Old house borer	Sapwood of softwoods; primarily pine	Seasoning to seasoned	Oval, 1/4 to 3/8 in (6 to 10 mm) long diameter	Oval up to 3/8 in (10 mm) long diameter; numerous in outer sapwood, ripple marks on walls	Very fine powder and tiny pellets; tightly packed in tunnels	Yes
 Oval Holes 1/4" to 3/8" or larger	Flat oak borer	Sapwood and heartwood of hardwoods, primarily oak	Seasoning and newly seasoned	Slightly oval, 1/16 to 1/12 in (1.6 to 2 mm)	Oval up to 1/12 in (2 mm) long diameter;	Fine granules	No
 Longer Oval Holes 1/4" to 3/8" or larger	Flat-headed borers	Sapwood and heartwood of softwoods and hardwoods	Seasoning	Oval, 1/8 to 1/2 in (3 to 13 mm) long diameter	Flat oval, up to 3/8 in (10 mm) long diameter; winding	Sawdustlike, may contain light and dark portions if under bark; tightly packed	No
 Round Holes 1/32" to 1/16"	Bark beetles	Inner bark and surface of sapwood only	Unseasoned under bark only	Circular, 1/16 to 3/32 in (1.6 to 2.5 mm) diameter	Circular, up to to 3/32 in (2.5 mm) diameter, random	Coarse to fine powder, bark-colored, tightly packed in some tunnels	No
 Round Holes 1/32" to 1/16"	Ambrosia beetles	Sapwood and heartwood of hardwoods and softwoods	Unseasoned logs and lumber	Circular, 1/50 to 1/8 in (0.5 to 3 mm) diameter	Circular, same diameter as holes; across grain, walls stained	None present	No
 Round Holes 1/32" to 1/16"	Wood-boring weevils	Sapwood and heartwood of hardwoods and softwoods	Slightly damp, decayed	Raggedly round or elongate, 1/16 to 1/12 in (1.6 to 2 mm) diameter	Circular, up to 1/16 in (1.6 mm) diameter	Very fine powder and very tiny pellets, tightly packed	Yes

CHAPTER 3

WOOD-DECAY AND NON-DECAY FUNGI

Objective. In this chapter you will learn the different fungal types which are commonly found in structures and how to recognize each. You will learn their biology and the environmental conditions which make their growth possible.

Contents. Introduction.

Brown rot.

Sap-staining fungi, bluestain, sapstain.

Surface-staining fungi, mildew, mold.

Water-conducting fungi, dry-rot, *Poria*.

White pocket rot, pock rot, white spec.

White rot fungi or white rot.

GROUP:	Wood-decay and non-decay fungi
KINGDOM:	Plantae
DIVISION(=PHYLUM):	Mycota
SUBDIVISION:	Eumycotina

INTRODUCTION. Wood-decaying fungi (primarily brown rot including the water-conducting fungi, and white rot) cause as much, if not more, damage to structures each year than do termites. Estimated residential repair costs for wood rot repair were projected to be more than $17 billion. Often, damages attributed to termites was actually primarily caused by wood-decay fungi because moisture conditions favorable for fungi were not corrected.

The presence of non-decay fungi (primarily surface-staining fungi or molds and mildews, and sap-staining fungi) is a good indication that conditions exist which may soon be favorable for wood-decay fungi.

All, these fungi are found throughout the United States, although some are restricted to areas of warmer and/or more humid conditions. The importance of these organisms to WDI inspection relates to the moisture conditions that may foster their growth. These conditions may be enough to also intice other organisms like wood destroying insects to infest the wood. In addition rots are destructive. Most WDI inspection are for insects only, however companies need to make a decision and position themslves on the issues of wood rots and moiture conditions.

RECOGNITION. Refer to individual sections for details. However, each group can be briefly described as follows (#'s 1-3 are non-decay fungi whereas, #'s 4-6 are wood-decay fungi):

1. **Sap-staining fungi** (blue-stain fungi). Produce colored **hyphae** (threadlike strands) deep within the wood. The stain color is usually bluish, bluish black, gray, or brown.

2. **Surface-staining fungi** (molds and mildews). Produce colorless hyphae (threadlike strands) within the wood and form colored **spores** ("seeds") on hyphae at the wood surface which give a powdery or "fuzzy" appearance to the surface. The spores may be black, brown, gray, green, blue, yellow, orange, white, etc.

3. **White / brown pocket rot** (pock rot, white / brown pocket, white / brown spec). Numerous small pits filled with white / brown hyphae, attacks wood of living coniferous (soft woods/evergreen) trees, usually Douglas fir. Does not survive in wood products but evidences of the "pits" can be seen.

4. **Brown rot.** Wood usually becomes brownish. Upon drying, wood shrinks into small cubical pieces with cracks perpendicular to the wood grain. Cubical pieces easily crushed to powder. When actively growing will be soft to probing.

5. **Water-conducting fungus** ("dry-rot", ***Poria incrassata***). Produces papery yellowish-white mycelial fans (masses of hyphae) and rootlike rhizomorphs (thick strands of hyphae) which may be whitish to brownish to black. Produces a
brown-rot type of decay.

6. **White rot.** The wood has a bleached appearance, usually with black zonal lines. Wood becomes stringy and spongy, not brittle.

IDENTIFICATION. It is necessary to at least be able to determine if the fungus observed is a wood-decay fungus or a non-decay fungus. If it is a wood-decay type, then recognition of the water-conducting (*Poria incrassata*) versus brown or white rot is required because different control measures are necessary.

BIOLOGY. The wood-decay and non-decay fungi are plants which lack chlorophyll. Therefore, since they cannot produce their own carbohydrate food, they live on carbohydrates contained or stored in wood. The fungal **reproductive body** or **spore** ("seed") germinates when the proper conditions of oxygen, temperature, and moisture exist, by developing threadlike **hyphae**. The hyphae secrete enzymes (chemicals) which break down wood into usable food. As they grow, the hyphae branch many times, sometimes forming white masses of hyphae called **mycelial** mats or fans on the surface or in cracks. The hyphae of some fungi form thick rootlike strands called **rhizomorphs** which allow them to conduct water long distances. Eventually fruiting structures called **sporophores** (some are called mushrooms, toadstools, conks) are produced. These sporophores then produce spores by the billions which are disseminated by wind, water, insects, animals, and humans.

Wood-attacking fungi require the proper combination of food (wood), moisture (damp), temperature (mild), and air/oxygen (some) for growth, as follows:

1. **Food.** Wood-decay fungi use the cellulose and lignin of plant cell walls as their food, which significantly reduces wood strength. Brown-rot fungi use mostly cellulose whereas, white-rot fungi use both cellulose and lignin as food. Non-decay fungi such as surface-staining and sap-staining fungi use the stored starches, sugars, proteins, and/or fats as food which may cause discoloration, but has little effect on wood strength.

2. **Moisture.** For growth, wood-decay fungi require the wood moisture content (moisture in cell walls) to be at or about the **fiber saturation point** which for most wood varies (by the species) from 28-32%. Below the fiber saturation point, the fungus is inactive but not dead and growth will resume when the required moisture is again present. Non-decay fungi require a wood moisture content of about 20% for growth and below this level, they may be inactive but not dead.

3. **Temperature.** Fungi are inactive or dormant at cool temperatures. Most attain optimum growth rates between 70-85 F (21-29 C), and are killed by brief exposures to temperatures between 105-150 F (40-66 C).

4. **Air/Oxygen.** Decay fungi require as little as 1/20 of the oxygen found in air, so it is rarely a limiting factor. However, fungal growth is stopped by

submersion in water or burial several feet deep in soil, such as in the case of pilings, because of a lack of oxygen.

The brown-rot and water-conducting fungi primarily attack softwoods (conifers/evergreens) such as pine, spruce, and fir. White-rot fungi primarily attack hardwoods (broadleaf trees) such as maple and oak. Surface-staining and sap-staining fungi attack the sapwood of both softwoods and hardwoods. White pocket rot attacks softwoods, primarily Douglas fir.

Fungi usually enter a structure, or contact wood products, as airborne spores. Another source would be the soil if there is wood-to-ground contact. It is possible to bring in infected lumber at the time of construction or later. Regardless of the source, the proper combination of food, moisture, temperature, and air must exist before growth occurs.

BROWN ROT

COMMON NAME: Brown rot

SCIENTIFIC NAME: *Gloeophyllum* spp., *Daedalea* spp., etc.

CLASS/ORDER/FAMILY: Basidiomycetes/Polyporales/Polyporaceae

INTRODUCTION. Brown rot is the principal cause of the damage associated with wood-decay fungi attacking structures. Its common name probably comes from the characteristic change to a brown color of the wood being attacked and that the attacked wood becomes rotted or devoid of strength. It is found throughout most of the United States where moist conditions exist.

RECOGNITION. Wood usually becomes ***brownish.*** Upon drying, ***abnormal wood shrinkage*** yields small cubical pieces of wood with cracks perpendicular to grain. When dry, ***cubical pieces are easily crushed into powder.***

Brown-rot fungi form spores on the surface of special structures called basidia which line the inner surface of pores or tubes; texture of fruiting body (sporophore) tough, leathery, corky, or woody when mature; fruiting bodies often resemble crusts, shelves, or mushrooms.


Brown Rot Fungi Damage

SIMILAR GROUPS. (1) Some sap-staining fungi which stain brown or black lack abnormal shrinkage upon drying along with formation of brittle small cubes of wood which crumble into powder. (2) Black or brown surface-staining fungi give wood surface powdery or fuzzy appearance, no marked shrinkage or wood cubes upon drying.

BIOLOGY. During growth, brown-rot hyphae not only attack the wood's stored sugars and starches but also attack the cellulose of the wood cell's wall and superficially degrade the lignin as food. Since cellulose is one of the principal strengthening agents of the cell wall, this attack can greatly reduce the wood's strength as well as increase its permeability (ability to absorb water).

Some brown-rot fungi have the ability to tolerate high temperatures and withstand dry conditions. For example, *G. saepiarium* has an optimum temperature of 95F (35C), which is the maximum at which the water-conducting fungus (*Poria incrassata*) can grow. Also *G. saepiarium* at normal air temperatures can remain dormant for at least 9 years, and revive upon rewetting.

HABITS. Brown-rot fungi primarily attack softwoods (conifers/evergreens) such as pines, spruce, and fir. They require a minimum wood moisture content of 28-32%.

SAP-STAINING FUNGI/BLUESTAIN/SAPSTAIN

COMMON NAME: Sap-staining fungi, bluestain, sapstain

SCIENTIFIC NAME: *Ceratocystis* spp., etc.

CLASS/ORDER/FAMILY: Ascomycetes/Microascales/Ophiostomataceae

INTRODUCTION. The common name reflects that these fungi stain the sapwood as they grow through it. Although these fungi do not structurally weaken wood, the resulting stain limits where/how this wood can be used. The distribution is worldwide.

RECOGNITION. The sapwood is commonly stained blue, blue-black, gray, or brown, but shades of yellow, orange, purple, and red occasionally occur. In cross section, the stain may affect the entire sapwood or be present in wedge-shaped patches, narrower towards the heartwood. It often penetrates from the ends of logs or boards.

HABITS. Sap-staining fungi usually colonize (attack) the sapwood of softwoods and hardwoods. They require at least 20% wood moisture to grow and thus colonize green or partially air-dried wood. They may also colonize air-dried and kiln-dried wood that has been rewetted.

Sap-staining fungi most commonly occur in roof trim, siding, sills, joists, and subflooring. Occasionally they occur in exterior columns, steps, decks, and porches, in roof rafters, joists, and sheathing, in doors, windows, and door and window frames, and in flooring, walls, and interior trim.

Their most serious effect on wood is that they greatly increase the porosity of the colonized wood. This means that colonized wood wets much more easily and is therefore more vulnerable to decay fungi and moisture-induced deformations. Although sap-staining fungi have little effect on the wood's strength, they can reduce its toughness or shock resistance.

Since they grow much more rapidly than decay fungi, sap-staining fungi can be used as evidence of wetting in exterior woodwork such as siding. Such wetting will lead to decay unless corrected.

SURFACE-STAINING FUNGI/MILDEW/MOLD

COMMON NAME: Surface-staining fungi, mildew, mold

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Fungi Imperfecti/Various/Various

INTRODUCTION. The common names reflect that these fungi often cause a change in wood surface color and are powdery in appearance. Although these fungi do not structurally weaken wood, their presence is an indication that moisture conditions exist or did exist which may contribute to wood decay. Their distribution is worldwide.

RECOGNITION. Surface with fuzzy or powdery appearance from growths of various colors; black and greens common, orange, red, yellow, and white occur occasionally. Stain limited to surface in softwoods, easily brushed off. Stain in large-pored hardwoods penetrates too deeply to be brushed or planed off. Extent of fungal growth ranges from small spots to total coverage of surface.

BIOLOGY. With softwoods, the presence of surface-staining fungi becomes evident when masses of pigmented spores are produced on the surface of the wood. With large-pored hardwoods such as oak, the wood may be superficially stained by spores produced within the large vessels.

HABITS. Surface-staining fungi primarily colonize (attack) the sapwood of softwoods and hardwoods. They require a minimum wood moisture content of about 20% and do better at 28-32+%. In hot weather, mold can become visible within a week. Their most serious effect on wood is to greatly increase the wood's porosity. Moldy wood wets much more easily and is therefore more vulnerable to decay fungi and moisture-induced deformations.

Molds and mildews can grow on or within many different kinds of materials as long as there is sufficient nutritive value and moisture present, as well as enough warmth. Moisture can come from condensation, showers, clothes dryers, cooking, damp basements or crawl spaces, roof or plumbing leaks, etc.

WATER-CONDUCTING FUNGI, "DRY-ROTS"

COMMON NAME: Water-conducting fungus, "dry-rot"

SCIENTIFIC NAME: *Poria incrassta* (Berk. & Curt.) Burt, *Merulius lacrymans* (Wulf.) Fr. (Findlay & Savory, 1960)

CLASS/ORDER/FAMILY: Basidiomycetes/PoIyporales/PoIyporaceae

INTRODUCTION. Water-conducting fungus is a special brown rot which can bring its own moisture from 30 feet (9 m) or more away from the moisture source via its rhizomorphs (thick strands of hyphae). Hence, the common names of water-conducting fungus and "dry-rot". These fungi do not occur in a large number of homes but they can cause significant damage in a couple of years. They occur in the Pacific Coast, northeastern, and southeastern states.

RECOGNITION. ***Widespread decay***; only other cause of widespread decay is condensation problems. Recognized by its papery, yellowish-white ***mycelial fans*** (masses of hyphae) and its rootlike ***rhizomorphs*** (thick strands of hyphae) which are white but become brown to black with age. The rhizomorphs are usually 1/4-1/2" (6-12.5 mm) wide but can be more than 2" (50 mm). Only mychologists (fungi experts) can distinguish the species.

Water-conducting fungi form spores on the surface of special structures called basidia which line the inner surface of pores or tubes; texture of fruiting body (sporophore) tough, leathery, corky, or woody when mature; fruiting bodies often resemble crusts or shelves. Fruiting bodies succulent, flat, up to 1/2" (13 mm) thick; pale olive gray with dirty white or pale yellow margins and/or lower surface when young, but with age become dry and brown to black; surface (often downward facing) covered with fine pores.

SIMILAR GROUPS. (1) Any fungi with mycelial fans but they lack rhizomorphs and except where condensation is wetting the wood, their decay will be limited to roof leaks, plumbing leaks, and soil contact.

BIOLOGY. During growth, water-conducting fungal hyphae not only attack the wood's stored sugars and starches, but they also attack the cellulose of the wood cell's wall and superficially degrade the lignin as food. Since cellulose is the principal strengthening component of cell walls, this attack can greatly reduce the wood's strength as well as increase its permeability (ability to absorb water).

Water-conducting fungi prefer areas of low temperature with 95F (35C) being the maximum temperature at which it can grow. The minimum growth temperature is 54F (72C), its optimum temperature is 77F (25C), and it will die if exposed to temperatures a few degrees above 95F (35C) for a short period of time. Water-conducting fungi cannot withstand long periods of drying. They last only 10 days at 90% relative humidity and 1 day at 30% relative humidity.

HABITS. Water-conducting fungi attack softwoods (conifers/evergreens) such as pine, spruce, and fir. They require a wood moisture content of 28-32% for growth at the attack point. They can conduct sufficient water for 30 feet (9 m) or more from the moisture source to allow for attack/growth. Because low temperatures are preferred, they are usually found in protected parts of the structure such as dirt-filled porches and crawl spaces, not in exposed woodwork.

Most attacks/infestations occur in structures only a few years old, or in those with recent structural additions or modifications. This suggests that infected wood is a common method of introduction. Other methods of introduction include use of infected soil in dirt-filled structures such as porches and via coal. The usual area of initial fungal development is untreated wood in contact with the soil.

WHITE POCKET ROT/POCK ROT/WHITE SPEC

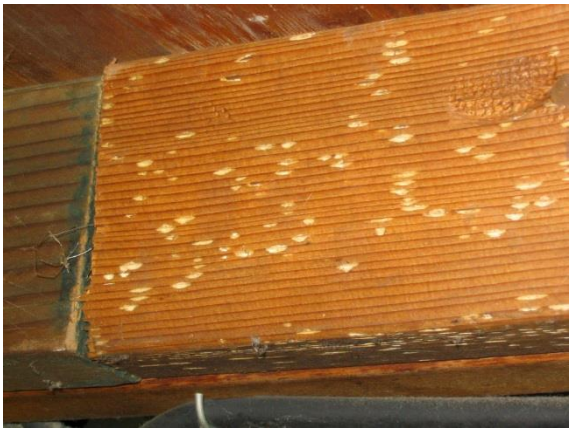
COMMON NAME: White pocket rot/pock rot/white spec

SCIENTIFIC NAME: *Fomes pini* (Thore), etc.

CLASS/ORDER/FAMILY: Basidiomycetes/Polyporales/Polyporaceae

INTRODUCTION. The common names reflect that these fungi cause small spindle/lens-shaped depressions or pockets in the wood that are usually filled with white fibers. Although these fungi only colonize the heartwood of living trees and cause little reduction in wood strength, their presence does limit where such wood can be used. Various species are found throughout the United States, including Alaska and Hawaii.

RECOGNITION. Decayed areas of heartwood deep pink to reddish brown with spindle-shaped or lens-shaped depressions/pockets. Typically 1/8-1/2" (4-12 mm) long, and usually filled with white fungus or rotten wood fibers; area surrounding pocket appears sound. Usually found in softwood lumber from West Coast.



BIOLOGY. White pocket rot colonizes the heartwood of living softwood trees. It occurs most commonly in over-mature Douglas-fir, and in pines and other firs. Fungal activity ceases when the tree is cut. When the wood from infected trees is seasoned, this fungus dies.

HABITS. Because white pocket rot is only active in living trees and dies when their lumber is seasoned, no growth or increase in its occurrence will be observed in structures.

In structures, it is most commonly found in roof rafters, joists, and sheathing, and in sills, joists, and subflooring. Wood with white pocket rot is also used for studs.

Besides in structures, wood with white pocket rot is commonly used in pallets and wooden shipping crates and materials.

WHITE ROT FUNGI/WHITE ROT

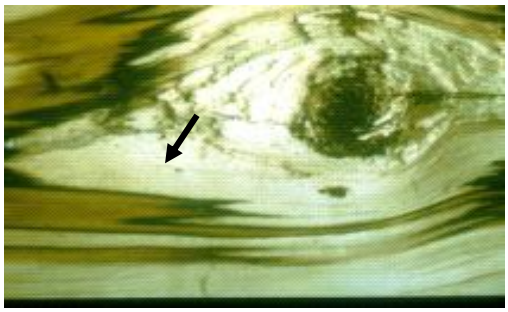
COMMON NAME: White rot fungi or white rot

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Basidiomycetes/Polyporales/Polyporaceae

INTRODUCTION. The common name comes from the bleached or whitened appearance of wood colonized by these fungi and that these fungi can severely reduce the strength of wood. As the rot progresses, the wood becomes soft, fibrous, and devoid of strength. It is found worldwide, and is common in the eastern half of the United States, the coastal half of Washington, Oregon, and northern California, and in Alaska and Hawaii.

RECOGNITION. Wood first becomes slightly bleached, frequently with black zonal lines between the bleached and unbleached areas. As decay progresses, wood becomes soft, fibrous (stringy and spongy), and bleached; finally devoid of strength.



SIMILAR GROUPS. None.

BIOLOGY. During growth, enzymes produced by white-rot hyphae not only degrade the wood's stored sugars and starches but also degrade both the cellulose and lignin of the wood's cell walls. Since cellulose is the principal strengthening agent of the cell wall, this colonization can greatly reduce the wood's strength as well as increase its permeability (ability to absorb water). They require a wood moisture content (WMC) of greater than 30% to grow. Optimal growth occurs at 75-85 F (24-30 C).

HABITS. White-rot fungi can colonize (attack) the sapwood of all species and the heartwood of nonresistant species, but they usually attack hardwoods. They require a wood moisture content (WMC) of greater than 30% and therefore colonize green or partially air-dried wood. They can also colonize air-dried and kiln-dried wood that has been rewetted.

Activity starts immediately after wood exposure to spores, but it takes several weeks for the bleaching to become obvious. Boards can become severely damaged in 6-12 months, and even quicker under moist and hot conditions.

White rot most commonly occurs in hardwood materials, but can be found in exterior columns, steps, porches, and decks, as well as in doors, windows, and door and window frames. Occasionally it occurs in roof trim, rafters, joists, and sheathing, in siding, and in sills, joists, and subflooring.

Wood Decay and Non-Decay Fungi
Study Questions

1. What are the three groups of non-decay fungi associated with structures and how can each be identified?

2. What are the three groups of decay fungi associated with structures and how can each be identified?

3. Describe the general life cycle of a fungus from spore to the production of their fruiting bodies.

4. What are the "food" requirements of wood-decay fungi and why does their consumption cause reduction of wood strength?

5. When non-decay fungi attack wood, why do they have little effect on the wood strength?

6. What is the wood moisture content required for growth by wood-decay fungi? What happens to the wood-decay fungi when the wood moisture content falls below this level required for growth?

7. The critical factor in the development of a wood decay damage problem is not lack of fungi. If not, then what is it and why?

8. Water-conducting fungi can attack dry wood up to 30 feet from a moisture source. How are they able to do this? What special things should be done during the inspection?

9. The presence of white pocket rot is not a concern when found in lumber or structural timbers. Why?

Chapter 4
NON-REINFESTING INSECTS WHICH ATTACK WOOD

Objective. When you complete this chapter, you will be familiar with those other insects which are occasionally found attacking trees. The insects included here may use wood as a food source or a place to pupate and do not commonly reinfest structural wood. However, evidence of their feeding or attacke may leave damages that will be seen during inspections.

Contents. Introduction.

Ambrosia beetles or wood stainers.

Bark beetles.

Buprestids, flatheaded and metallic wood borers.

Cerambycids, longhorned beetles, roundheaded borers.

Dermestid beetles: hide beetle and larder beetle.

Bostrichid/False powderpost beetles.

Wharf borers.

Wood wasps or horntails.

CLASS: Insecta

ORDERS/FAMILIES: Coleoptera/Buprestidae, Cerambycidae, Dermestidae, Platypodidae, Scolytidae, Hymenoptera/Tenthredinidae

METAMORPHOSIS: Complete

INTRODUCTION. This is a catch-all group for those insects which attack trees whose wood may be used in structures, or are found in wood associated with structures from time to time. Some of these insects are merely brought into the home in firewood, some feed on other materials and then bore into wood to pupate, while others feed on wood as larvae but cannot reinfest structural wood, seasoned wood, because it is either too dry or the bark has been removed (required for egg laying). Many of these insects are typically nuisance pests because they cannot reinfest the wood found in the structure.

RECOGNITION. (Arranged alphabetically by order and then by family.)

BEETLES (woodborers) (order Coleoptera). Adults only. Front wings (elytra) horny (hardened) or leathery, without veins, meeting in a straight line down middle of back, concealing any membranous (like cellophane) hind wings; front wings sometimes short, leaving abdominal segments exposed; wings rarely reduced or absent.

Antennae usually with 11 or fewer segments. Mouthparts chewing.

Buprestids, flatheaded and metallic wood borers (family Buprestidae). Adults usually 3/16-1 1/2" (5-40 mm) long; hard bodied, compact, somewhat flattened. Color nearly always metallic or bronzed, especially ventral surface, some species marked with red or yellow. Antenna usually short, sawtoothed (serrate); threadlike/comblike in some species. Elytra usually deeply grooved or pitted, with sides nearly parallel, and apices/tips often pointed.

Cerambycids, longhorned beetles, roundheaded borers (family Cerambycidae). Adults usually 3/8-1" (10-25 mm) long; usually oblong or elongate and somewhat cylindrical, some flattened with only prothorax cylindrical. Head with compound eyes notched on inner margins. Antenna very long, usually exceeding body length, and inserted into eye notch so that base is partially surrounded by eye; usually 12-segmented. Elytra usually covering abdomen, a few species with short elytra.

Dermestid beetles, hide and larder beetles (family Dermestidae). Adults about 1/4-3/8" (5-10 mm) long; elongate oval. Color dark brown to black, with pronotal margins whitish or elytra with wide pale yellow transverse band in basal half. Head without a median ocellus (simple eye). Antenna short, clubbed, fitting in groove below side of pronotum.

Ambrosia beetles (families Platypodidae and Scolytidae).

Platypodidae. Adults about 1/16-5/16" (2-8 mm) long; body very elongate, nearly parallel-sided. Color light to dark brown. Head visible from above, as wide or wider than pronotum. Antenna weakly elbowed and clubbed, club large, flat, and 1-segmented. Prothorax constricted near middle. Elytra usually with apical margin variously prolonged.

Scolytidae. Adults usually 1/32-1/4" (1-5 mm) long; elongate-cylindrical. Color brownish to black, with pale markings and/or stripes. Head usually concealed from above, narrower than pronotum. Antenna short, elbowed and nearly always clubbed, club abrupt, nearly round, and of 1-3 segments. Front

of pronotum often bears teeth. Elytra apical area often concave, ridges sometimes armed with spinelike teeth.

Bark beetles (family Scolytidae). Adults mostly 1/32-1/8" (1-3 mm) long; elongate-cylindrical. Color brown, reddish brown, or black. Head usually concealed from above, narrower than pronotum. Antenna short, elbowed and nearly always clubbed, club abrupt, large, nearly round, and of 1-3 segments. Front of pronotum often bears teeth. Elytra apical area often concave, ridges sometimes armed with spinelike teeth.

SIGNS OF INFESTATION. Varies with the pest species.

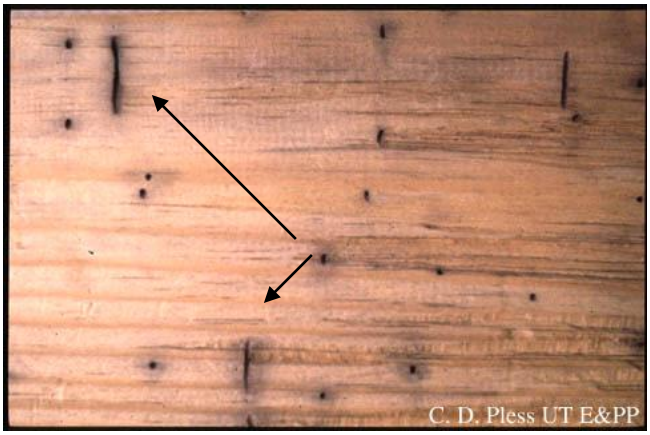
AMBROSIA BEETLES

COMMON NAME: Ambrosia beetles or wood stainers

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Platypodidae, Scolytidae

METAMORPHOSIS: Complete



Typical staining caused by Ambrosia beetles

INTRODUCTION. The common name comes from their use of ambrosial fungus as food, and that this fungus stains the wood. Adults bore into the wood of live or recently cut/felled trees or sawed lumber to create tunnels and chambers in which to raise this fungus, but they do not eat the wood. Wood damage occurs

primarily from the dark stain caused by the ambrosia fungus. In most homes, they are only nuisance pests except in the case of log homes. Ambrosia beetles found in homes include species belonging to two beetle families, the Platypodidae and Scolytidae. Various species occur throughout the United States and Canada, and worldwide.

RECOGNITION.

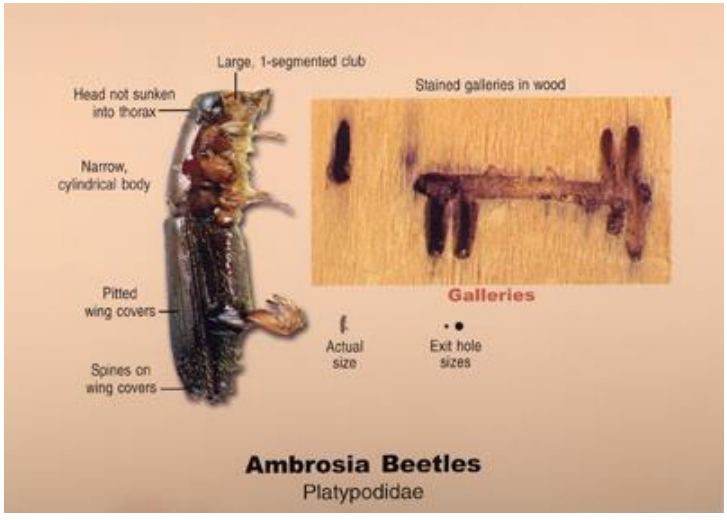
1. **Platypodidae.** Depending on the species, adults about 1/16-5/16" (2-8 mm) long; ***body very elongate, nearly parallel-sided.*** Color light to dark brown. ***Head visible*** from above, ***as wide or wider than pronotum. Antenna weakly elbowed*** and clubbed, ***club large, flat, and 1-segmented. Prothorax constricted near middle.*** Elytra usually with apical margin variously prolonged.

   Depending on the species, mature larvae about 1/8-1/2" (4-12 mm) long; legless.

2. **Scolytidae.** Depending on the species, adults about 1/64-3/8" (0.6-9 mm, most 1-5 mm) long; body ***elongate-cylindrical.*** Color brownish to black, some with pale markings and/or stripes. ***Head usually concealed*** from above, narrower than pronotum. ***Antenna short, elbowed*** and nearly always clubbed, ***club abrupt nearly round, and of 1-3 segments. Front of pronotum often bears teeth.*** Elytral apical area often concave, ridges sometimes armed with spinelike teeth.

   Depending on the species, mature larvae about 1/16-3/8" (2-10 mm) long; legless;body C-shaped, subcylindrical; and color usually white.

DAMAGE AND SIGNS OF INFESTATION. Adult beetles bore for several inches into live or recently cut/felled hardwood and/or softwood trees or sawed lumber. They bore across the grain in the sapwood and/or heartwood, but sometimes construct short lateral/side tunnels following the grain off the main tunnel. All these tunnels are the same size for a given species because they are all constructed by the adult. They bore into



both sapwood and heartwood but do not eat the wood, and the tunnels are free of frass. The tunnel walls are covered with ambrosia fungal spores. The primary wood damage is from the dark blue, brown, or black stain which results from this fungus being grown as their food source. The stain may extend into the surrounding wood in streaks or patches and can seriously devalue lumber, especially the lighter-colored species.

Signs of infestation may include the beetles themselves, piles of frass/wood shavings, and round entrance holes ranging from 1/64-1/8" (0.5-3 mm) in diameter. The wood shavings are often curled as if cut from the wood by a small, rounded, wood-carving chisel. A wood moisture content of 30% is required for fungal growth and beetle survival; below 30% the adults leave and the fungus and larvae die. Hence, there is no reinfestation and/or problem in seasoned wood with the possible exception of log homes.

BIOLOGY. Adult ambrosia beetles bore across grain into the wood and inoculate the tunnel walls with various ascomycete fungal spores which produce the ambrosia fungal food. Eggs are laid in the inoculated tunnels, in lateral tunnels if they are present, and the larvae feed on the threadlike fungal hyphae. Pupation occurs within these tunnels and adults emerge through the original entrance hole. There are usually 1-2 generations per year, but sometimes more with overlapping broods.

HABITS. See above under Damage and Signs of Infestation. Ambrosia beetles are not a problem in homes built with seasoned or kiln-dried wood because the wood moisture content is well below the critical 30%. However, they can be brought into the home in green/unseasoned firewood and emerge before it is burnt. In this case, they are a nuisance pest only and will not infest the wood in the house.

They can be a major nuisance problem in log homes constructed of freshly cut or green logs where they can be attracted by the thousands to such logs at the longitudinal log abutments/joints. Here they discharge copeous quantities of sawdust during their tunnel boring which can cause the owners grave concern.

They will also attack dry, stained siding if populations are high, though they die before tunneling an inch (25 mm) or less.

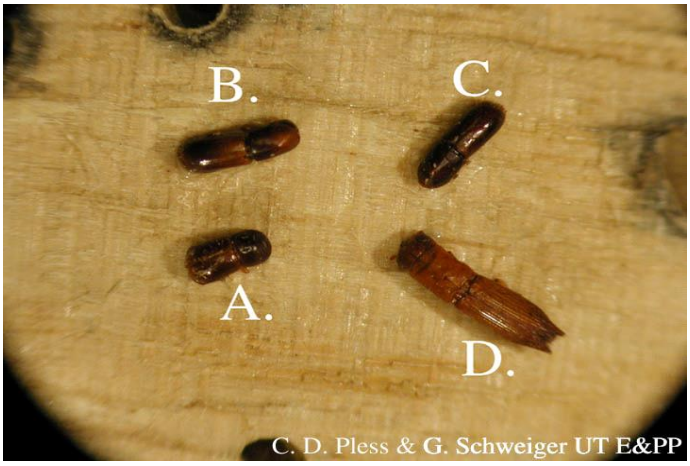
BARK BEETLES

COMMON NAME: Bark beetles

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Scolytidae

METAMORPHOSIS: Complete



Bark beetles are small and can be of various shapes

INTRODUCTION. The common name comes from their dependence on the presence of bark on wood for their existence and survival. In homes, they are nuisance pests only because they cannot infest wood that has no bark or reinfest wood with dry bark. They are usually brought in with firewood. Various species occur throughout the United States and Canada, and worldwide.

RECOGNITION. Depending on the species, adults about 1/64-3/8" (0.6-9 mm, mostly 1-3 mm) long; body ***elongate-cylindrical.*** Color brown, reddish brown, or black. ***Head usually concealed*** from above, narrower than pronotum. ***Antenna short, elbowed and*** nearly always clubbed, ***club abrupt, large, nearly round, and of 1-3 segments.*** Front of pronotum often bears teeth. Elytral apical area often concave, ridges sometimes armed with spine-like teeth.

Depending on the species, mature larvae about 1/16-3/8" (2-10 mm) long; legless; body C-shaped, subcylindrical; and color usually white.

DAMAGE AND SIGNS OF INFESTATION. Bark beetles do not cause damage to wood other than the slight cosmetic scoring/etching of the outer surface of the sapwood. There is no structural damage and they do not reinfest seasoned or barkless wood.

Signs of infestation include piles of frass/sawdust below and around the outside entrance holes which go through the bark. If the bark is removed, the tunnels and galleries leave scoring on the surface of both the sapwood and inner bark. Depending on the species, these scorings vary from completely random to a central tunnel with many lateral/side tunnels which resembles a large centipede in appearance. Adults each have their own round exit hole about 1/16-1/8" (1.5-3 mm) in diameter. Emergence can look as if the tree was peppered with shotgun pellets. Both live and recently killed hardwood and softwood trees are attacked/infested.

BIOLOGY. Depending on the species, either the male or female bores the entrance tunnel through the bark to the cambium (layer of growing cells between the bark and sapwood). The adults excavate the brood galleries and the eggs are laid in the tiny side niches at intervals along the length of the gallery. The larvae tunnel out away from the egg gallery and tightly pack their tunnels with frass. As they molt, their tunnel size increases. Pupation takes place at the end of their tunnels. Emerging adults tunnel directly/straight out through the bark. There are usually 1-5 generations per year.

HABITS. Bark beetles can be brought into the home in unseasoned firewood and emerge from the wood when stored. If inside the structrue the beetles will fly to light and may be found on window sills or around doors.In this case, they are a nuisance pest only and will not infest the wood in the house.

BUPRESTIDS/FLATHEADED & METALLIC WOOD BORERS

COMMON NAME: Buprestids, flatheaded and metallic wood borers

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Buprestidae

METAMORPHOSIS: Complete

Flathead beetles get their name from the flatten thorax of the larvae

INTRODUCTION. The common name of flatheaded comes from the larva whose thorax is greatly enlarged and flattened, metallic because the adults almost always have a metallic luster, and wood borers because the larvae bore through wood. They are primarily nuisance pests indoors and are commonly brought in with firewood, but their damage must be recognized because wood previously damaged by the larvae is often used as structural timbers. Of concern are log homes with bark left on the logs, and the golden buprestid, *Buprestis aurulenta* Linnaeus, in the western states because of its long life cycle. Over 700 species are found in the United States and Canada, and over 11,300 worldwide.

RECOGNITION. Depending on the species, adults mostly about 3/16-3/4" (5-20 mm; range 2-40 mm) long; ***hard-bodied, compact, somewhat flattened;*** hairs (setae) present or absent. Color nearly always ***metallic or bronzed,*** especially ventral surface, some species marked with red or yellow. ***Antenna usually short, sawtoothed*** (serrate); threadlike/comblike in some species. ***Elytra*** (wing covers) usually deeply grooved or pitted, ***with sides nearly parallel, and apices/tips often pointed.***

Depending on the species, mature larvae usually 3/16-1 15/16" (5-50 mm; range 2-100 mm) long, legless; body elongate with thorax (especially prothorax) greatly enlarged and flattened, abdomen parallel-sided, straight, and slightly flattened; color whitish or cream..

DAMAGE AND SIGNS OF INFESTATION. In wood, the larvae make winding tunnels which are oval but flat, with the width being 3-4+ times the height. Tunnel

walls are etched/scarred with fine, transverse lines. The tunnels are tightly packed with sawdustlike borings and pellets.

Under bark, the galleries are serpentine (snakelike) and wander over the outer surface of the sapwood. These galleries are packed with a mixture of light (from wood) and dark (from bark) frass.

The exit holes are oval and about 3/16-1/4" (5-6 mm) across, with the width being at least 3-4 times the height.

They attack both the sapwood and heartwood of softwood and hardwood trees. Weakened, injured, dying, or dead trees are attacked as well as seasoning wood and lumber.

REPRESENTATIVE SPECIES.

1. Golden buprestid, *Buprestis aurulenta* Linnaeus. Adults about 3/4" (20 mm) long; color metallic golden green or blue-green with median elytral suture and margins bordered in copper; mature larva about 1 3/8" (35 mm) long, width across flattened thorax about 3/8" (9 mm), color white; prefers Douglas fir, also occurs in pine, spruce, fir, and western red cedar; found in Rocky Mountain and Pacific Coastal states, British Columbia, and in **Vermont.**

2. *Buprestis lineata* (Fabricuis). Adults about 1/2-3/4" (12-17 mm) long; color dorsally brown to black, often with brassy to cuperous shine, front of head or mandibles usually spotted with and front and lateral pronotal margins reddish orange to yellow, elytra each with 2 usually orange (varies reddish to yellow) stripes, 1 starting near base and extending parallel to suture to apical 1/3-1/4, other stripe from base at side curving around humerus (shoulder) and extending almost to apex but pattern varies; color ventrally coppery to bronze or greenish except head and front of prosternum spotted with orange and apical abdominal sternite/segment usually with small orange spot on each side; attacks *Pinus* spp.; **found in eastern United States and adjacent southern Canada.**

3. Sculptured pine borer, *Chalcophora virginiensis* (Dury) (=*C. angulicollis* (LeConte)). Adults about 1-1 3/16" (25-31 mm) long; color shining black with impressed areas of pronotum and elytra dull black to gray, sometimes with bronze luster; pronotum with 2 grooves and each elytron with 4-6 elongate raised areas; occurs in pine, fir, and other conifer/evergreens; found in southern Canada, **scattered coast-to-coast in United States**, and introduced into Europe.

BIOLOGY. Adult females lay their eggs in bark or wood crevices, or under bark at the edge of wounds. The 1st instar larvae first bore under the bark, then into the sapwood, and then sometimes into the heartwood. Larvae usually require 1-2 years to mature. Pupation takes place in an elongated pupal cell near the surface of the wood. Emerging adults cut their way to the surface.

Larvae of the golden buprestid usually require 2-4 years to complete their development, but this may be greatly lengthened if infested wood is incorporated into wood products. There are cases of adults emerging up to 50 years after the initial infestation. Adults live 3-5 months.

HABITS. See the Damage and Signs of Infestation and the Biology sections above. The feeding larvae make rasping noises similar to those made by larvae of the old house borer, *Hylotrupes bajulus* (LeConte). The tunnels of the golden buprestid range in length from 3.3-16.4 ft (1-5 m).

There is little danger of serious damage to structural timbers because these beetles have usually completed their development before the log is sawed, and they do not infest or reinfest seasoned wood. However, those that might survive in air-dried wood can cause minor damage and serious concern to homeowners when the adults emerge. Occasionally, they can emerge through roofing materials and cause leaks. Inside, they have emerged through hardwood floors, linoleum-covered flooring, and plasterboard/sheetrock as well as emerging from furniture such as dressers, and from kitchen cabinets.

Outdoors, golden buprestid adults usually emerge during the spring and summer. However, indoors they typically emerge in the autumn and winter.

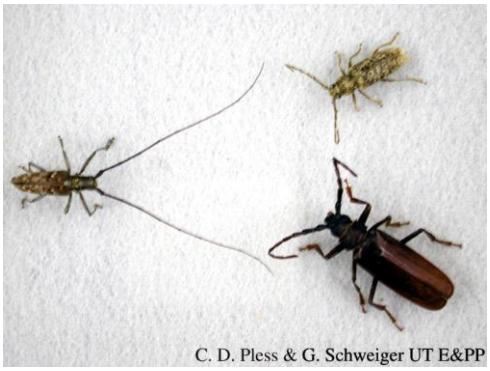
CERAMBYCIDS/LONGHORNED BEETLES

COMMON NAME: Cerambycids, longhorned beetles, roundheaded wood borers

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Cerambycidae

METAMORPHOSIS: Complete



INTRODUCTION. The common name of longhorned comes from their antennae which are very long, often much longer than the body. Roundheaded comes from the larvae which have a fairly cylindrical thorax and bore round to slightly oval holes in wood, and wood borers because the larvae bore through wood. With the exception of the old house borer, *Hylotrupes bajulus* (Linnaeus), and the flat oak borer, *Smodicum cucujiforme* (Say), these beetles do not reinfest seasoned wood and are therefore nuisance pests, although some can cause minor/cosmetic damage by adult emergence through various materials. About 1,200 species occur in the United States and Canada. This section will be restricted to those species which attack wood used in structures or are commonly brought into the structure in firewood.

RECOGNITION. Depending on the species, adults usually about 3/8-1" (10-25 mm; range 2-60 mm) long; usually oblong or elongate and somewhat cylindrical, some flattened with only prothorax cylindrical. Head with ***compound eyes notched*** on inner margins. ***Antenna very long, usually exceeding body length,*** and ***inserted into eye notch*** so that base is partially surrounded by eye; usually 12-segmented (range 10-25+ segments). Elytra (wing covers) usually covering abdomen, a few species with short elytra.

Depending on the species, mature larvae about 3/8-3 1/8+" (10-80+ mm) long; body elongate, cylindrical, parallel-sided except thorax enlarged/swollen, and segments distinctly separated; color whitish or cream; ocelli 0-5 pairs; antenna short, 3-segmented; and legs absent, or very short and 5-segmented with spinelike tarsus.

DAMAGE AND SIGNS OF INFESTATION. Larval galleries wind irregularly below the bark with a lot of frass evident. The galleries usually extend into the sapwood (some species into heartwood) of softwoods and hardwoods. Galleries are oval, up to 1/2" (12 mm) long diameter, and have the frass loosely or tightly packed into them. Depending on the species, frass texture varies from being rather fine and meal-like to very coarse and almost excelsiorlike. Exit holes are round to slightly oval, with the longer diameter 1/8-3/8" (3-10 mm); the longer

diameter is never more than twice the height of shorter diameter. They attack unseasoned wood, both logs and lumber. They do not reinfest seasoned wood with the exception of the flat oak borer and the old house borer.

Log homes present special problems. This is because bark is often left on the logs, especially around knot-holes, the logs are often either green or air-dried at the time of construction, design flaws allow the logs to increase or retain a high wood moisture content, the homes are constructed in wooded areas, and the logs are often not rigorously maintained with preservative and sealer. This situation often allows for a series of species of roundheaded wood borer infestations which can start before the trees are cut/felled and progress through advanced stages of wood decay.

HIDE BEETLE

COMMON NAME: Hide/leather beetle

SCIENTIFIC NAME: *Dermestes maculatus* DeGeer

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Dermestidae

METAMORPHOSIS: Complete

INTRODUCTION. This beetle's common name comes from hides and skin being the preferred food of adults and larvae. It has been widely distributed via the shipping trade and is now found worldwide.

RECOGNITION. Adults about 1/4-3/8" (5.5-10 mm) long; elongate oval. Color ***black,*** sometimes reddish brown; pronotal margins colored with white hairs (setae); ***abdominal venter whitish with black spots at basal sides*** of segments 1-4, segment 4 of male with central black pit with brush of hairs (setae), segment 5 (last/terminal) mostly black. Head ***without a median ocellus.*** Antenna short, clubbed, fitting in groove below side of pronotum. ***Elytron*** (wing cover) ***with apical margin serrate*** (sawtoothed), ***ending in a small spine on inner margin.***

Larvae up to about 5/8" (15 mm) long; dark brown, covered with long brown hairs (setae), with a broad yellow dorsal median length-wise stripe extending from head to near end of body. Head in dorsal view with 2 tubercles (small projections), one each between midline and antennal base. Abdominal 9th segment (next to last) with urogomphi (paired dorsal processes) sharp-pointed, curved forward and upward in side view.

DAMAGE AND SIGNS OF INFESTATION. Skins or hides are damaged primarily on its inner surface with holes cut by larvae to reach inner surface; hair loosened by hide destruction on inner surface; molt skins dark brown with numerous brown hairs, 2 sharply pointed anteriorly and upward curved spines near rear end; fecal pellets long and slender,1/64-1/8" (0.5-3 mm) long by 1/128" (0.2 mm) wide.

To pupate, mature larvae can bore into hard substances such as woolen goods, hair brushes, cork, tea chests, woodwork, and even structural timbers. Width of hole about 1/8" (3-4 mm). Adults may be seen emerging from wood, so the identification of such adults is important.

BIOLOGY. Adult females lay their eggs (creamy, about 1/16"/2 mm long) in batches of 2-20 in cracks, skins, and hides; humdreds of eggs may be deposited. At about 85F/29C, eggs hatch in 2-3 days and the larvae go through an average of 7 molts in 30-35 days. The pupal stage lasts 7 days, and the adult requires 5 days before egg laying.

Developmental time (egg to adult) ranges from a minimum of 35 days in summer to a maximum of 238 days; about 60-70 days at average temperatures and humidity. The number of molts varies from 5 at high relative humidity to 11 under adverse conditions. Adults live for about 60-90 days.

HABITS. Both adults and larvae will feed on skins and hides and such materials as smoked meat, hams, cakes, dried cheese, and carrion; they are often used to remove the flesh from bones for museum collections. They often infest chicken houses where they feed on feathers, dead birds, chicken feed, and droppings. Adults are cannibalistic on young larvae and older larvae on fresh pupae.

The mature larvae wander in search of hard substrate in which to pupate, at times up to 26-36 ft (7.3-11 m). They bore into the hard substrate to make a pupal chamber. When the selected substrate is wood, severe damage can result when the population is large and/or uncontrolled. They prefer to bore into the softer spring wood.

The primary breeding areas are quite diverse and may include places such as wall/ceiling voids where yellowjackets, honey bees, etc. lived or where cluster flies, box-elder bugs, etc. overwintered. Other primary breeding areas include rodent bait left in attics, crawl spaces, or basements, wasp and hornet nests in attics, under eaves, around windows, etc., dead insects and spiders in the attic or elsewhere, animal trophies or rugs, stored items made of leather and/or fur, dead animals in the chimney flue, etc. In such places, the larvae feed on the animal and/or plant material present.

The larvae shun light (negatively phototrophic) but are very active. In contrast

the adults are attracted to light and can often be found at windows. The adults are strong, active fliers and feed on a variety of flowers. They often gain entrance to structures by flying in through open doors and windows as well as crawling in through other openings. In heated structures, hide beetles can be found year-round but are usually more abundant in the spring and summer.

LARDER BEETLE

COMMON NAME: Larder beetle

SCIENTIFIC NAME: *Dermestes lardarius* Linnaeus

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Dermestidae

METAMORPHOSIS: Complete

INTRODUCTION. The common name of larder comes from the fact that this is a major pest of almost any stored meat or grain product. It is found throughout the United States and the world.

RECOGNITION. Adults about 1/4-3/8" (7-9 mm) long; elongate oval. Color ***dark brown to black with basal 1/3 of elytra*** (wing covers) ***with a pale yellow transverse band*** which contains 6-8 small black spots; ***abdominal undersurface uniformly dark*** with no pattern, but covered with fine yellowish hairs (setae); legs covered with fine yellowish hairs. Antenna short, clubbed, fitting in groove below side of pronotum.

Larvae up to about 3/8-5/8" (10-15 mm) long. Color dark brown, covered with long brown hairs (setae). Abdominal 9th segment (next to last) with paired dorsal processes; sharp-pointed, curved backward and downward in side view.

DAMAGE AND SIGNS OF INFESTATION. Skin or hide damaged primarily on its inner surface with holes cut by larvae to reach inner surface; hair loosened by hide destruction on inner surface; molt skins dark brown with numerous brown hairs, 2 sharply pointed posteriorly (to rear) curved spines near rear end; fecal pellets long and slender, 1/64" (0.5-3 mm) long by 1/128" (0.2 mm) wide.

To pupate, mature larvae bore into solid materials such as hams and wood. They may bore into wood to a depth of about 1/2" (13 mm), with hole width about 1/8" (3-4 mm). The last larval molt skin is used to plug the entrance/exit hole. Adults may be seen emerging from wood.

BIOLOGY. Adult females lay their eggs on suitable larval food or in cracks and crevices where such food is stored. Eggs hatch in about 12 days. Male larvae molt

5 times and female larvae molt 6 times but there may be more molts under adverse conditions. The mature larva wanders to find a suitable place for pupation which lasts 3-15 days.

Developmental time (egg to adult) may require only 40-50 days but usually takes 2-3 months or longer, the pupal stages often prolongs this development; optimal temperature for development is 64-68F/18-20C. There is usually only 1 generation per year but in some localities there may be as many as 6. The adults may overwinter in bark crevices and enter buildings in the spring and summer. Adults live about 3-5 months.

HABITS. Most damage is done by larval feeding, but adults also feed and cause damage. The mature larvae wander in search of solid material in which to pupate. They bore into such material to make a pupal chamber and then plug the entrance/exit hole with the last molt skin.

BOSTRICHIDS/FALSE POWDERPOST BEETLES

COMMON NAME: Bostrichid, false/large powderpost beetle, branch-and-twig borer

SCIENTIFIC NAME: Various

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Bostrichidae

METAMORPHOSIS: Complete

INTRODUCTION. Bostrichids are commonly known as the false powderpost beetles. This distinguishes them from the Iyctids which were the first to be called powderpost beetles because of their powder-fine dustlike frass. The common name of branch-and-twig borer comes from their habit in nature of infesting the dead and dying branches of trees. Bostrichids are worldwide in distribution, with about 60 species occurring in the United States.

RECOGNITION. Depending on the species, adults mostly about 1/16-1" (2-24 mm) with 1 western species about 2" (52 mm) long, but those typically found indoors range from 1/8-1/4" (3-6 mm). Color reddish brown to black. Antennal club of 3-4 segments, often enlarged to 1 side. First abdominal segment ventrally about equal in length to other segments. Two body forms present: (1) most species elongate and ***cylindrical,*** elytra (wing covers) parallel-sided, ***pronotum with rasplike teeth*** at front, prothorax as wide as head but not enclosing it, ***head*** directed downward and usually **not visible**
from above; and (2) a few species with ***body flattened, head clearly visible*** from above, ***pronotum without rasplike teeth***. Depending on the species, most mature larvae about 1/4-3/8" (5-8 mm) long. Color nearly white. Body C-shaped but with thorax enlarged. Antenna 3- or 4-segmented. Posterior (rear most) spiracle not enlarged. Legs 4-segmented, hairy.

SIMILAR GROUPS. (1) Deathwatch beetles (Anobiidae) with antennal club segments expanded, pronotum lacks rasplike teeth. (2) Powderpost beetles (Lyctidae) with body flattened, head visible from above, abrupt 2-segmented antennal club. (3) Bark and ambrosia beetles (Scolytidae) with antenna elbowed and clubbed, pronotum sometimes lacks rasplike teeth.

DAMAGE AND SIGNS OF INFESTATION. Exit holes are round and depending on the species, range from 1/8-1/4" (2.5-7 mm) in diameter. Another indication of an infestation is the accumulation of piles of powdery, meallike frass beneath the exit holes or streaming from them. This frass/dust is tightly packed in the tunnels or galleries and contains no pellets like the frass of anobiids.

BIOLOGY. Female bostrichids differ from anobiids and Lyctids in that they bore into wood to prepare for egg laying. Eggs are laid into wood pores exposed by these cross-grain tunnels. Most species develop in the sapwood and as the larvae bore, they tightly pack their meallike frass in the tunnel behind them. After several molts, the mature larva bores a little nearer to the surface, sometimes constructing a pupal chamber, and pupates. When the adult emerges, it bores straight to the wood's surface and exits/emerges. The developmental period (egg to adult) varies with the species, but is usually about 1 year. Adults are usually seen from spring through autumn. The bamboo borer only requires about 51 days developmental time, so there may be several generations per year. Developmental time for some species which lay eggs in partially seasoned wood may be lengthened from 1 year to up to 5 years if the wood dries rapidly, but the black polycaon beetle has been found emerging from wood about 20 years old. Since bostrichid larvae cannot digest cellulose, they feed only on the cell contents which is primarily starch, but also protein and sugar.

HABITS. Bostrichids attack both softwoods and hardwoods, and mostly the sapwood. They usually attack new hardwood lumber and manufactured products, wood that is less than 10 years old. Many species will not reinfest seasoned wood. The wood moisture content required for beetle development in seasoned wood is much higher then the normal wood moisture found in finished wood products.

Depending on the species, most mature larvae about 1/4-3/8" (5-8 mm) long. Color nearly white. Body C-shaped but with thorax enlarged. Antenna 3- or 4-segmented. Posterior (rear most) spiracle not enlarged. Legs 4-segmented, hairy.

WHARF BORER

COMMON NAME: Wharf borer

SCIENTIFIC NAME: *Nacerdes melanura* (Linnaeus)

CLASS/ORDER/FAMILY: Insecta/Coleoptera/Oedemeridae

METAMORPHOSIS: Complete

INTRODUCTION. The common name comes from the fact that the larvae bore into wharf pilings, both in sea water and fresh water. Adults are nuisance pests, especially when they suddenly appear in large numbers. This species is distributed worldwide.

RECOGNITION. Adults about 1/4-9/16" (7-14 mm) long; ***body elongate, slender, and soft.*** Color of dorsum pale brownish/reddish ***yellow with elytral tips*** and sometimes pronotal sides ***blackish***, eyes and venter black, antenna pale, and legs mostly dark. Antenna threadlike, about half of body length, and 12-segmented in males, 11-segmented in females. ***Pronotum with sides rounded*** (no lateral margins), widest at front, narrower than elytra at base. Elytra each with 3 or 4 fine longitudinal ridges.

Mature larvae about 1/2-1 3/16" (12-30 mm) long; body elongate, parallel-sided, straight, and subcylindrical; color grayish white except for yellowish head and blackish mouthparts; dorsum of prothorax, mesothorax, metathorax, and abdominal segments 1 and 2 each with paired fleshy domelike protuberances covered with short spinules, abdominal segments 3 and 4 with paired ventral proleglike protuberances (ampullae) covered with short toothlike structures (asperities); surface smooth, with moderate number of scattered hairs/setae.

DAMAGE AND SIGNS OF INFESTATION. The larvae typically bore in very

moist wood in which fungal decay has already started. They do not bore a system of tunnels and galleries, but instead tend to work in rather indeterminate spaces which are plugged here and there with long torn wood fibers. These boring spaces are often adjacent to sound wood Larvae can significantly accelerate the destruction of wood already attacked by fungal decay.

Typically the first visible sign of infestation is the appearance of numerous adults. Quite often the infested wood is buried and not accessible.

BIOLOGY. Little has been published on the biology of this species other than the information given in the Damage and Signs of Infestation and Habits sections; descriptions of the larva and pupa have been published.

HABITS. See the Damage and Signs of Infestation section above.

Around structures, wharf borers may occur in decaying moist wood found in foundation pilings under buildings, in damp basements and/or crawl spaces, wood around leaky plumbing, in buried wood, and in wood with ground contact such as old form boards and support posts.

WOOD WASPS OR HORNTAILS

COMMON NAME:	Wood wasps or horntails
SCIENTIFIC NAME:	Various
CLASS/ORDER/FAMILY:	Insecta/Hymenoptera/Siricidae
METAMORPHOSIS:	Complete

INTRODUCTION. These wasps get their common name of wood wasps because of the adult's superficial wasplike appearance and that their larvae bore in wood, and that of horntail because of the hornlike prolongation on the last abdominal segment. They cause damage in new structures via their emergence holes coming through finished surfaces. Horntails are found throughout the United States, with 19 species occurring in the United States and Canada.

RECOGNITION. Adults large, about 1/2-1 5/8" (12-40 mm) long with females much larger than males. Color usually brownish or black, sometimes with paler markings, wings sometimes dark. ***Pronotum*** in dorsal view ***wider than long, shorter along midline than at sides;*** front tibia with ***single apical spur. Abdominal base broadly joined to thorax***; both sexes with hornlike prolongation of last abdominal tergite (dorsal plate), female with long ovipositor (egg laying apparatus) below. Do not bite or sting.

Depending on the species, mature larvae up to 1 3/4" (45 mm) long. Color whitish to creamy yellow, posterior/rear end of abdomen with a small, dark horny spine. Shape cylindrical, slightly S-shaped with head bent down and tail bent up. Legs very short.

DAMAGE AND SIGNS OF INFESTATION. Exit holes round, about 1/8-1/4" (4-6 mm) in diameter; usually appear within 3 years (range 2-4 years) after the wood is used in construction. Tunnels are tightly packed with coarse frass, and wind in many directions through both sapwood and heartwood. The coarse frass is not easily jarred out and is rarely seen on surfaces beneath the exit holes. The tunnels are commonly surrounded by soft decayed wood which can give a grayish halo to the wood a few millimeters from the tunnel when viewed in cross-section.

BIOLOGY. Very little study has been done on the biology of North American species. Adults are active from late spring to early autumn. Mating occurs in tree tops, with the females descending to the trunks for egg laying. The female inserts her ovipositor to a depth of 3/8-3/4" (8-20 mm) and deposits 1-7 eggs at short intervals as the ovipositor is withdrawn. She also introduces into the egg tunnel fungal spores from a storage organ located at the base of her ovipositor . This egg laying process is repeated over about 10 days, with about 300-500 eggs being laid. The fungus grows quickly and serves as the larval food; they do not eat wood but merely tunnel through it. The chewed wood fragments are passed behind the larva after the fungal nutrients have been extracted. Fungal growth requires that the wood moisture content exceed the fiber saturation point (30%).

The larvae start feeding at right angles to the oviposition/egg tunnel in the sapwood. As they grow, they tunnel into the heartwood and later tunnel back into

the sapwood, making a typical C-shaped tunnel some 10-30" (25-76 cm) long depending on the species. The larvae pass through 3-4 molts which may require 2-3 years outdoors but up to 4-5 years if the wood quickly dries such as in structures.

Pupation occurs in a silken cocoon at the end of the larval tunnel, usually located about 3/4-1" (18-25 mm) below the wood's surface. The pupal stage lasts about 6 weeks. If the pupa is located too deep in the wood, the adult is unable to chew to the surface and dies in the tunnel. Adults chew directly to the surface to emerge, and do so through a round exit hole.

HABITS. Species in the genera *Sirex, Urocerus,* and *Xeris* infest only conifers/evergreens/softwoods. The 2 species in the genera *Eriotremex* and *Tremex* infest only deciduous/broadleaf/hardwood trees. Only trees which are in decline are attacked, that is, trees which are weakened by fire, disease, insect attack, air pollution, etc.

Horntails are not common pests in structures, nor do they cause a great deal of structural damage. However, they can appear in rather large numbers when infested wood is used in a structure. They can cause intense customer concern when the adults emerge because of both the conspicuous exit holes and that the adults are rather large, noisy fliers, and look intimidating.

Although they will not reinfest seasoned wood, the adults will readily chew through whatever finished surface is covering the infested wood. They have chewed through hardwood floors, paneling. sheetrock, plaster walls, linoleum, carpeting, nonceramic floor tiles, etc. They can also emerge from infested wood used in manufactured products such as chairs, dressers, door frames, etc. Occasionally, they may emerge from firewood brought into the house but not quickly used.

Non-Reinfesting Insects Which Attack Wood Study Questions

1. How can ambrosia beetle adults be recognized and separated from other adult beetles? Why do they not reinfest structural wood?

2. How can bark beetle adults be recognized and separated from other adult beetles? Why do they not reinfest structural wood?

3. How can buprestid beetle adults be recognized and separated from other adult beetles? Do they reinfest structural wood?

4. Why are these beetles not considered a danger to the structural integrity of the wood?

5. How can cerambycid beetle adults, excluding the old house and flat oak borers, be recognized and separated from other adult beetles?

6. How can hide and larder beetle adults be recognized and separated from other adult beetles?

7. Where would you expect to find these non-reinfesting insects?

8. For each of the pests discussed in this chapter, what life stage is it that bores into the wood? Which, if any, have a life stage that actually eats the wood? If the immature stage does not eat wood, what does it eat?

Chapter 5

CONDITIONS CONDUCIVE TO WOOD DESTROYING ORGANISMS

Objective. When you complete this chapter, you will be able to identify construction features that can contribute to infestation as well as symptoms or "conditions conducive" to certain problems or infestations.

Contents. Introduction.

Conditions conducive.

Construction techniques.

Conclusion.

References available.

INTRODUCTION. The primary duty of the inspector is to seek visible evidence of the Wood Destroying Organisms. Knowledge of Building construction and conditions that can lead to the infestation by various organisms can enhance the inspector's ability to find evidence.

There are numerous common construction techniques. You should become familiar with the common elements of construction e.g. foundations, building materials used, and common types of structures built in your company's area. There can be several conditions that develop from the lack of maintenance or just with the natural aging of a structure that can lead to the development of "**conducive conditions"** to insect or wood destroying fungi attack. Most of these conducive conditions that develop as a structure ages are related to moisture. However, there are certain types of constructions that may also allow termites to enter the structure undetected. Because of these the inspector needs to be aware they exist and carefully check certain areas of the structure during the inspection process.

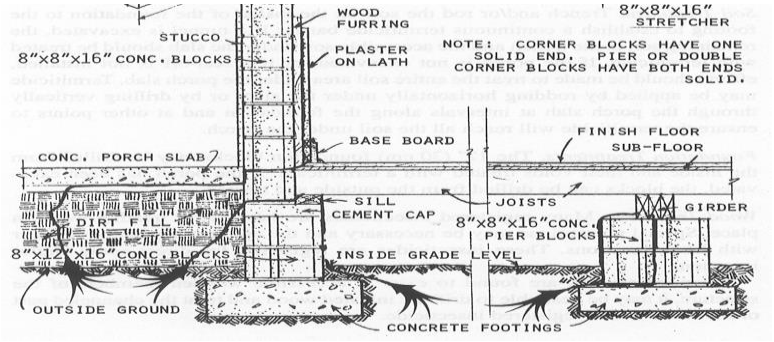
CONSTRUCTION TECHNIQUES. Construction techniques may vary from region to region in New England. The history of this area means that older homes that exist may be historic and at least one-hundred years old. They may have been remodeled or possess construction features which are no longer used in the construction industry.

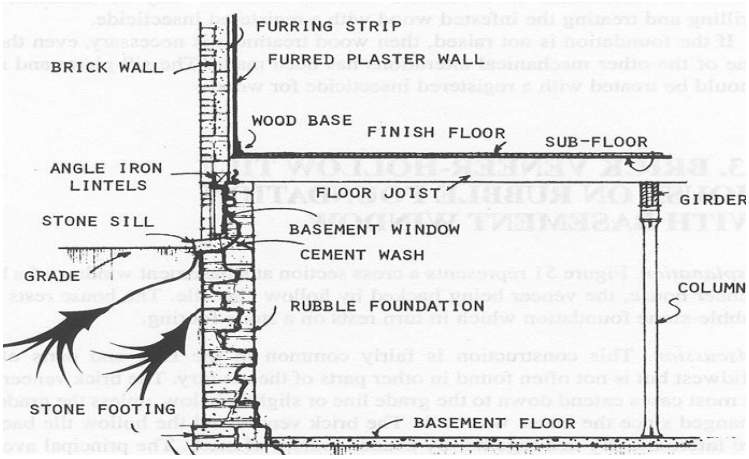
In addition, new construction techniques and custom builders may bring new features to structures that have not been seen before. This coupled with remodeling and additions to existing homes can complicate the inspection and

make it difficult to determine access by wood destroying organisms, especially subterranean termites. It is important for you to become familiar with construction practices in your area of operations. A good general rule is to **expect the unexpected**. Some of the most common problems are discussed in this chapter.

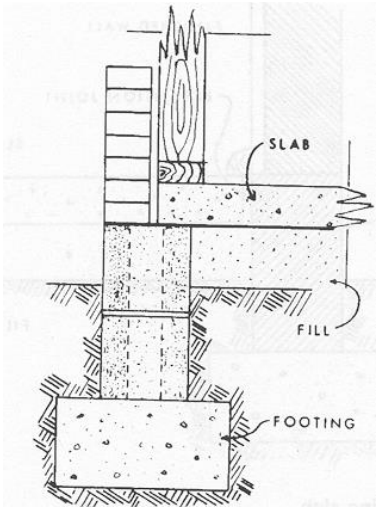
Because the inspection may lead to treatment of the structure, all conditions that may influence the infestation of a property may also influence the type of control program performed.

FOUNDATION TYPES. There are three basic types of foundations; crawl space, basement and slabs. Structures may also possess a combination of these construction types. Basement and garage floors are usually floating slabs. Two of these diagramed here, the crawl space and basement, can be assessable for inspection from under the structure

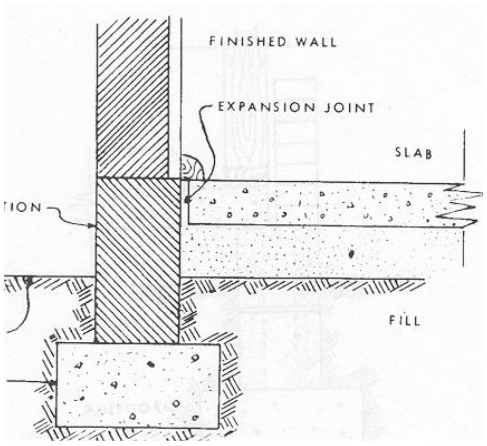




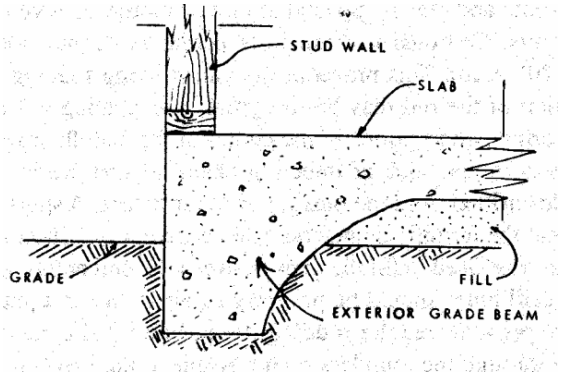
Slab structures consist of a concrete pour that becomes the base of the structure. The diagrams on page 5-3 show; (A) supported, (B) floating, or (C) monolithic and possibly a combination. Each slab construction has its problems. For instance; a floating slab usually has an expansion joint around the perimeter of the slab, and are poured directly onto the soil or fill material to about a foundation wall. As you can see in the figure, termites can enter through expansion joints. This type of slab is commonly used in attached garages and basement structures. We sometimes refer to this as slab on grade construction.



A (Supported)



B (Floating)



C (Monolithic)

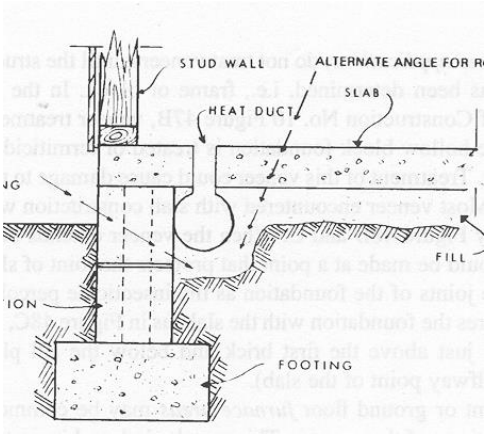
The Monolithic slab, and possibly supported slabs, have been used in building larger commercial structures or in building row, townhouses or apartment structures. When the slab is poured, it becomes the footer for the foundation. It is not a common construction type in New England.

In general, slabs can be a deterrent to termite infestation as long as there are no cracks or penetrations through the slab. Unfortunately, that is not usually the case. As structures age settlement cracks will form in slabs and foundation walls. In addition, for many years now all utility entrances into slab homes and other homes come in under ground, through foundation walls and penetrating slabs:

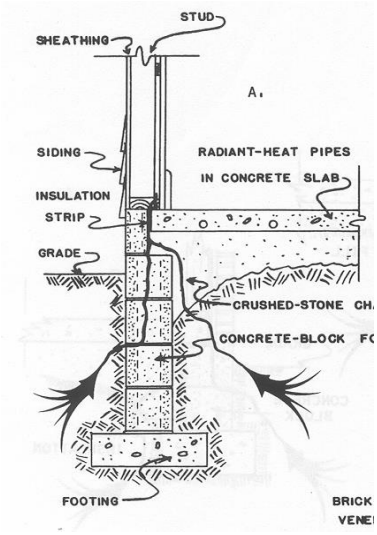
this includes plumbing, gas, water, electrical, and even phone and communication cables. It is important that the inspector be able to identify vulnerable areas of the construction so these areas can be checked during the inspection.

There are also some other "construction features", often associated with slabs, that have lead to problems with termite infestation. They include, but are not limited to:

1. **Air ducts under or embedded in the concrete slab.** This condition poses a risk by providing a direct access for subterranean termites. In older construction, the ducts may even be cardboard and be in contact with the soil under the slab. In addition grade stakes, holding the ducts in place during the slab pour, may also be left in the slab. Unfortunately these penetrate into the soil and can be found by termites.

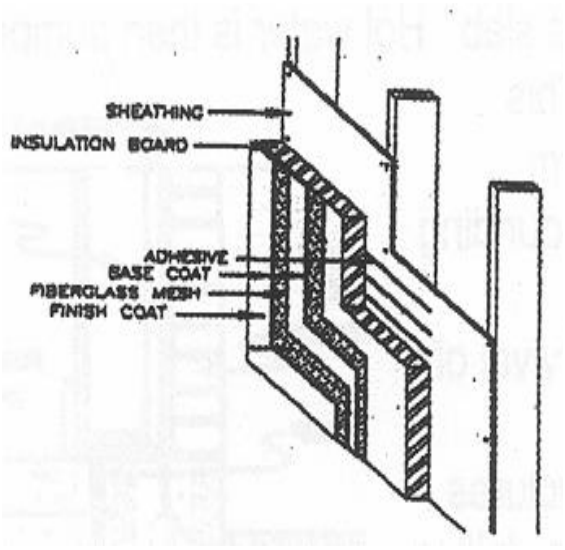


2. **Hot water, radiant heat pipes embedded in a slab.** This construction technique employs the use of coils of copper, aluminum or polymer tubing embedded throughout a slab. Hot water is then pumped into the tubing, and used to heat the structure. This construction effects the soil environment under the structure and can create an attractive environment for the survival of subterranean termites. Treatment of these structures requires extreme care in drilling through the slab to avoid drilling the hot water supply lines in the slab. Alternative treatment methods such as baiting or exterior-only liquid treatment should be considered. New materials like insulated heated flooring can also have similar effects on soil environments.

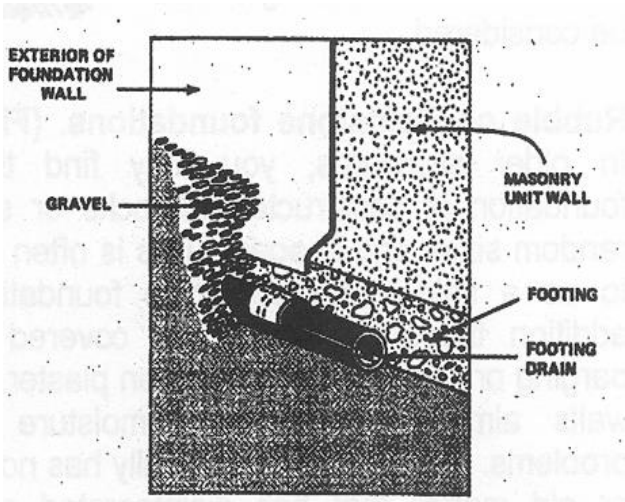


3. **Rubble or Fieldstone foundations.** In older structures common in New England, you may find that the foundation is constructed of rocks or stone of random sizes and shapes. This is often referred to as a field stone or rubble foundation. In addition these walls may be covered with a parging, a plaster like coating on the wall, or a concrete coating. These walls almost always have moisture related problems. This foundation usually has no mortar, or old mortar that has disintegrated over the years. Rubble foundations provide numerous hidden areas for termites to enter structures. Inspect carefully and look for termite tubes and check sill plates or log beams closely.

4. **EFIS- External Facing Insulation System (Drivit, Synthetic Stucco)** This construction technique that became very popular in the mid-1980s. The exterior finish of the structure looks like stucco. The exterior cladding of the structure includes the attaching of a foam board base fastened by glue and / or fasteners directly to the buildings sheathing material, usually plywood. This foamboard is then covered with synthetic stucco like material. Installation problems may lead to serious moisture problems, and subsequently a termite infestation in the structure may find this moisture source, resulting in serious structural damage. Carpenter ants also find the foam a good nesting material. In addition, the foam board often contacts or penetrates the soil covering the exterior of the foundation wall. Inspectors should be aware of the potential hazards involved in the inspections of buildings that are constructed with EFIS siding. This method of construction can make detecting evidence of infestation difficult, especially when the foam board is attached to the foundation walls.

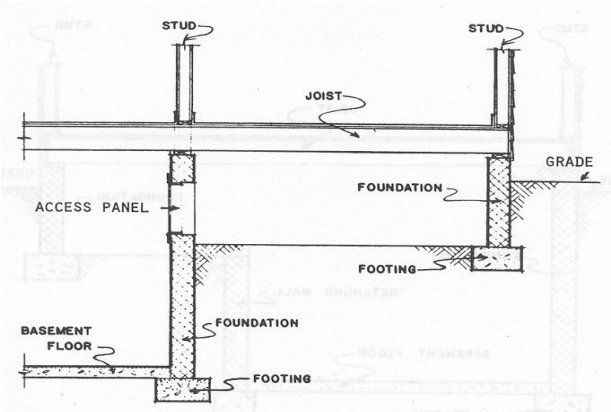


5. **Sub Slab Drainage System (French Drains)** This construction technique is used to channel excessive water from beneath a structure to a specific drainage site. There is usually a sump pump in the basement of the structure. However, in some cases there may be a gap, often a couple of inches wide between the slab and the foundation wall. These systems provide an easy access point for subterranean termites, and a potential contamination hazard for corrective treatments. Refer to the manufacturers' recommendations and the NPMA for procedures for treating structures with French drains. When these are found, the inspector should ask about the system, what type and where it drains.



6. **Structures with Wells and Cisterns**. It is not unusual in older structures to see evidence of a well or cistern within the foundation walls. These need to be identified during the inspection even if they are not being used. This is needed more for treatment information, than the concern about termite infestation. Although, wells and cisterns within foundation walls can be a serious problem because they can attract termites or create conditions conducive for beetles. Termiticide labels have specific instructions on how to deal with these features around a structure.

7. **Combination Structures.** Just to complicate the problem, often we are called on to inspect structures that may be a combination of construction types. Split levels, slabs and basement/crawl space structures are common in older structures and renovated structures. In addition, remodeling or additions to the structures may lead to slab on grade construction abutting a foundation wall. Often, these areas are covered because they are part of the living area. Look for indications of these types of construction and pay particular attention to those areas where slabs abut structures.



CONDITIONS CONDUCIVE. In general, most conditions conducive to infestation can be related to the presence of moisture. The listing of conditions conducive is not a requirement under the inspection guidelines for NPMA-33 form. However, it is important that the inspector recognize these conditions and evaluate each for possible termite or wood destroying organism infestation. The following list is not in any particular order of importance, as they will be uniquely important to each individual property.

1. Wood to soil contact: This age-old problem presents problems from the standpoint of wood destroying insects such as subterranean termites and carpenter ants. Additionally, this condition is conducive to wood decay fungi and deterioration of wood due to excessive moisture content. These wood to soil contact points may be as simple as form boards left in around a slab, fence posts against a foundation, siding in contact with the ground, flower boxes or planters against a house just to name a few. A thorough inspection could reveal many others not listed here.

2. Excessive wood moisture: The most effective way to determine the wood moisture content is with the use of a moisture meter. There are several different models or types of moisture meters. They measure the relative percentage of wood moisture based upon electrical conductivity. Excessive wood moisture is important to determine because it is a condition conducive to infestation from subterranean termites, carpenter ants, powder post beetles and wood decay fungi.

3. Insufficient ventilation in crawl spaces: insufficient ventilation can lead to the buildup of excessive moisture conditions in the wooden structural members in the understructure. The natural consequences of excessive moisture in crawl spaces are wood decay fungi, subterranean termites, carpenter ants and certain types of wood destroying beetles. Ventilation in crawl spaces should provide for

good air exchange to prevent the formation of condensation and no "dead air" spaces where air can become stagnant. Vapor barriers will also reduce soil moisture from entering the crawl space.

4. Structural leaks: Anytime there are water leaks in structural components of buildings, conditions conducive to infestation from subterranean termites, carpenter ants and wood decay fungi are created. These leaks may be difficult to determine; however, a careful visual inspection may reveal evidence in the form of water stains to trim boards, drywall, carpets, rusty nails, peeling paint, etc. Some of these structural leaks may originate from windows, doors, chimneys, flat roofs, electrical and plumbing inlets, faulty plumbing, deteriorated roofs, etc.

5. Firewood, Landscaping and Other Cellulose Materials Against the Foundation: As every experienced inspector knows, these elements are sure to harbor insect problems. Sometimes it is impossible to move or thoroughly inspect these areas, but at the very least, they should be noted on your inspection graph as a potential problem and disclaimed as obstructions as they will inhibit the inspectors' ability to investigate potential problems.

6. Faulty Grading: Proper grading around the exterior of a structure is critical for the proper runoff of rain water and water from the irrigation of lawns and gardens. While Wood Destroying Organism Inspectors are not expected to possess expertise in how to correct problems in this area, it is important to be able to identify improper grading around structures due to the important role it plays in identifying potential problems with infestation and corrective treatments. Symptoms of improper grading include low areas adjacent to foundations, standing water, localized areas absent of vegetation, leaking basements, constantly running sump pumps, standing water in air ducts in the slab, etc. These areas should be thoroughly investigated by a qualified individual prior to the application of any liquid termiticide.

7. Absence of Gutters and Downspouts: Gutters and downspouts are designed to channel water to a specific area along the foundation where it can be diverted away from the structure preventing water buildup and the resulting problems associated with excessive moisture. If gutters are clogged or faulty, moisture may build up in the walls, cause wood to rot, and invite insect infestation in the walls. This is something to be noted and inspected for during the interior inspection.

8. Wood mulch next to the foundation. The presence of wood mulch next to the foundation may create a moisture condition that insects like termites and carpenter ants can use or be attracted to.

CONCLUSION. As a professional WDI Inspector, an individual must possess a wide range of knowledge on construction techniques. All of the techniques used in construction create a tangled web of conditions that interact to create many unique situations within a particular structure. Understanding certain conditions that will predispose a particular area of a structure to developing a water problem or insect infestation will allow you to perform a more accurate inspection.

REFERENCES AVAILABLE. There are many excellent reference materials available from your local building association, The National Pest Management Association and termiticide manufacturers. In addition, perusing Google can provide many articles and imiages of various systems and sturctures. A prudent inspector will take the time to research the predominant construction techniques common in their service area and incorporate this information into their regular training.

Conditions Conducive to Wood Destroying Organisms Study Questions

1. Gutters and downspouts are important because? Inspectors should note any exterior problems and do what to follow up?

2. What are the problems with External Facing Insulation Systems (EFIS)? Why are these problems important to know?

3. Examples of heating systems that are important to termite treatments are?

4. It is possible for a structure to have more than one condition conducive to termite infestation? List several

5. Wood to soil contact is important on WDI inspections because?

6. List the types of foundations found in New England and how they are vulnerable to termite attack.

7. What factors could lead to a conducive condition?

8. Failure to detect conditions conducive to infestation could result in?

9. Discuss the presence of wood mulch next to the foundation as a conducive condition.

CHAPTER 6

The Inspection Process: Tools and Protocols

Objective. When you complete this chapter, you will be familiar with the tools and equipment needed to perform an effective inspection. You will also be familiar with the general process of conducting a thorough, accurate and complete inspection of a structure.

Contents.

INTRODUCTION. Before we discuss an inspection procedure (Protocol) an important aspect is to make sure you have the necessary tools to aid you in an effective inspection. Although personal preferences may differ slightly from what will be described here, in general the tools and process allows the inspector to document all his or her findings and to do this with set procedure.

REQUIRED TOOLS AND EQUIPMENT. As with almost every other type of work, the proper tools, in good working condition, will allow you to perform your job safely and efficiently. While this list is comprehensive, you may discover other useful tools as you gain experience to aid in your ability to perform thorough inspections.

Inspection tools may include the following to assist inspectors in making an accurate inspection. Refer to company policies for specific mandatory equipment lists.

1. Personal Protection Equipment (PPE) includes such items as a Tyvek suit, safety glasses, bump cap, knee pads and gloves— these are essential especially when inspecting crawl space and attic areas of structures. Bump hats protect against head injury and coveralls enable you to keep from bringing soil and other debris into the structure. Gloves, and knee pads can be optional, but in crawl spaces there can be many objects and materials that can cut or cause injury to hands.

2. A good flashlight, head lamp or second flashlight with spare batteries and bulb. These are absolutely essential that there be a good light source in crawl and attic areas. Flashlights may also assist in lighted areas of the structure when searching behind appliances and furnishings, or other tight areas along baseboards.

3. A sounding/probing tool— sounding and probing suspected areas for termite and other WDOs requires a sturdy tool for this process. It is not essential that the tools be large or heavy, but should afford the inspector some reach as they may have to probe into areas where the hand cannot reach. A large standard head screw driver is used by many inspectors, using the handle for sounding and the other end for probing.

4. A clipboard with pens and/or pencils—for holding the report form or other documents and for making diagrams and taking notes during the inspection. Make

sure you have a backup as lost pens and pencils are common in inspections. More companies are using tablet or electronic documentation during the inspection these can be used to store pictures and even fill out the inspection report so it can immediately can be emailed to designated person (realtor, customer, office)

5. Measuring tape or other device—for recording distance along foundations or specifically listing damaged area. Usually used when calculating for treatment specifications, but could be essential when remodeling is evident to determine hidden area within the structure

6. Tool kit (to include Slot & Phillips screwdriver, pliers, adjustable wrench, and small hammer)—these may be used to gain access to areas like crawl spaces or remove bath trap doors to access the bath trap or plumbing entrances.

7. Extendible mirror to see in difficult areas—used in some cases in conjunction with the flashlight to see into areas where termite or other WDO damage or evidence may be found.

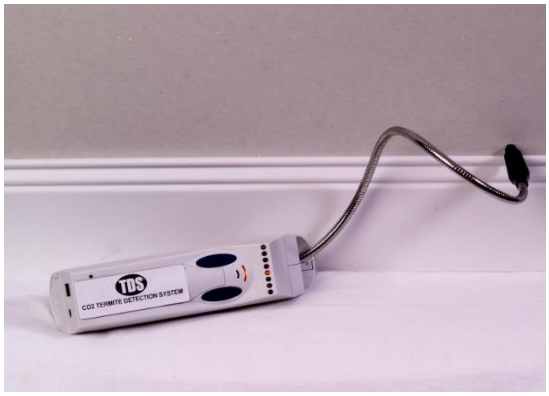
8. Respirator and dust mask—usually worn during the inspection in crawl spaces and attics. They can protect against exposure to mold and other organisms in crawl spaces as well as dust.

OPTIONAL EQUIPMENT AVAILABLE. The following tools and equipment are considered optional tools. Many are used to try to find insects or a conducive condition within a wall. This is not a visible area of the structure. Some companies use these to establish the existence of active infestations within inaccessible areas like walls. Some are being used by companies when trying to troubleshoot difficult control situations, others may assist inspectors in making accurate determinations of the existing condition the day of the inspection. In general the use of these tools should be determined by company policy. Most of these devices are used for the detection of subterranean or drywood termites.

1. Borescope or other periscopic device—have been used, but have limited use in initial inspection, generally because they require a hole to be drilled or opened to see into what is considered inaccessible areas.

2. Termite detection dogs—specially trained animals to detect termite activity. Generally finding active termites.

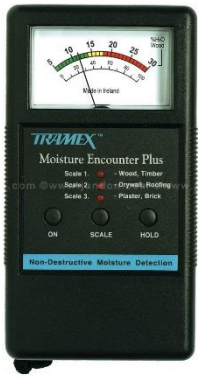
3. CO_2 detectors—have been developed and researched. The CO_2 detectors can detect active subterranean termite infestations in wall voids.



4. Acoustic detectors (AED), stethoscopes—have been used to detect wood destroying beetles also. AEDs are electronic devices that pick up on the frequency of the sounds generated by insect feeding activity or movement. They may require special adaptive probes or attachments to "hear" through coverings over the wood like wallboard. Stethoscopes have been used by some companies to detect carpenter ant nest or activity locations.

5. Cameras— there are not many cell phones made today without cameras. Some very sophisticated and almost all allow for video recording , as well as voice over documentation. It is a valuable tool for consideration. It will definitely assist in documenting conditions the day of inspection. These can be used to document evidence seen or condition of the property the day of the inspection. pictures can also be included in reports.

6. A moisture meter with a range from at least 15 to 30 percent—has become more widely used in WDO inspections. It is needed to determine "activity" of wood rots and potential moisture problems within walls. Moisture meters can be expensive, especially those used to determine moisture conditions within walls. They also can be used to document a conducive condition existing the day of the inspection.



7. A ladder—for inspecting and gaining access to an attic, for examining the sill plate area in a basement, or on the exterior if ground level inspection reveals a concern that the inspector wishes to investigate around windows or gutters.

8. Movement detectors—Devices that use microwave technology to detect termite and ant movement in walls and floors.

9. Infrared Cameras—are being used to detect "anomalies" in walls and ceilings and within wood products or

structural wood. These anomalies are often associated with moisture or temperature difference within the walls. These may be associated with termite activity.

INSPECTION PROTOCOLS/ PROCEDURES

INTRODUCTION. The object of a WDI inspection is to be thorough, accurate and complete. Accomplishing this requires organization so reports are clear, precise and describe what was found during the inspection. In this section of the chapter we will discuss the procedures and documentation needed to do an effective WDI/O Inspection. Company Policies and procedures will determine the use of these suggested operations guidelines.

A good definition to consider during an inspection is this: ***It is an analytical assessment of the risk, that a structure has, to being infested or attacked by re-infesting wood destroying organisms.*** Using this guide existing evidence can be found and the potential for infestation can be noted. In addition during re-inspection of warranty customers, new evidences can be noted and corrected or pointed out to be a threat to the possible future infestation.

The inspection process starts and end in the office. We will discuss the details of that involvement.

PRELIMINARY RESEARCH. When the initial call / request for an inspection comes in it may be for a property transfer inspection, a current customer who thinks they have termites or the inspection may be an annual inspection for a termite treatment contract. The person taking that call should ask some pertinent questions and possibly ascertain the caller's problem or whether they are currently a customer. A check of the company files both current and canceled should be performed to ascertain if the company has ever performed a treatment or previous inspection on the property.

Some pertinent questions to ask may be:

1. Have there been any leaks? Roof, pipes, steam, etc.
2. Has the property previously been inspected for WDOs? If yes, when and by whom? What were the results?
3. Has the structure previously been treated for WDOs? If yes, when, by whom and is warranty in effect? (Request documents showing al inspections and treatments)

4. Have there been any additions since structure was treated? If your company has provided this service review the records and any reports in the file.
5. Has there been a building inspection by a qualified building inspector? Results?
6. Have any repairs been made to damage from wood destroying organisms? Where?

The answers to these questions and any file information should be passed along to an inspector who should review the file, making copies of inspection reports and especially diagrams or graphs from previous inspections or treatments. The inspector should bring the previous reports/graph copies for use during the inspection.

The inspector should record the answers received for use during the inspection. For example, in any structures had been treated previously, the inspector must be very careful to look for new repairs or cosmetic work, which may cover damage. The inspector should also be alert for freshly painted areas. The answers received may also prove useful if the inspection is questioned at some later date.

INSPECTION PROCEDURES: Below we will cover inspection of different areas, all of which must be inspected (when applicable).

Remember that this inspection is basically a series of checklists, areas of the structure and/or items to investigate and check off during the inspection. Although a visual inspection, there will be tools used for probing and detecting wood destroying organisms. A worksheet and checklist would be a good tool for you to use to remind you of items that need to be checked, and for recording findings as you proceed with your inspection.

EXTERIOR. Beginning your inspection on the exterior allows you to prepare a graph of the structure which will be discussed later in this chapter. You should compare your graph with any previous graphs and investigate any differences and report them. In taking notes, you will write down more than is called for on the inspection form (Chapter 7). This is to assist you in determining control strategies, or if questions arise in the future. Be sure to:

1. Check the foundation for visible evidence of current or previous termite activity. Explain evidence in detail, i.e. "active mud tube found on foundation wall."
2. Check for cracks or expansion joints behind concrete porches and patios for evidence of termites.
3. Examine and sound wooden windowsills and door frames for insect activity.

4. Examine fascia boards for visible evidence of insects and moisture damage.
5. Check wood decks, porches, posts, and fences etc., which are attach to the structure must be examined by probing/sounding for signs of insects or moisture. Note: Wood to soil contact may be reported. Indicate where patios, decks, steps, trellises, etc. adjoin the structure. Also note; any of these that are attached to the structure are considered part of that structure. So if termites are found attacking a deck attached to the structure the structure is then considered infested by termite.
6. Inspect landscaping timbers and decorative driftwood, stumps or firewood for WDO activity.
7. Check for deteriorating mortar on brick/block walls near the soil. The mortar is probably deteriorating due to moisture from inside the brick/block. Note on graph any special attention to this area on the inside inspection.
8. Check for areas where the soil stays moist from downspouts, faucets, improper grading, etc. These areas are ideal for establishment and growth of termite colonies. Examine these moist areas both on the outside and the inside of the structure.
9. Inspect for foraging carpenter ants around the foundation, on tree limbs that touch structure and electric/telephone lines leading into the structure. Check where utility pipes enter the exterior of structure for signs of carpenter ants.
10. Look for signs of wells or water pipes entering the structure from wells or well pumps.
11. Check for signs of termite activity in mulch or other wood debris (i.e. stumps) close to the structure.

INTERIOR. Interior inspections include all levels of the structure, not just the ground level. Follow the same pattern in all rooms. Move right to left, up and down. Inspection of basement, slab and crawl construction will be described individually in following sections. Be sure to check:

1. The exterior door frames must be inspected/sounded/probed for visible signs of activity.
2. Baseboards for visible damage, mud tubes, exit holes, etc. Carpets will need to be pulled up in areas that are suspect.
3. Windowsills for visible signs of activity. Look for discarded wings of swarmers on the sill and possibly spider webs in the window. Look at the edge of carpet, behind draperies or curtains for wings or dead insects.
4. The walls and ceilings for signs of insects tunneling under wallpaper or drywall. In perimeter walls near downspouts, check for moisture signs.

Look for drop tubes from termites on the ceiling. Look for wood boring beetle exit holes in the beams on the ceiling.

5. Built in cabinets/bookcases. Be sure to open the doors and inspect inside.

ATTIC. Care must be exercised when inspecting attics to minimize the risk of falling through inadequate floors. This risk does not preclude the inspector from inspecting the attic. However, there may be circumstances that make inspecting too difficult or risky. Some of these reasons may be that the attic space is too small to allow entry, filled with insulation, has lack of proper flooring, etc. In these isolated cases, the attic should be marked inaccessible and the reason described, i.e. "attic full of insulation that covers ceiling joist obscure the joists cannot be inspected."

1. Move as far towards the gable ends and eaves as possible. If most of the attic cannot be inspected it should be marked inaccessible (i.e. the insulation covers ceiling joists).
2. Inspect sub-roof and rafters for evidence of leaks, mud tubes, and wood destroying beetles, and carpenter ants. Be sure to inspect the floor, ceiling joists, rafters, etc. for evidence of carpenter ants.
3. Inspect areas above bathrooms, around chimneys, roof valleys and any heat or cooling units for signs of activity not evident from below.

Company policy will dictate the conditions under which attics are inspected. The use of ladders to gains entrance to scuttle holes or access panel is a company decision. However, it should be pointed out that if the inspector enters the attic area. Then some visual inspection is possible even if limited in scope.

CRAWL SPACE. Protective clothing may be needed in this area. If standing water is preventing the inspection, it should be reported as inaccessible, the moisture problem recorded and a suggestion that another inspection be done after water is removed. A moisture meter should be used to determine moisture problems. When wood rot or fungi are found in these cases, moisture readings from at least four areas (left front, left rear, etc.) and the center of the crawl space should be recorded. Be sure to check:

1. Around and above the crawl space door and frame.
2. The top of the foundation wall (sill plate area) for dead insects and wings. Check spider webs for insect parts. Inspect, sound and probe the sill plate, box header, floor joists and sub flooring for moisture, damage, mud, exit holes, etc. Since wood destroying beetles can fly into crawl spaces through vents, then unfinished, exposed wood near these entrances should receive special attention.
3. All wood for active wood destroying fungi.
4. For cellulose debris; examine for WDI activity.

5. The piers, pipes and fireplace footings in the crawl space for mud tubes. Inspect the crack between double floor joists and the crack between the sill plate at the top of the foundation wall for mud tubes.
6. The floor of the crawl space for tree roots, stumps, Carpenter ant frass, and form boards. Record the nature of this floor, i.e.: soil, concrete, broken-up concrete, etc.
7. The underside of all sub flooring, if visible/accessible, especially under bathrooms, and both sides of all floor joists.
8. Any insulation. If insulation or some other material, such as rolled-foil insulation, fiberglass, foam or plastic exists between or over sub-structural wooden members, these items should be listed in the section of the inspection form as an obstruction or inaccessible areas. However, care should be taken to pay particular attention to the highly susceptible areas such as the area directly behind dirt-filled porches, attached decks, masonry fireplaces, etc. Sounding and probing of those wooden members is performed when accessible. Company policy may dictate specific instructions for this procedure.
9. For sump pumps, sub-soil drainage systems and water level marks.
10. Any area where the crawl space is wet or has standing water should be reported.
11. Areas along the interior foundation where there are attached porches, slab patios, and areas with heavy shrubbery outside.
12. Carefully near heat sources close to soil where the soil can be kept warm throughout the winter. This warm environment can be attractive to termite colonies. The inspector should pay close attention to this area during the interior inspection.
13. Any damp, wet or rotting wood.

Special note on crawl space renovation: Times change and the renovation of crawl spaces to reduce moisture and "condition" the space have become more prevalent with many companies offering this service. It may entail insulating the walls, certainly placing a heavy (6 mil or higher) soil cover and sealing all ventilation openings. It should also include sealing against rodent entry.

Materials used include foam blocks (usually borate treated), spray-on closed-cell foam, batted insulation on walls, heavy duty vapor barriers, concrete installation over vapor barriers, sump installation, and dehumidifiers. When inspecting open crawl spaces notes should be taken, as well as pictures, to support the conditioning proposal.

The ability to inspect already conditioned crawl spaces will vary with the methods that were used. The benefits of this service are measurable in lower utility bills and energy conservation. The benefit to the PMP is there will be an

environment that does not favor insect or other pest infestations. Annual inspections should still be done for termites as they may find ways into the structure.

BASEMENT.

Finished basements should be inspected using the same procedures described in "interior" section. Be sure to:

1. Check to see if visible evidence of wood-destroying insect infestation is noted in the walls
2. In finished basements with drop ceilings, a further investigation of accessible areas may be performed to determine the extent of the infestation. WDI inspections do not require that the removal or dismantling of the ceiling be performed. Therefore, refer to specific company policies pertaining to this matter.
3. Inspect the bottom of wooden stairs for wood/soil contact and evidence of activity.
4. Inspect pipe penetrations through the floor.
5. Inspect interior partition walls for insect signs. Pipe penetrations inside these walls, which cannot be inspected, should be noted on the graph. Were interior walls at one time partition and now bearing? If so, are there cracks in the floor under the sleeper to these walls?

Unfinished basements. Note the type of floor: concrete, floating or supported slab, or dirt. Be sure to:

1. Look for water stains on the foundation walls. These would indicate flooding.
2. Inspect for sumps and drainage systems.
3. Inspect the walls for presence of mud tubes. Be sure to check cracks in the wall.
4. Inspect and sound the sill plate, box header, sub floor and both sides of floor joists. All exposed wood should be inspected for moisture, fungi, etc. Report any wood members that extend through the floor.
5. Check wooden windowsills and door frames for activity and wood topsoil contact.

INTERIOR SLAB LIVING AREA.

Slab structures often have considerable obstacles for the inspector. In a furnished slab home as much as 85% of the areas that need to be inspected are hidden or inaccessible because of carpeting, furniture, appliances, etc. The inspector must call on all previous knowledge of the insects and conditions that contribute to infestations, to augment the inspection process. Slabs in finished structures can be of various types, supported or floating, or combinations. In these instances,

attention should be given to accessible areas and listing those areas that cannot be viewed.

Check one room at a time, starting at the floor and moving to the window and then to the ceiling. This or another routine procedure should be established so as to avoid overlooking anything. Examine each room and open each door. Corners where there are downspouts or walls with debris filled gutters should receive special attention.

Slabs that have a perimeter expansion joint (floating or suspended) need special attention to the entire perimeter. Tap and probe the baseboard in the entire house. Inspect all pipe penetrations through the slab and the bath trap. Investigate any bumps in wallpaper, any cracking, buckling, etc. in the walls or floor. Baseboard heat supplies termites with heat and moisture and deserves special attention during inspection. Tap the walls just above the heat unit. Look for new paint, peeling paint, bumpy wallpaper, or other signs of insect attack.

Check for leaks under the sinks in the kitchen and bathrooms. Look for loose tile or missing caulk in tile surfaces.

Some slab structures have heating pipes under the slab. This can encourage termite colony success. In these cases, remove some heat vents and check for water in ducts.

Inspect the cracks where hot water enters the floor by the boiler and hot water heater. Floor coverings in slab structures hide evidences you're looking for. Light, easily moved furniture should be moved and the floor underneath checked. Wood parquet and raised floors fit in this area also. Inspect carefully and report thoroughly.

DETACHED STRUCTURES.

If instructed to inspect detached garages, sheds, pool houses, etc. on the property, these structures must be inspected using the same procedures discussed previously. If inspected, these structures must be documented as inspected on the report.

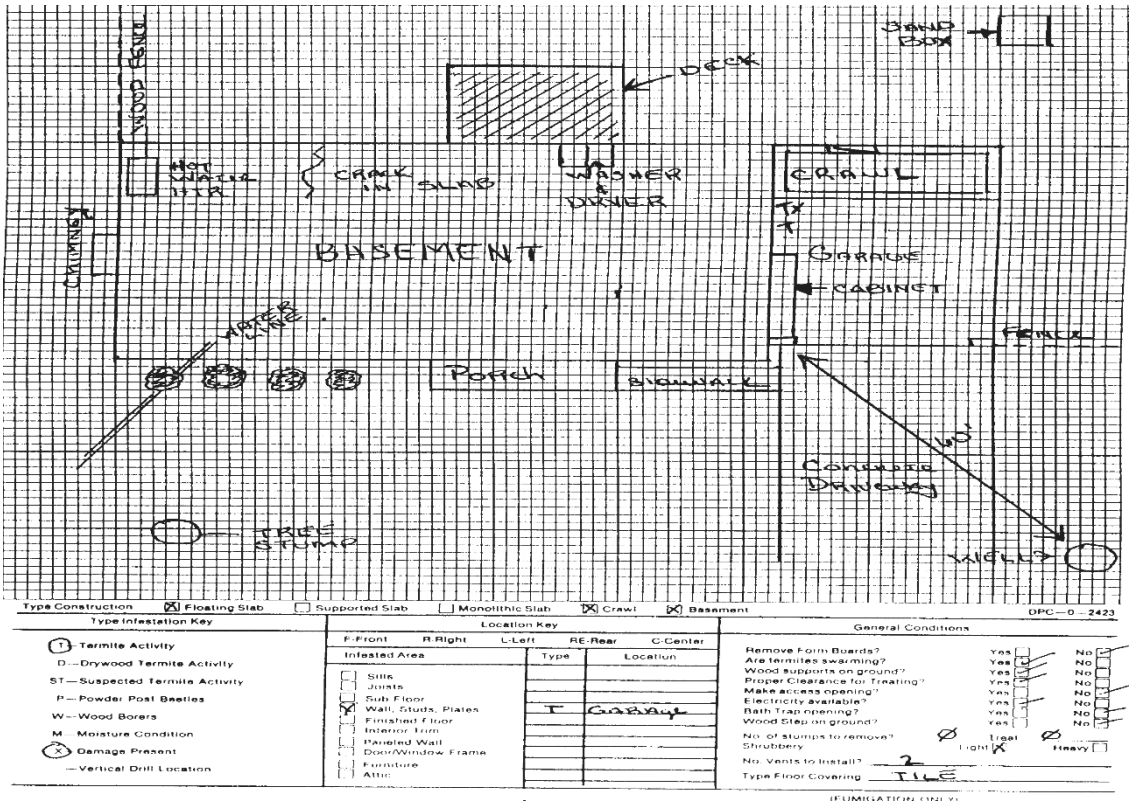
OTHER IMPORTANT ITEMS.

1. Where the inspector feels it is critical, he may make a specific request that an area be made accessible and a re-inspection ordered. The generic comments on the WDI report will explain most obstructed or inaccessible conditions adequately. A nominal inspection fee should apply to any re-inspection.
2. Any visible damage that is discovered should be recorded on the graph. A WDI inspector should not attempt to quantify damage as to its severity.

3. The inspector should cross-reference all documents he prepares to properly complete his report.
4. The inspector's report must be legible and intelligible

Developing a Graph/Diagram

INTRODUCTION. What is a graph in relation to a wood destroying organism inspection report (WDIR)? The "graph" or "diagram" is developed by the inspector during the inspection, usually as he or she walks around the exterior of the structure. **It is documentation of the condition present the day of the inspection.** The graph will depict the structures "foot print" accurately in shape and design and will note directly on the graph where evidence of wood destroying insects and/or fungi are found. It is designed to provide the buyer or lender with a clear picture of the conditions that exist on the day of the inspection. The graph can also be used in developing treatment specifications including linear feet measurements, and placement of termite bait stations as well as other treatment specifications.



There may be other reasons for developing a graph of a structure, but the first concern is that the graph depicts the structure and the location of visible evidences of wood destroying organisms. Most pest control companies have established

policies on the drafting and preparation of the graph. These policies will also determine the distribution of the graph to parties involved in the real estate transfer. The graph also becomes part of the company records for that customer. Other information contained on the graph may be related to, or assist if a treatment is contracted. However, in the case of the WDIR, the graph is strictly for the location of evidences of wood destroying organisms.

It will be necessary for the inspector to utilize and have knowledge of basic building construction. This is needed because certain terms and descriptions will aid in identifying different areas of the structure.

The graph can also be instrumental to the inspector in the future if they have to recall certain circumstances on the day of the inspection. Therefore, the graph also becomes a reference for future inspections or possible questions about the findings in the report. In regard to inspections, there is no state statute that directs the development of the graph. Each company may have its own specific instructions about when, if and how a graph is drawn. **It is good company and industry practice to utilize this method to document inspections for wood destroying organisms.**

DEVELOPING THE GRAPH. As mentioned the graph should be an accurate depiction of the relative size and shape of the structure inspected. The graph does not have to be exact to measurement. It should however, consist of the basic exterior design of the structure with notations on porches and slabs abutting the structure, garages, sheds, etc. that may be included in the inspection. Some companies require their inspectors to measure the structure, although the graph is usually never drawn to scale. For the purposes of the WDIR the accurate depiction of the shape will suffice.

The graph should be done on graph paper for ease of drawing and spacing, but can be done on plain paper. **The NPMA 33 form does not have such an area available, if a diagram or graph is attached to a WDIR it will have to be noted on the report that it is attached (see Chapter 7).**

The inspector should use a ballpoint pen or other dark writing instrument to outline the foundation and abutments to the structure. Some companies use an inspection worksheet of which part of it is graph paper. The graph should orient the structure to the viewer as to front and back of the structure or possibly north-east-south-west orientation. This aids in describing location of evidence inside or outside the structure. Graphs should also contain information about the structure like whether it is a slab, crawl or basement structure, and whether the garage is attached or not.

Most inspectors will use notations on graphs to indicate damage, active termite or other wood destroying organism activity and indications of possible hidden damage. You could quickly fill up a graph with written notes and make it illegible. Therefore many companies rely on symbols for denoting activity damage and other signs of wood destroying organisms. Some examples include:

- X is usually used to denote damage
- ST is usually used for denoting damage from termites
- PPB for powder post beetle
- OHB for old house borers
- F or WR for fungi (wood rot)
- ST or X with a circle around the letter(s) for activity along with the damage
- PHD for possible hidden damage

It may also be good to develop shorthand or notations for those situations where the activity is tubes, swarmers etc.

GRAPHING THE EXTERIOR. Walk around the structure and diagram the exterior lines of the foundation. Add porches, steps, windows, wells, and other attachments or items important to the inspection.

As the inspector does this they can note any evidences they see of wood destroying insects around the foundation. Do not forget that the inspector is not just looking down at the soil/foundation line but up also at guttering, windows and other areas for evidence or damage, infestation and /or moisture situations.

Items that should be considered in this part of the inspection include:

Location of wells.
Location and size and shape of decks.
Location of moisture drainage problems.
Location of plumbing or electrical access points.
Location of any surface water i.e. streams, lakes or ponds.
Location or any pools or spas.
Location of chimneys and fireplaces.

Any findings noted in the crawl space should be noted on the graph as well as the relative location of the entrance and support piers in the crawl space.

GRAPHING THE INTERIOR. Once the inspector has drawn the outline of the structure and located any visible signs of wood destroying organism activity, the inspection moves inside. There is no need to draw an accurate floor plan of the structure, but it is good to show stairs leading to basements or attics, access areas to attic or crawls, relative relationship of rooms if damage or evidences are

found. Some inspectors will note on a smaller diagram the specific location of damage in a particular room. There are a wide variety of ways to do this but again the graph should accurately site those locations of visible wood destroying organisms.

CONCLUSION. The graph is a very valuable piece of paper. This will enable the inspector to recall the conditions of the structure and the relative size and shape of the structure for any future references. The graph accompanying an inspection report will be extremely valuable to the person ordering the inspection. Between the graph and the written information, the person reading the report should have an accurate picture and be able to see where problem(s) may be located.

How to Prepare the Graph
Study Questions

1. Discuss the purpose of the graph. When must a graph be completed?
2. List at least six items that an inspector needs to show the approximate location of when graphing the exterior.
3. Discuss possible situations in which more than one graph would be drawn.
4. Why should an inspector graph the exterior first? What notations on the graph of the exterior would be helpful when inspecting the interior?
5. List at least three items that need to be shown when graphing the crawl area.
6. What items can be added to a graph to help orient the graph reader to specific areas?
7. List at least two construction situations that may be added to the graph to help make the report clearer.

The Inspection Process: Tools and Protocols Study Questions

1. List at least five tools that are necessary to make an effective WDI inspection, and discuss their role in an effective inspection.

2. List at least four pieces of safety equipment required to make a safe inspection.

3. List at least three pieces of optional equipment available to assist in making a WDI inspection, and discuss how they aid in making an effective inspection.

4. The inspector must check his/her company files before the leaving the office for an inspection. Discuss what the inspector should be looking for and why.

5. List five questions the inspector could ask the home owner or real estate agent to get details about the structure.

6. Discuss six areas that must be inspected in all crawl spaces.

7. Why is it important to establish a pattern of inspecting (i.e. left to right, floor to ceiling) and follow this pattern in each room of a slab structure?

8. Name six areas to be inspected during an inspection of a basement and discuss the reason for each.

CHAPTER 7

NPMA 33 FORM AND SUGGESTED GUIDELINES

Objectives: The purpose of this chapter is to familiarize each inspector with the NPMA 33 form and its instructions.

Contents:

- Introduction
- NPMA 33 Form & Suggested Guidelines
- Study Questions

This chapter contains the NPMA 33 form section by section. Each section depicted will have instructions written by the National Pest Management Association (NPMA). You should have a copy of this form in front of you for reference.

This form is used for property transfer inspections and is required by the HUD/VA guaranteed property transactions. The NEPMA has adopted the NPMA-33 form as the recommended form to be used on all property transfer inspections.

Under generally accepted practices, it is the responsibility of the inspector/inspecting company to inspect for and report visible evidence(s) of wood destroying insects. Specific areas of the structure inspected and method used may be determined by local or regulatory requirements and/or company protocols and direction.

Where to purchase NPMA 33 Forms: www.npmapestworld.org/npmaforms

Wood Destroying Insect Inspection Report

Notice: Please read important consumer information on **page 2.**

Section I. General Information

Inspection Company, Address & Phone

Company's Pest Control Business Lic. No.

Date of Inspection

Address of Property Inspected

Inspector's Name, Signature & Certification, Registration, or Lic. #

Structure(s) Inspected

Section II. Inspection Findings

This report is indicative of the condition of the above identified structure(s) on the date of inspection and is not to be construed as a guarantee or warranty against latent, concealed, or future infestations or wood destroying insect damage. **Based on a careful visual inspection of the readily accessible areas of the structure(s) inspected:**

☐ **A. No visible** evidence of wood destroying insects was observed.

☐ **B. Visible** evidence of wood destroying insects was observed as follows:

☐ 1. Live insects (description and location): _____

☐ 2. Dead insects, insect parts, frass, shelter tubes, exit holes, or staining (description and location): _____

☐ 3. **Visible** damage from wood destroying insects was noted as follows (description and location): _____

NOTE: This is not a structural damage report. **If box B above is checked, it should be understood that some degree of damage, including hidden damage, may be present.** If any questions arise regarding damage indicated by this report, it is recommended that the buyer or any interested parties contact a qualified structural professional to determine the extent of damage and the need for repairs.

Section III. Recommendations

☐ No action and/or treatment recommended: (Explain if Box B in Section II is checked) _____

☐ Recommend action(s) and/or treatment(s) for the control of: _____

Section IV. Obstructions and Inaccessible Areas

The following areas of the structure(s) inspected were obstructed or inaccessible:

☐ Basement _____

☐ Crawlspace _____

☐ Main Level _____

☐ Attic _____

☐ Garage _____

☐ Exterior _____

☐ Porch _____

☐ Addition _____

☐ Other _____

The inspector may write out obstructions or use the following optional key:

1. Fixed ceiling
2. Suspended ceiling
3. Fixed wall covering
4. Floor covering
5. Insulation
6. Cabinets or shelving
7. Stored items
8. Furnishings
9. Appliances
10. No access or entry
11. Limited access
12. No access beneath
13. Only visual access
14. Cluttered condition
15. Standing water
16. Dense vegetation
17. Exterior siding
18. Window well covers
19. Wood pile
20. Snow
21. Unsafe conditions
22. Rigid foam board
23. Synthetic stucco
24. Duct work, wiring, and/or plumbing
25. Spray foam insulation
26. Equipment

Section V. Additional Comments and Attachments

(these are an integral part of the report) _____

Attachments _____

Signature of Seller(s) or Owner(s) if refinancing. Seller discloses to the buyer all information, to their knowledge, regarding W.D.I. infestation, damage, repair, and treatment history.

X

Signature of Buyer. The undersigned hereby acknowledges receipt of a copy of both page 1 and page 2 of this report and understands the information reported.

X

Important Consumer Information Regarding the Scope and Limitations of the Inspection

Please read this entire page as it is part of this report. Please refer to the NPMA Suggested Guidelines for instructions on completing this report. This report is not a guarantee or warranty as to the absence of wood destroying insects nor is it a structural integrity report. The inspector's training and experience do not qualify the inspector in damage evaluation or any other building construction technology and/or repair.

1. **About the Inspection:** A visual inspection was conducted in the readily accessible areas of the structure(s) indicated (see Page 1) including attics and crawlspaces which permitted entry during the inspection. The inspection included probing and/or sounding of unobstructed and accessible areas to determine the presence or absence of visual evidence of wood destroying insects. The WDI inspection firm is not responsible to repair any damage or treat any infestation at the structure(s) inspected, except as may be provided by separate contract. Also, wood destroying insect infestation and/or damage may exist in concealed or inaccessible areas. The inspection firm cannot guarantee that any wood destroying insect infestation and/or damage disclosed by this inspection represents all of the wood destroying insect infestation and/or damage which may exist as of the date of the inspection. ***For purposes of this inspection, wood destroying insects include: termites, carpenter ants, carpenter bees, and reinfesting wood boring beetles. This inspection does not include mold, mildew or noninsect wood destroying organisms.*** **This report shall be considered invalid for purposes of securing a mortgage and/or settlement of property transfer if not used within ninety (90) days from the date of inspection. This shall not be construed as a 90-day warranty. There is no warranty, express or implied, related to this report unless disclosed as required by state regulations or a written warranty or service agreement is attached.**

2. **Treatment Recommendation Guidelines Regarding Subterranean Termites:** Treatment or corrective action should be recommended if live termites are found. If no evidence of a previous treatment is documented and evidence of infestation is found, even if no live termites are observed, treatment or corrective action by a licensed pest control company should be recommended. Treatment or corrective action may be recommended if evidence of infestation is observed, and a documented treatment occurred previously, unless the structure is under warranty or covered by a service agreement with a licensed pest control company.
For other Wood Destroying Insects, please refer to the NPMA suggested guidelines for added guidance on actions and or treatment.

3. **Obstructions and Inaccessible Areas:** No inspection was made in areas which required the breaking apart or into, dismantling, removal of any object, including but not limited to: moldings, floor coverings, wall coverings, siding, fixed ceilings, insulation, furniture, appliances, and/or personal possessions; nor were areas inspected which were obstructed or inaccessible for physical access on the date of inspection. Your inspector may write out inaccessible areas or use the key in Section IV. Crawl spaces, attics, and/or other areas may be deemed inaccessible if the opening to the area is not large enough to provide physical access for the inspector or if a ladder was required for access. Crawl spaces (or portions thereof) may also be deemed inaccessible if there is less than 24 inches of clearance from the bottom of the floor joists to the surface below. If any area which has been reported as inaccessible is made accessible, the inspection company may be contacted for another inspection. An additional fee may apply.

4. **Consumer Maintenance Advisory Regarding Integrated Pest Management for Prevention of Wood Destroying Insects.** Any structure can be attacked by wood destroying insects. Homeowners should be aware of and try to eliminate conditions which promote insect infestation in and around their structure(s). Factors which may lead to wood destroying insect infestation include: earth to wood contact, foam insulation at foundation in contact with soil, faulty grade, improper drainage, firewood against structure(s), insufficient ventilation, moisture, wood debris in crawlspace, wood mulch or ground cover in contact with the structure, tree branches touching structure(s), landscape timbers and wood decay. Should these or other conditions exist, corrective measures should be taken in order to reduce the chances of infestation of wood destroying insects and the need for treatment.

5. **Neither the inspecting company nor the inspector has had, presently has, or contemplates having any interest in the property inspected.**

SUGGESTED GUIDELINES FOR COMPLETING THE WOOD DESTROYING INSECT INSPECTION REPORT – NPMA-33 Version 1.3 08/2019

For updates to these instructions, visit www.npmapestworld.org

Form NPMA-33 MUST be used by wood destroying insect (WDI) inspectors to report the results of WDI inspections for any HUD/VA guaranteed property transactions. The NPMA-33 is also typically used for conventional transactions. If a state, through regulation or statute, requires the use of a state approved form and excludes the use of all other forms, the state mandated form must be used.

Under generally accepted practices, it is the responsibility of the inspector/inspecting company to inspect for and report on visible evidence of wood destroying insects, and visible damage. Inspected areas of the structure(s) inspected may vary according to local and regulatory requirements and practices.

If the state in which the inspection is conducted has prescribed procedures for inspections, those should be followed in conducting the inspection. The NPMA-33 does not preempt state requirements for inspection practices and reporting. If no state guidance exists, the inspection procedures should be in accordance with this document.

Before starting the inspection process, inspectors should read and understand the NPMA-33. If completing the form by hand, a fine point pen is recommended.

Section I. General Information

This section is for reporting general information about the location of the inspection and the inspecting company. All boxes in this section must be filled out completely. Inspection Company, Address, and Phone Number: Enter the business name, address and business phone number of the company performing and reporting the results of the inspection.

Company's Pest Control Business License Number: Enter the business license number of the company conducting the inspection activities. This is the state license to conduct pest control or pest inspection activities. In states where no business licenses are issued, enter "not required."

Date of Inspection: Enter the date on which the inspection was conducted. If it was done on more than one date, enter all dates that the property was inspected.

Address of Property Inspected: Enter the complete physical address of the property.
Inspector's Name, Signature & Certification, Registration, or License Number: Print the full name of the inspector who conducted the inspection. The inspector must then also sign the report and enter his/her certification, registration, or license number issued by the state pest/pesticide control regulatory agency.

Structure(s) Inspected: List all of the structures on the property that are part of the report (for example: "house and detached garage"). The person ordering the inspection should specify which structures need to be inspected.

Any findings are restricted to visible evidence in, on, or under the structure including the structure itself and areas beneath any portion of the structure such as crawls, basements, and porches. Decks attached to the structure are considered part of the structure.

Areas beneath decks and roof overhangs, adjacent mulch, landscape timbers, tree stumps, woodpiles, etc. should NOT be reported in this section. The inspector may wish to note WDI evidence observations found in these areas under Section V (Comments).

Section II. Inspection Findings

In this section, the results of the inspection are reported. **Wood destroying insects, for the purpose of this inspection, include termites, carpenter ants, carpenter bees, and reinfesting wood boring beetles.** If more room is necessary, comments may be noted in **Section V** or by using attachments if such attachments are listed in **Section V.** The inspection reports conditions on the date of the inspection only and no warranty is provided by this report unless accompanied by an attachment and noted in **Section V.**

A. **No visible evidence of wood destroying insects was observed.** Check this box if there is absolutely no visible evidence (past or present) of wood destroying insects in, on or under the structure as defined above. This box should NOT be checked if there is **any** visible evidence of wood destroying insects.
B. **Visible evidence of wood destroying insects was observed as follows:** Check this box if there is ANY visible evidence of wood destroying insects observed regardless of the extent or age of evidence. If **box B** is checked, at least one of the following boxes (1, 2, and/or 3) must be checked and an explanation, description and location of the wood destroying insect evidence must be provided. More than one box may be checked, if appropriate.

1. **Live Insects; (description and location):** Check this box if live wood destroying insects were found. List the type and specify the general area(s) where the live insects were found. The areas listed should provide enough detail to direct other interested parties to the general area.
2. **Dead insects, insect parts, frass, shelter tubes, exit holes, or staining (description and location):** Check this box if dead insects, insect parts, frass, shelter tubes, exit holes, or staining (carpenter bee droppings or scraped termite tubes) were found. Describe the evidence and specify general area(s) where evidence was found.
3. **Visible damage form wood destroying insects noted in the following area(s):** Check this box and specify the general area(s) where the evidence was noted if visible damage caused by WDI was observed. The inspector should probe and/or sound readily accessible wood members. The inspector is not a damage expert; damage is nothing more than visible evidence of either current or previous infestation. The inspector should not distinguish between structural and cosmetic damage. The report clearly states, *"this is not a structural damage report".* If the inspection company does provide damage evaluation and/or repair as an additional service, a separate contract should be attached and may be noted as an attachment in **Section V.**

Note that the next paragraph on the form clearly explains to the Buyer and Seller that damage, including hidden damage, may be present if **box B** is checked above. Further, if any questions arise regarding damage reported, a qualified structural professional should be contacted.

Section III Recommendations

The lenders, realtors, buyers and sellers are looking to the inspector to make a recommendation as to what corrective measures may be necessary or prudent. The inspector should use his/her knowledge, training and expertise along with careful observation of the structure(s) being inspected when deciding whether or not a treatment should be recommended.

Live insects do not necessarily have to be observed during the inspection for the inspector to recommend a treatment. Examples may include: fresh carpenter ant or powder post beetle frass noted, carpenter bee staining or signs of subterranean termites with no documentation of previous treatment.

Wood Destroying Insect Treatment Recommendations

Termites

If live termites are observed in, on or under the structure, a treatment and/or corrective action should be recommended (regardless of whether or not the structure has been previously treated). If evidence of termites such as bodies, wings, fecal pellets, kickout holes, mud tunnels, carton nests, staining, or damage is observed and there is no documentation of treatment that indicates that the infestation has been addressed, then treatment and/or corrective action should be recommended.

Regarding Subterranean Termites (which includes Formosan termites)

Treatment and/or corrective action should also be recommended for a structure that has been treated previously and shows evidence of infestation, even if no live subterranean termites are observed, if documentation of a treatment performed by a licensed pest control company does not exist. Treatment or corrective action may be recommended if a documented treatment has occurred in the past, unless the structure is under warranty or covered by a service agreement with a licensed pest control company. If any documentation is presented after the report is completed, the inspector should not change the report but rather advise that documentation be provided to the lender or appropriate parties.

If a baiting system is installed but the inspector does not know whether the contract is current, the inspector may recommend a treatment for subterranean termites and should also note "unless there is a current baiting system service agreement in effect" or similar language. If any documentation is presented after the report is completed, the inspector should not change the report but rather advise that documentation be provided to the lender or appropriate parties.

Reinfesting Wood Boring Beetles

If live, adult beetles are found in, on, or under the structure, or if any life stage of beetles are found within the wood, then treatment and/or corrective action should be recommended. If evidence of wood infesting beetles such as bodies, frass, exit holes or damage is observed and there is no documentation of treatment that indicates that the infestation has been addressed, then treatment and/or corrective action should be recommended.

Carpenter Ants

If live carpenter ants are observed in, on, or under the structure (trailing into building elements) then a treatment and/or corrective action should be recommended. If bodies/body parts, wood debris or other "frass" from carpenter ants or damage is observed and there is no documentation of treatment that addressed such evidence, then treatment and/or corrective action should be recommended.

Carpenter Bees

If carpenter bees are observed moving in or into and out of any structural members then treatment and/or corrective action should be recommended. If evidence of carpenter bees such as damage, entry holes, frass, staining etc. is observed and there is no documentation of treatment that addressed such evidence, then treatment and/or corrective action should be recommended.

Note: It should be understood that these treatment recommendations are suggested guidelines. Every inspection is different and there may be special situations, mitigating factors, or state regulations, which could cause an inspector to make a recommendation that does not follow these general guidelines.

Section IV. Obstructions & Inaccessible Areas

Virtually every property will have some obstructed or inaccessible areas. The typical areas are listed with a key provided on the right side for ease of use. For example, if there were boxes stored against the wall in the basement, the walls were paneled, and there was ceiling tile, the box next to Basement would be checked and "1,3,7" would be listed. In addition, or in place of the key, a written description may be entered on the line. Additional areas may be listed under "Other" or in Section V.

Section V. Additional Comments and Attachments

List any additional comments from any section. This may include any pertinent information not previously listed such as documentation of previous treatment, photographs, or diagrams. Service agreement information, if any, should include the expiration date. If additional space is necessary, comments may be continued on the attachment and referenced on the Attachments line. List **all** attachments in this section. The Buyer will then know that there are important attachments to the report.

Signature of Buyer & Seller.

The Buyer and Seller must sign and date the report. It is not the inspector's responsibility to obtain these signatures. These should be obtained at closing by the Realtor or closing firm. The Seller's signature signifies that the Seller agrees that all pertinent property history regarding WDI infestation, damage, repair, and treatment has been disclosed to the Buyer. The Buyer signs the form to indicate that they acknowledge receipt of a copy of the report.

Page 2 - Important Consumer Information

This page contains information for the consumer in order to explain the scope and limitations of the inspection. **Inspectors should read and understand all information on page two.** In addition, a maintenance advisory regarding integrated pest management is detailed for the consumer. Both the Buyer and Seller should agree to any corrective action and responsibility for corrective action. Under no circumstances is the inspector responsible for corrective action unless provided by separate contract. A full understanding of the scope and limitations of the inspection cannot be gained without reading **Page 2.**

If your state or area requires a wood destroying organism report, NPMA has prepared a model of a Wood Destroying Organism Attachment to the Wood Destroying Insect Inspection Report. The attachment is designed to report fungus conditions. HUD and VA do NOT require an organism attachment as part of national requirements for HUD and VA loans. PCOs are free to adopt or alter the model Wood Destroying Organism Attachment for specific areas. It is not copyrighted and may be reproduced.

For a free copy of the model attachment, send a self-addressed stamped envelope to NPMA Model WDO Form, 10460 North Street, Fairfax, VA 22030 or visit www.npmapestworld.org.

It is the position of NEPMA that accessibility is an important issue in these inspections. Essentially if you can enter the crawl space and move unobstructed through the crawl space then it is highly recommended that you inspect this area event though the distance between the bottom of the floor joists and the soil surface is less than 24 inches mentioned in the consumer information. Individual company policies should delineate acceptable situations for crawl space and attic inspections.

NPMA 33 FORM AND SUGGESTED GUIDELINES

STUDY QUESTIONS

1. When reporting the address of a property inspected, may we enter the buyer's and/or the seller's name? If so, why would we?

2. Regarding obstructions and inaccessible areas, this section states that lack of a ladder for access to attics or less than _____ of clearance beneath floor joists in the crawl space are acceptable explanations for inaccessibility to parts of the structure.

3. List several reasons why a termite treatment may be recommended.

4. Give a reason why a termite treatment may not be recommended if there is evidence of termites (other than live insects) observed in, on, or within a structure.

5. How long is the inspection guaranteed?

6. How long is the inspection form good for?

7. Does the presence of a termite bait system indicate past or current termite activity in the structure?

CHAPTER 8

PREVENTING AND DEFENDING WDI/WDO INSPECTION LAWSUITS

Objective. When you complete this chapter, you will be familiar with the general means available to a WDI inspector, and his company, to prevent potential and defend actual litigation arising from WDI inspection reports.

Contents. Introduction.

Insurance considerations.

Notification of a potential claim or lawsuit.

Theories of defense.

Other considerations.

Process of filing a lawsuit.

Conclusion

INTRODUCTION. The following is taken from a management release from the NPMA. It sums up the issues that surround claims and lawsuits that arise from WDI inspections. We have modified this in some sections to update it and tailor it for New England. You should remember that lawsuits, mostly concerning the presence of termite damage or infestations, are not always tied to a Property Transfer or the WDIR report. In fact many are tied to treatment re-inspections and reports. As always one of the most important parts of the process is documentation. Good documentation has stopped lawsuits dead in their tracks. At the same time even the best inspections and documentation does not stop a zealous homeowner and their attorney. Read this information carefully and understand that the company and the inspectors will be involved in any lawsuit that arises. Also it is essential you understand the nuances of local laws, regulations and consumer protection ordinances that could be involved in these claims.

It is probably wise to consider that everyday a WDI inspector may be faced with a potential claim involving a structure that the company inspected for WDI/WDO and for which a written report was issued.

The guidelines for the actual performance and reporting of WDI/WDO inspections in New England are not tied at present to any state regulations. Rather they exist in this manual and course conducted by the New England Pest Management

Association. The states in which your company works in may have regulations that discuss the process of an inspection in general. In some cases, these regulations may allow a state regulatory agency to investigate a inspection and review the report material.

It is recognized by insurers of this industry that one of the single largest dollar category of claims paid is that arising claims filed on WDI/WDO inspection reports.

It is, therefore, obvious that the manner in which a WDI/WDO inspection is performed, and by whom, is of great importance. The WDI/WDO inspector should be experienced in the types of construction found in the area, and know the biology and habits of the targeted species of the inspection, the signs indicating their infestation, and the treatment techniques required for each WDI/WDO potential pest and for each type of construction. Additionally, the WDI/WDO inspector should be cognizant of the environment in which the inspection is being performed, relative amounts and placement of storage, relative condition of wall coverings, signs of water leaks or damage, structural alteration or additions, and signs of previous treatments. For example, evidence of fresh repairs or recent paint may be masking an infestation or damage, etc. The WDI/WDO inspector frequently performs inspections in dusty crawl spaces. Realtors might also add pressure by calling at the last minute for an inspection for a "closing in an hour." The willingness of the inspector to help may lead to a less than thorough job.

A "universal standard" may never evolve, but WDI/WDO inspectors must realize that, at the very least, their inspections and reports **are compared to those of their industry peers. Inspections should be reported with the idea that records may be presented in court.**

In summary, WDI/WDO inspections, and the reports generated from them, should be as complete and thorough as possible, the more information the better, depending on the region and regulations. Save all data and material relative to an inspection, as well as a copy of the report itself, including all addenda. Most states do not directly indicate the required retention of these reports, but a good rule of thumb is to retain them for **at least two years past statute of limitations for property damage in the state of the inspection**. Your insurance company may have more specific recommendations, you should discuss this with them. Familiarity with these statutes is important. An attorney should be consulted in this regard. If the WDI/WDO report is for a structure which the company has treated and is under a warranty, save all data pertinent to the inspection in the account file.

The actual form for a WDIR (for property transfer) is recommended by The New England Pest Management Association this is the NPMA 33 form. It is recommended that all initial inspection for WDI use this report form. The WDI/WDO inspection reports of real estate transfers involving a new mortgage

backed by the **Veterans Administration (VA) or the Department of Housing and Urban Development** require the NPMA 33 form.

The utmost care must be taken to complete all appropriate sections and items of any WDI/WDO inspection report. Years after the completion of the inspection, the report, including all referenced addenda or attachments, is the only means that you, your lawyer, and possibly your insurer have to reconstruct the conditions of the structure the day of the inspection.

To initiate litigation or a demand against the company based on the WDI/WDO inspection report, plaintiff, in conjunction with their lawyer, formulates a **"theory of liability,"** which is the legal basis for the litigation or demand. A theory of liability may be based upon common statutory law or regulations. Several theories of liability are commonly put forth in the same suitor demand. It is necessary for only one of the theories presented in a suit to be proven in order for the plaintiff to recover damages.

INSURANCE CONSIDERATIONS. Many pest control companies choose not to bear the full financial liability of inspections. Instead, they choose to purchase liability insurance for inspections, commonly called errors and omissions insurance.

Purchasing general liability insurance is not a guarantee that inspections are covered in every circumstance and for any amount of money. Purchasing insurance allows companies to be indemnified or to pass costs for situations and for dollar amounts specified in the contact on to their insurance company. Frequently during the stress of a lawsuit, an inspection company finds that they are covered for a finite amount or has no coverage for inspections because they chose not to purchase adequate types and amounts of insurance for their type of business. The owners/managers should read the policy carefully and be aware of exclusions before a situation arises, and the claim payment is denied. If an upgrade in the policy is desired, the insurance agent is usually willing to do this. It is highly recommended that you read your policies regarding this issue or contact your insurer for explanations of benefits and coverage. Avoid the anger and frustration of being notified by the insurer that there is no coverage. Also, remember that most states do not permit insurance for punitive damages, which are punishment damages.

Some pest control companies have a structure where inspectors are independent contractors, thus attempting to shield the company from liability should the inspector be negligent. Most states, for liability purposes, do not recognize full time contractors working for one company as an independent contractor. Attorneys should be consulted to review individual company situations.

WHAT TO DO IF NOTIFIED OF A POTENTIAL CLAIM OR LAWSUIT. Consider all inspections as potential claims and lawsuits. It is difficult to know when a phone call from a customer may develop into a very extensive and expensive lawsuit.

Steps for Productively Handling a Claim:

1. **Read the Insurance Policy Carefully** - The policy will clearly spell out the rights and responsibilities of the insured company as well as the rights and responsibilities of the insurance company. Remember, the insurance policy is a contract between the insurer and the insured and does not guarantee unlimited coverage for an infinite amount of time. Know if the policy is "claims made" or "occurrence" and understand the difference. Further, the policy may state that no expenses for professionals such as lawyers or expert witnesses may be incurred unless approved by the insurer.
2. **Obey the Reporting Requirements** - The policy typically spells out when and how potential or real claims must be reported to the insurer. Failure to report properly within a certain amount of time, manner, etc. may result in denial of coverage. You should be familiar with these requirements.
3. **Do not Expect the Insurer to Cover Claims from Inspections Prior to the Company's Current Coverage** - If an inspection company was insured through Insurer 1 up to 1993, and then became an insured of Insurer 2 in 1993, and a claim arises from an inspection conducted in 1992, Insurer 2 may not be responsible for all damages. Insurer 2 may handle the claim, and, as a service to the company, subrogate or recover damages from Insurer 1. Some of the insurance policies designed for PMPs provide protection for a set amount of time….for example… 2 years from the date of the inspection. Therefore, it's entirely possible that a prior policy, even if no longer in force, might have to respond to a claim if the inspection was completed during the prior policies coverage period.
4. **Expect Fair and Quick Responses from the Insurers** - Insurers are legally responsible for carrying out the terms of the contract or policy. Do not hesitate to call, request updates, and take notes for the file. Respond to all requests by the insurer-, if a request is unreasonable, tell the insurer.

THEORIES OF DEFENSE. In our justice system, a person, or company, is innocent until proven guilty. That premise places the burden of proof on the plaintiff. Under this same system, it becomes incumbent upon the WDI/WDO inspection company, their insurer, and defense lawyers to rebut liability by relying on a variety of factual matters (defenses) which, if presented to the Court, should result in a finding in favor of the inspector.

Inaccessible Areas -An active WDI/WDO infestation that existed in an area that was hidden or inaccessible at the time of the inspection should not result in liability. Such areas are clearly beyond the responsibility of the inspector. However, because a judge or a jury determines if the areas were inaccessible, it cannot be stressed enough that ALL hidden and inaccessible areas must be

clearly identified in the report. Do not rely upon a judge or jury to "understand" that certain areas are normally inaccessible: List all inaccessible areas on the report. This may require more time in filling out the report or require an addendum sheet to list all inaccessible areas.

Not A Structural Damage Report - It is all too easy for the buyer/third party/plaintiff to misinterpret the actual intent of the report. Whereas the NPMA 33 form clearly states that it is not a structural damage report, the wording of a lawsuit often reflects that the WDI/WDO inspection company had a duty to render findings regarding structural damage. Unless such a report was specifically contracted for or promised, the true and stated intent of the report must be asserted, amplified with the lack of specific contract or promise to provide otherwise. This can result in the successful dismissal of a case. If the companies current WDI/WDO inspection report or forms do not carry wording to the effect that the report is not a structural damage report, consult with the company attorney regarding the best method to modify or amend those forms to carry clear and consistent intent of the inspection.

Not A Warranty as to the Absence of Insects –An inspection report should clearly spell this out, but unless the buyer/ third party/plaintiff actually reads the report carefully, it may be perceived as containing a warranty of no WDIs/WDOs in the structure. Technically, a warranty is a promise of some kind and/or for some duration. A suit filed against a WDI/WDO inspection company for breach of warranty could be dismissed by asserting the disclaimer language in the WDI/WDO inspection report. However, if an addendum to the report has been given, or sold, to the buyer which thereby imparts a warranty that contradicts the disclaimer language in the report, the Court may not necessarily rule in the WDI/WDO inspection company's favor.

Concealment By Seller of Visible Evidence - Here is where the "eagle-eye" of the experienced and thorough WDI/WDO inspector pays off. It is possible for a seller to have knowledge that the structure is infested with a WDI/WDO and actively conceal it from other interested parties. If this can be exhibited to the Court, the WDI/WDO inspection company can practically be assured of a successful defense. Since no seller would be too eager to admit for the record that they are guilty of such conduct, the proof must come from the WDI/WDO inspection report itself, e.g., some record within the report that establishes the existence of new paneling, fresh paint, scrape marks on a wall, or new baseboards in a slab area. To the novice WDI/WDO inspector, these may appear to be nothing more than surface attempts by the seller to improve the marketability of the structure and are hardly worth noting. The experienced WDI/WDO inspector, recognizing that some people will stop at nothing to save the cost of treatment and/or resultant repairs, mentions such structural and cosmetic items in the report.

Industry Procedures Met or Exceeded - If the WDI/WDO inspection company, or its counsel, can show that the WDI/WDO inspection and report were performed in a manner consistent with industry guidelines, no liability should result. It should be difficult, if not impossible, for a buyer/third party/plaintiff to hold a WDI/WDO inspection company, its inspector or its report, to a standard beyond that which the industry holds itself. Expert witnesses are often consulted and brought into the case by both the plaintiff and the defendant. As you can imagine there may be mutual disputes arising from the experts' often-conflicting views of the industry standards.

Lack of Contractual Relationship with the Buyer - The buyer is obtaining loan for a property, who actually pays for the inspection has the contract with the WDI/WDO inspection company. Therefore, if the WDI/WDO inspection company is sued for breach of contract by a person who did not pay for the inspection, the action may be dismissed for lack of a contract upon which to be sued. **Be advised that most courts consider the buyer a third party beneficiary of this inspection and this defense may not hold up.**

It must be noted here that the ultimate decision by a judge or jury often has less to do with the actual or implied intentions of either party to the action than with the preponderance of evidence that is presented by one side or the other. Despite the fact that our justice system is rooted in the tenet that a person is innocent unless proven guilty, the cold, hard fact is that a defendant had better do all they can to prove their innocence, because the plaintiff will do all they can to prove his case. In essence, then, whichever side presents the most overwhelming preponderance of evidence to support their case most likely succeeds. If the sides are balanced, the decision should go to the plaintiff, but, then, nothing is certain.

OTHER CONSIDERATIONS. The successful defense of any claim or court action relies on several factors, not the least of which is providing quality work: a thorough inspection and an equally thorough inspection report.

If after taking legal possession of the structure a potential claimant should contact the company claiming an alleged infestation or damage, **act promptly** to arrange a mutually agreeable time to inspect the structure and the area in question with the buyer present. Document that meeting by:

Taking the company's copy of the report from the files with you. Have a copy for the owner.

Take notes on all discussions you have with the buyer. Date(s), time(s) and where meeting(s) were held, who was in attendance.

Take Pictures during the meeting if areas have been opened or exposed.

During any post inspection, do not admit to any fault. Rather, take the opportunity to point out to the owner the wording of the report, and all the inaccessible areas that the company reported. If, indeed, a WDI/WDO infestation exists in an area that should have been visible to the inspector, it may be in your best interests to offer to treat the areas, or the structure.

If WDI/WDO infestation or damage exists in an area that was inaccessible at the time of the original inspection, and is clearly listed in the report as being inaccessible, the initial reaction may be to deny any responsibility. However, **it may be in the company's best interests** to offer to treat the area, or the structure, or even to provide certain repairs. If the offer to perform certain services or repairs is accepted, do not render such services or repairs until the buyer has signed a waiver that clearly outlines that they will receive the services or repairs. In return, they waive all rights to initiate a claim for damages should a similar situation arise, and to reveal to anyone the conditions of the settlement. If they violate the waiver, the monetary value of any and all such services or repairs shall be forfeited to the WDI/WDO inspection company. Any offers should be determined by company policy.

Experience has shown that settlement offers made relatively soon after the perceived loss serve not only to eliminate or minimize legal costs, but also tend to reduce the overall outlay of the settlement. Early settlement also has the distinct advantage of keeping the matter out of public court records, thus preserving a company's reputation. **HOWEVER, ALL "CLAIMS" SHOULD BE REPORTED TO YOUR INSURANCE COMPANY AS SOON AS THERE IS A INDICATION OF A POTENTIAL PROBLEM. THIS ASSURES PROPER HANDLING OF THE CLAIM IF IT BECOMES A LAWSUITE OR EXTENDED NEGOTIATION PROCESS.**

PROCESS OF FILING A LAWSUIT. If the situation cannot be resolved amicably, litigation may result. At the first sign that a situation may result in litigation, contact the company's errors and omissions insurer. Errors and omissions insurance covers those situations where the company has not performed an actual "treatment," but where it has rendered a professional opinion. Contacting the insurer early on in the process helps them to prepare a defense in the event that a suit is filed.

If a suit is filed, the company is usually served with papers. Read the cover sheet(s) carefully. Often it states, in effect, that the company has a certain number of days to respond to the charges, otherwise a "default judgment" may be entered against the company. The company needs to fax and mail that information to the company's insurer , and/or attorney IMMEDIATELY. If a default judgment is filed against the company, it is because the company, in essence, forfeited the right to defend the company against the charges, regardless of their relative accuracy. Only prompt action can preserve the company's rights. In the event of a default judgment against the company, a trial may still take place, but only to determine the amount of the damages.

Be sure to inform the company's lawyer and/or insurer of all the facts: good and bad. Only then can they properly evaluate the company's potential defensibility.

Once the company's lawyer or insurer has answered the complaint, the case enters the discovery phase. During this period both sides use all available means to discover what the other side is contending. These means include: a) interrogatories - written questions requiring responses, b) requests for production of documents - it is here that a well- written report and supporting documents can make or break the case, c) requests for admission - questions which require true or false responses, and d) depositions - interviews with individuals who are questioned under oath.

Following the discovery phase the matter enters the pre-trial phase, during which the information garnered may lead one side or the other to file a motion for dismissal or for summary judgment.

Once the case has gone to trial, both sides have the opportunity to present their cases, with the burden of proof being on the plaintiff. The plaintiff has the last opportunity to present evidence.

As the defendant, listen to counsel: they have the experience with other lawyers, judges, plaintiffs, and witnesses to guide representation through the narrow legal channels that lie ahead. Trust their judgment and their recommendations. When the opportunity comes to tell the company's story, do so as dispassionately as possible. Stick to the facts, and rely on the thorough and complete "paper trail" that should exist for each WDI/WDO inspection report that is issued.

Regardless, the key to preventing the lawsuits is training. Only the most experienced should conduct inspections.

Preventing and Defending WDI/WDO Inspection Lawsuits
Study Questions

1. Under what conditions/situations are WDI inspections required or needed?

2. Who is authorized to perform WDI inspections in New England?

3. What form is required to report the WDI inspection results?

4. List examples of an inaccessible and /or obstructed areas and list why they are considered inaccessible or obstructed is?

5. Documentation is one of the best defenses defense for a WDI claim is? Why? Are there others? And how may you increase the quality of this documentation

6. Who currently regulates the WDI inspections in New England?

7. Why is it important to notify your insurance agent or company when a complaint is lodged against your company?

NOTES

Glossary of Building Terms

The definitions given below are specific to this manual; in other works they may have additional meanings.

Attic The space above the top floor ceiling and the roofing material. Attics may be either accessible or inaccessible, have flooring, mechanical equipment, insulation and/or stored material. Extreme caution should be observed when inspecting attics to avoid injury or damage to the property.

Baseboard A piece of decorative trim (non-structural) that is installed at the base of the wall where the wall covering meets the flooring.

Basement A below grade area of a structure that may be finished to serve as living space, storage space or mechanical equipment location. Some basements are completely below grade, while others are only partially below the finished exterior grade.

Beam A wooden or metal structural component that serves to support multiple floor joists, ceiling rafters or other structural components of a building.

Bridging Small wooden members that are place in an "X" fashion between floor joists to add structural strength to floor joists.

Crawl space An unfinished, uninhabitable space below a structure that may be enclosed by a foundation wall, decorative skirting or other non-structural material.

Expansion Joint The space that exists between the junction of masonry components of a structure. This space is may be "filled" with a variety of materials including Styrofoam, or other compactable cellulose materials. Expansion joints serve as a primary entry point for subterranean termite due to the direct access to the soil.

Flashing A flexible metal or other water proof membrane that is installed as a water-proofing material on roof-wall junctions, around chimneys and other areas that can not be adequately sealed to prevent undesirable water entry.

Floor Covering Any finished material applied over the sub-flooring. Floor covering materials may be wood or wood composits, carpet, tile, and linoleum that is glued, nailed or stapled over the sub-flooring.

Floor Joist The structural component that supports the sub-floor and floor covering. Floor joists may be fabricated from dimensional lumber from 2" x 6"'s to 2" x 12"'s or from laminated materials (TIG joists).

Footing Usually a concrete base that is installed below frost line in non-compactable soil or bedrock to provide a rigid base to support the foundation wall and prevent settlement of the structure.

Furring Strips Sections of wood, metal or plastic that is installed to provide a fastening surface for wall covering, cabinets or other building materials. Furring strips are frequently installed over masonry surfaces before the application of the finished wall covering.

Grade The elevation of the soil around a structure. This term usually applies to the highest level of soil around a structure. The grade should slope away from the structure.

Header A wooden or metal structural component that is used to span an opening and accept the load from the absence of wall studs. A header is installed above window and door openings.

Lath Material A structural component of a wall that serves as a base to apply a plaster wall covering. Lath materials may be composed of wooden strips, metal screen, or modified drywall.

Load Bearing Wall A structural, vertical surface that carries the weight of the structure. Exterior walls are always load bearing. Depending on the size and design of the structure, load bearing walls may also be present on the interior of a structure, and usually have a load bearing beam and a footer.

Masonry Materials such as brick , stone or concrete block that are usually used for foundations or veneers on the structure.

Partition Wall Any wall that is not load-bearing. Partition walls are used to divide up the space within a structure. Partition walls have no footing or foundation and may be removed without compromising the structural integrity of the building.

Pier A structural, vertical, wooden, steel or concrete or other masonry material that is installed in lieu of a continuous foundation wall. Masonry piers are installed over a footer just as a foundation wall. Wooden and steel piers may be driven into the soil to the depth of non-compactable soil or bedrock. Piers serve as load bearing supports for beams for floor joists and other horizontal surfaces.

Roofing Rafters A series of wooden or metal structural framing members that serve as the structural support for the roofing materials. Roofing rafters may be fabricated or constructed on site. There are several different types of roofing rafters that are used for different roof designs. All roofing rafters serve as the support for the roof sheathing materials and roof finishing materials. They must

be capable of carrying the load generated by the weight of the roof and transferring this load to the foundation or load bearing walls.

Sheathing A structural material that is used to add strength to the exterior walls and roofing rafters. Sheathing materials include plywood, styrofoam, particleboard, cellotex and other synthetic materials. Exterior finish wall coverings, such as, brick and siding are attached directly to the sheathing material.

Siding The finish material for the exterior walls. Siding is made of waterproof materials such as brick, wood vinyl or aluminum. Recent use of foam board as an exterior finish material has complicated inspection access to the foundations.

Sole Plate The horizontal structural framing material that is installed at the base of the wall studs. The sole plate is made of the same dimensional material as the wall studs. In slab construction, the sole plate is usually made of pressure treated lumber to prevent damage from moisture and insects.

Stud A structural vertical wooden or metal member that is installed to provide the framework for a building. Studs may be structural or non-structural depending on the wall that the stud is located in.

Sub-floor A structural component that is installed directly over the floor joists to provide a flooring base. Sub-flooring is usually made of plywood or particleboard and is fastened directly to the floor joist.

Top-plate The structural vertical member that is usually a doubled section of the same dimensional lumber that is used for the stud material. The top-plate adds structural rigidity to the wall and provides a secure surface to which the floor joists or rafters can be attached.

Veneer usually a masonry facade on the structure can be stone or brick.

Glossary of Terms

The definitions given below are specific to this Manual. Sources used in compiling these definitions include "The Torre-Bueno Glossary of Entomology" (1989) and "The Random House College Dictionary" (1988). Where appropriate, the plural of a word is given in parentheses, usually with the notation of "pl."

Abdomen The posterior or hindmost body region.

Adult The fully grown, sexually mature arthropod.

Alate Winged form; possessing wings.

Ametabolis Having no metamorphosis.

Antenna (pl. antennae) The paired, segmented feeler-like sensory organs located on the head above the mouthparts.

Anterior Front, in front, before.

Arthropod Any segmented invertebrate of the phylum Arthropoda, having jointed legs.

Asymmetrical Not symmetrical (evenly developed on both sides).

Band A transverse marking different in color from the background color, may completely ring a structure such as the tibia.

Beak Any notable prolongation of the front of the head; a snout.

Bicolored Of two (2) different colors.

Bilateral symmetry The left and right sides are essentially similar.

Broadleaf tree A tree which in general has wide/broad leaves (vs. needlelike) and is usually deciduous, shedding its leaves seasonally and being leafless for part of the year; hardwoods.

Brood All individuals that hatch about the same time from eggs laid by one series of parents; in social insects, the immature members of the colony collectively, including eggs, nymphs, larvae, and pupae.

Budding The process in which reproductives or potential reproductives, workers, and certain immature leave the parent or major colony to start a new colony.

Carton In termites (lsoptera), the nest building material composed of semidigested wood and soil cemented together with saliva and feces.

Caste Kinds of mature individuals among social insects which share similar body form and job description.

Cell (of wings) The space between the wing veins.

Cellulose A polysaccharide consisting of repeated glucose units, which is a major component of plant cell walls.

Centimeter (cm) 0.01 meter; 0.394 inch; about 2.5 cm = 1 inch.

Cephalothorax Anterior body region composed of the fused head and thorax.

Cercus (pl. cerci) One of a pair of dorsal appendages at the posterior end of the abdomen.

Chitin A major polysaccharide component of arthropod cuticle, secreted by the epidermis.

Complete metamorphosis In insects, development where the immature stages consist of an egg followed by a series of larvae and then a pupal stage before the adult.

Compound eye An eye composed of many separate visual elements, each of which is indicated externally by a facet.

Conifer Evergreen tree-e.g., pine, spruce, fir, etc.

Constricted Narrowed, pinched-in.

Crop In insects, the dilated portion of the alimentary canal behind the esophagus, which serves to receive and hold food.

Cuticle The thin, acellular, external layer of the exoskeleton, composed of 3 layers.

Deciduous tree A tree which looses/sheds its leaves seasonally, being without leaves for part of the year; most broadleaf or hardwood trees.

Developmental time The period from egg fertilization to emergence of the adult; egg to adult.

Dorsal Pertaining to the back or upper surface; top or uppermost.

Elbowed Abruptly bent in an obtuse angle (between 90-80§).

Elytron (pl. elytra) The leathery or hard front wing of beetles (Coleoptera).

Entomology The study of insects, that branch of zoology dealing with insects.

Epidermis The middle, cellular layer of the exoskeleton.

Evergreen A tree or other plant which does not shed its leaves until they are replaced by new leaves, always with green leaves; leaves narrow and often needlelike.

Exoskeleton A skeleton or supporting structure, on the outside of the body.

Facet The external surface of a single compound eye unit or ommatidium.

Fecal pellet In termites (lsoptera), the desiccated feces/excrement in the form of hexagonal configurations; firm/hard excrement or waste expelled from the anus.

Fiber saturation point The maximum amount of moisture vapor that wood can absorb from a saturated atmosphere.

Fontanelle In termites (lsoptera), the porelike opening on the frontal region of the head through which secretions of the frontal gland are ejected/squirted.

Frass Solid excrement of larval insects; plant fragments made by wood-boring insects which are usually mixed with excrement.

Functional worker In termites (lsoptera), workers who are either male or female and not sterile.

Fungus (pl. fungi) A plant which does not contain chlorophyll-e.g. molds, mushrooms, mildews, etc.

Generation From any given stage in the life cycle to the same stage in the immediate offspring.

Gradual metamorphosis In insects, development where the immature stages are the egg followed by a series of nymphs which are very similar in appearance to and habits of the adult stage; with no pupal stage.

Green logs Freshly cut logs which have not had their wood moisture content reduced to below 20% (=seasoned).

Hardwood The wood of broadleaf or deciduous trees, such as oak, walnut, etc.

Head The anterior or front body region which bears the eyes, mouthparts, and antennae.

Hibernation Period of inactivity during seasonal low temperatures.

Hypha (pl. hyphae) A threadlike strand of fungus.

Imago The adult stage.

Immature A life stage proceeding the adult stage; not sexually mature.

Impressed areas Areas of the surface which are lower than the surrounding or overall surface height.

Instar The stage between molts.

Kiln-dried lumber Lumber which has been artificially warmed or heated to reduce its moisture content and to kill any insect infestation.

Larva (pl. larvae) An immature stage of those insects with complete metamorphosis; the developmental stage between egg and pupa; in termites (Isoptera), the young instars preceeding the worker or nymph (with wing pads) stages.

Lateral Toward the side, away from the midline.

Life cycle The development of an insect from egg stage to egg stage.

Life history A detailed record of a life cycle (egg to egg).

Lignin An organic material that along with cellulose, forms the primary part of woody plant tissue; adds strength.

Lumber/board Wood which is 1" (24 mm) or less in thickness.

Major worker In termites (Isoptera) and ants (Hymenoptera: Formicidae), a member of the worker subcaste of largest size.

Mandible A jaw.

Manufactured product Wood which has been worked or processed such as millwork, flooring, and furniture.

Margin Of or pertaining to the edge.

Membranous Like cellophane; a thin, flexible, usually transparent, film of tissue.

Metallic Having the appearance of metal.

Metamorphosis The series of changes an insect goes through in its growth from egg to adult stage,

Meter (m) 39.37 inches; the standard of length in the metric system of measurement.

Millimeter (mm) 1/1000 meter; 0.3937 inch; about 25 mm = 7 inch.

Minor worker In termites (lsoptera) and ants (Hymenoptera: Formicidae), a member of the worker subcaste of smallest size.

Molting The periodic formation of a new exoskeleton, followed by the shedding of the old exoskelton.

Moniliform Composed of a series of beadlike segments; beaded like a necklace.

Monomorphic Of or having one size.

Morphology The study of form and structure.

Mycelial fan Flat masses of fungal hyphae.

Node A segment of the pedicel or of an ant's waist (Formicidae) or of other Hymenoptera.

Nymph The immature stage of insects having incomplete (= simple) metamorphosis.

Ocellus (pl. ocelli) A simple eye, consisting of a single lens.

Opposed Closest to or opposite.

Ovipositor The structure by which the eggs are deposited, may be external or withdrawn into the body.

Palpilla (pl. palpillae) Tiny fingerlike projections.

Parenchyma In trees, simple blunt-ended storage cells.

Parent colony The main colony containing the queen(s), other castes, and immatures including eggs.

PMP Pest management professional; one engaged in pest management as a profession.

Pedicel The waist of an ant (Formicidae) or of other Hymenoptera, composed of one segment (the petiole) or 2 segments (petiole plus postpetiole); the 2nd antennal segment of insects; in spiders (Araneae), the narrow waist/stalk connecting the cephalothorax and abdomen.

Permeability The ability to absorb water; the relative ease with which moisture can penetrate under a pressure gradient.

Perpendicular Oriented or being at a right angle (90º) to another surface.

Petiole The first node or segment of the pedicel or waist of ants (Formicidae) and other Hymenoptera.

Pheromone A chemical usually secreted by a gland which is released outside the body and is used in communication within a species.

Polymorphic Of or having more than one size.

Porosity of wood The state or quality of being porus (full of pores); the ratio, expressed as a percentage, of the volume of the pores or interstices (spaces between pores) of wood to the total volume of its mass.

Posterior Hind or rear, hindmost.

Primary reproductive In termites (Isoptera), the colony founding male or female derived from a winged adult.

Profile The insect or object when viewed from its side.

Proleg A fleshy abdominal process, occurring in pairs, used for locomotion in larvae of butterflies, moths (Lepidoptera), and sawflies (Hymenoptera).

Pronotum The dorsal or top surface plate of the prothorax.

Prothorax The first or front segment of the thorax, bearing the first pair of legs.

Pupa (pl. pupae) The resting or transformation stage of insects with complete metamorphosis; the developmental stage between larva and adult.

Queen Female member of a reproductive caste of a social species; in termites (Isoptera), a dealated, inseminated female adult or primary reproductive.

RH Relative humidity.

Rhizomorph The rootlike thick strands of fungal hyphae.

Sapwood The softer part of the wood between the bark and the inner/central heartwood.

Satellite colony A secondary colony which does not contain either a queen(s) or eggs, and is connected to the parent colony.

Scale A flattened seta or hairlike structure.

Scape The first or basal antennal segment.

Scavenger An organism that feeds on dead or decaying plant or animal materials, or on animal wastes; larvae which feed on grain only after the seed coat has been broken, either mechanically or by some other insect (stored product pests).

Seasoned wood Wood that has had its wood moisture content reduced to 19% or lower.

Secondary colony In termites (Isoptera), a colony of subterranean termites existing above ground which is made possible by a stable above-ground moisture source.

Secondary reproductive In termites (Isoptera), reproductives which developed from nymphs; nymphoid reproductive.

Segment A subdivision of the body or of an appendage between joints or areas of flexibility.

Serrate Sawlike, with notched edges like the teeth of a saw blade.

Seta (pl. setae) A bristle; a sclerotized hairlike projection.

Simple Unmodified by any condition causing complexity; not forked, toothed, branched, or divided.

Simple metamorphosis In insects, development in which there is no pupal stage.

Social insect An insect belonging to a group in which individuals display all of the following traits: cooperative care of the young; reproductive division of labor, with more or less sterile individuals working on behalf of the reproductives; and an overlap of at least 2 generations.

Softwood The wood of evergreen or conifer trees.

Species (pl. species) Fundamentally similar individuals who interbreed and produce offspring, but who do not ordinarily interbreed with other groups.

Spine A thornlike process of the cuticule not separated from it by a joint.

Spiracle The external opening of the tracheal (respiratory) system.

Spore In fungi, the single-cell reproductive body.

Sporophore Fungal fruiting bodies which produce spores.

Structural/dimension lumber Wood which is at least a 2x4".

Swarmer A winged reproductive; in ants (Hymenoptera: Formicidae) and termites (Isoptera), a member of the mass exodus of winged reproductives from the nest for the mating flight.

Temperate region/zone That part of the earth's surface having a climate that is warm in the summer, cold in the winter, and moderate in the spring and autumn; area between the tropic of Cancer and the Artic Circle in the Northern Hemisphere or between the topic of Capricorn and the Antarctic Circle in the Southern Hemisphere.

Terminal Located at the tip, end, or extremity.

Thorax (adj. thoracic) The middle body region which bears legs and wings, if present.

Translucent Almost clear but slightly milky.

Tubercle A small knoblike/wartlike rounded protuberance or lobe.

Vein A thickened line in a wing, often darkened; a thin, tubular structure.

Venation The pattern of veins in a wing; the complete vein system in a wing.

Ventral Pertaining to the belly or underside; lower or underneath.

Vertical Oriented or going up and down, top to bottom; being upright or perpendicular to the horizon.

Wing pads The encased undeveloped wings of nymphs which appear on the meso- and methorax as 2 flattish structures.

Wing scale In termites (Isoptera), the small basal portion of the wing remaining attached to the adult after the main portion of the wing is shed along the fracture line (basal suture).