

## Least-toxic Control of Termites

	<b>Dampwood</b>	<b>Drywood</b>	<b>Subterranean</b>
<b>Hometowns</b>	Pacific coast, from Baja CA north to British Colombia, and in parts of ID, MT, western NV and western OR, most often along the coast, and the cold, dry, high elevations of the Sierra Nevada, Coast Range, Cascade and Rocky Mtns	From NC, across the southern border of the U.S., along the CA Coast as far north as the San Francisco Bay area, and in HI	Found throughout the United States
<b>Personal Statistics</b>	<p><b>Reproductives</b> Can exceed one inch in length, including wings; Cream to dark brown</p> <p><b>Workers</b> About 1/2 inch long; White to cream.</p> <p><b>Soldiers</b> About 1/2 inch long; Head and jaws make a third of their length; Large, reddish brown to blackish head; Cream body</p>	<p><b>Reproductives</b> About 1/2 inch long; Fully developed wings; Usually dark brown</p> <p><b>Workers</b> Less than 1/2 inch long. Wingless; White.</p> <p><b>Soldiers</b> About 5/16 inch long; Massive brown head; Large mandibles; Light colored bodies</p>	<p><b>Reproductives</b> About 3/8 inch long, including wings; Long, light grey, translucent wings; Dark brown to black cylindrical bodies</p> <p><b>Workers</b> Up to 1/2 inch long; White to grey.</p> <p><b>Soldiers</b> About 1/2 inch long; Enlarged, cream head; Large mandibles; Greyish-white body</p>
<b>Fecal Facts</b>	Pellets are about 1 mm (1/25 inch) long; Slightly hexagonal; Expelled in sawdust-like piles from exits in galleries.	Tiny, hard, straw-colored pellets; Six distinct concave surfaces	No fecal pellets
<b>Housing Preferences</b>	Damp, decaying wood	Dry sites	Ground dwelling in moist sites
<b>Bad Habits</b>	Thrive in high-moisture wood; Soil-wood contact often leads to infestation; Activities can expand into sound wood and relatively dry wood; Tend to work from the foundation to the roof rafters.	Live entirely in wood. Begin new colonies in pre-existing openings in wood; Excavate small nesting area or gallery and plug the hole for protection from predators.	Colony is located in the ground; Forage for food in aboveground wood; Travel from underground tunnels to food sources in mud tubes; Prefer moist wood and cork; Most active in summer; Winged reproductives fly off to create new colonies in late spring.

Olkowski, Helga, Daar, Shiela, and Olkowski, William, *Common-Sense Pest Control*, Newtown: The Taunton Press, Inc., 1991.

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## Prevention

### Pre-construction

#### Site Preparation

- Remove all tree roots and stumps from the building site before starting construction.
- Remove grade stakes, form boards and wood scraps from soil before filling and backfilling.
- Do not bury wood in the backfill, under porches, steps or patios.

#### Foundation

- Slab-on-ground foundations are most susceptible to termite attack. Termites can enter wood by going over the edge of the slab, through expansion joints, openings around plumbing and cracks in the slab. Monolithic type slab is the best, followed by a supported slab, and then floating types.
- A poured, reinforced, crack-free concrete foundation hinders the passage of termites. Termites can go through a crack as small as 1/32 inch.
- Hollow-block or brick foundations should be capped with a minimum of 4 inches of concrete.
- Make certain there are 12 inches of clean concrete foundation between soil surface and structural wood.
- Sand grain barriers are effective. When grains are 1.6 to 2.5 mm, they are too heavy for termites to move out of the way, and the spaces separating the grains are too small to fit between. A 4" layer of sand is required under a concrete floor slab. With crawl spaces, there should be a 4-inch layer of sand around the interior of the foundation wall and around any piers. All possible paths between the soil and the wood framing must have a sand barrier.
- Termimesh™, a finely woven, stainless steel mesh designed as a barrier for under and around foundations, prevents termites from entering a building. *Pest Control* magazine (February 1999) reported that after five years of testing, stainless steel mesh remained 100 percent successful as a barrier to subterranean termites.
- Steel termite shields prevent termites from entering through the interior cracks of masonry walls or foundation blocks. A good metal shield placed

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on top of foundation and piers may prevent mud tubes from reaching the wood above them, but will more likely cause termites to build around the shield, making their mud tubes easily detected and destroyed.

### **Ventilation**

- Create ventilated spaces between the ground and any wood structure.
- Cover earthen crawl space floors with a vapor barrier – sheets of polyethylene (available at any home supply store) that cover all exposed areas, keeping moisture and dampness at the ground level instead of infiltrating the crawl space. The plastic is usually covered with sand or fine gravel to protect it from punctures when it is walked upon. It should be sealed around the perimeter to the foundation wall, and at any seams, with long-lasting caulking or mastic.
- If you vent your crawl space, be sure it has two, if not four, ventilation openings within 10 feet of the corners to provide for cross-ventilation. Vents should be opened in the winter and closed in the summer to prevent moisture problems.

### **Building**

- Build with termite-resistant materials, such as concrete and steel.
- Unfinished wood can be protected from termite attack by treatment with boric acid (Bora-Care®, Jecta®). Applied as a water solution by dipping or spraying the wood, it will penetrate deep into the wood, and act as an alternative to the afore mentioned barriers.
- Do not place basement partitions, posts, or stair stringers until the concrete floor has been poured.
- No wood should ever extend into or through concrete.
- Avoid using styrofoam insulation in the soil adjacent to foundation and basement.

### **Soil Grading**

- The finished grade outside the building should slope away from the foundation for good water drainage. In the final grading, allow a minimum of 4--6 inches of clearance between the top of the ground and the bottom edge of the veneer.

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### **Post-construction**

- Fill cracks or voids in concrete or masonry with expanding grout or high-grade caulk, and also caulk around sinks and bathtubs.
- Install fan-powered kitchen and bathroom vents to control moisture.
- Eliminate dampness - remove or fix sources of water, such as leaky pipes and plumbing, leaky irrigation systems, and improper guttering and siding, and repair leaky roofs.
- Replace rotten or damaged wood using naturally insect resistant wood.
- Cover exposed wood with paint or sealant.
- Screen windows, doors and vents with 20-grade mesh screen.

### **Both**

- Ensure good drainage away from the house – point downspouts or gutters away from the structure, into storm sewers or a drainage well.
- Eliminate all earth-to-wood contact, including mulch, scrap wood, lumber, fence posts, trellises, shrubbery, tree branches or stumps, and firewood that come in contact with the house.
- Trim or eliminate shrubbery that blocks airflow through foundation vents.
- Move any soil or compost piled up next to the house at least 10 feet away from the structure.
- Keep planter boxes built on the ground at least four inches from the house.

### **Monitoring**

#### **Dampwood**

Dampwood termites hide themselves to prevent moisture loss, and are hard to spot. The most obvious sign of termite activity is swarms coming from the building, usually on warm evenings in late summer or fall, especially after rain.

- Look around and under the structure for damp or damaged wood with holes or tunnels in it and wood that sounds hollow or soft when tapped.
- Use a screwdriver or pick to pry into suspicious areas and open up holes.
- Look for piles of sawdust and dead insects and any conditions that may be promoting moisture or wood decay.

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## Drywood

Drywood termites can be difficult to detect, as they live almost entirely inside wood.

- Look for discarded wings left behind after swarming, fecal pellets, and blistered, hollow-sounding wood.
- They are distinguishable from ants because ants have elbowed antennae, a narrow “waist” and a dark spot on their wings.

## Subterranean

- Look for piles or droppings of sawdust, dead or alive termites, swarms (usually in the spring, beginning in mid-March and through May, after a rain has softened the ground), discarded wings, mud tubes or mounds, and wood damage.
- Use screwdriver or pick to detect damaged wood.
- Regularly inspected solid wood or corked hollow stakes in turf can alert you to activity that may require attention.

## All

- Specially trained dogs can sniff and listen for termite infestations, even in hard to reach areas.
- Fiber-optic scopes can provide views of hard to inspect areas, such as behind drywall and paneling.

## Control

### Dampwood and Drywood

- **Removal of the infested wood or furniture** is the quickest and easiest way to handle a localized infestation. Small pieces of wood containing live termites can be soaked in soapy water to kill the insects. Larger pieces can be taken to a landfill or natural area where the decomposing abilities of the termites are helpful.

### Drywood

- **Cold treatment** is a temperature-altering system that utilizes liquid nitrogen to eliminate drywood termites. It is reported to have a 95-99 percent elimination rate and is a good method for inaccessible areas (*Journal Econ. Entomol.*, 89(4): 922-934). Small holes are drilled into the walls and liquid nitrogen is injected into the infested area, lowering the temperature enough to

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kill the termite colonies. Small items infested with drywood termites can be placed in a freezer or outside for several days during cold weather.

- The **Electrogun™** is a device that kills drywood termites using a high frequency, high voltage and low amperage electrical current. It should not be used if infestations are widespread, and is not effective next to metal, concrete, or ground because the current is diverted from the termites. It kills approximately 95 percent of the termites when used properly.
- **Microwaves** are effective as a spot treatment or localized infestations. An unshielded microwave device is used to raise the infested area's temperature to 190°, killing the termites. Your microwave oven will not be effective for small, infested items.
- **Desiccating dusts**, such as diatomaceous earth and silica aerogel can be used during new construction or in existing buildings to prevent drywood termite infestations. Choose a desiccating dust that it is not combined with a pyrethrin. Diatomaceous earth must be garden/ food grade, as swimming pool grade is associated with lung disease and ineffective at controlling insects. Desiccating dusts abrade the outer shell of the termites, causing them to dry out and die. They are also inorganic and not subject to decomposition, and should protect wood against termites for the life of the building. Avoid breathing in desiccating dusts, as they can cause lung irritation, and always wear a mask and goggles when applying.

### **Subterranean**

- **Dig out the colony and break open the mud tubes.** Openings will allow natural predators of the termites, especially ants, to invade the colony and kill them. Ants compete with termites and may kill them and limit their foraging.
- **Baiting Systems** are the newest innovation in subterranean termite control. They control termites in and around a structure using carefully placed bait stations, which contain a toxicant that is brought back to the colony by the foraging termites. Baits greatly limit the amount of a pesticide used as opposed to the traditional liquid termiticide soil barrier method of control, and decrease chances of exposure to the chemical because the baits are well contained. They are, however, still poisons and should be used with utmost care and only as a last resort.

Stations are installed below the ground in the yard, positioned within the structure in the vicinity of active termite mud tubes or feeding sites, or above ground in known areas of termite activity, typically in the direct path of active termite tunnels after the mud tubes have been broken.

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Baits consist of cardboard, paper or other acceptable termite food that will compete with the surrounding tree roots, stumps, wood piles and structural wood. The toxicant must be slow acting to enhance the transmission of the poison to other termites, including those not feeding on the bait, and to avoid the build up of dead or sick termites in the vicinity of the bait station, which would cause other termites to avoid the area.

The least-toxic bait station is Termitrol™, containing boric acid. More toxic baits include Firstline™ (sulfluramid), Terminate™ (sulfluramid), Sentricon™ (hexaflumuron), Exterra™ (diflubenzuron), and Subterfuge™ (hydramethylnon).

### All

- The termiticide **Bio-Blast™** contains *Metarhizium anisoplae*, a common soil-borne fungus, as the active ingredient. The spores from the fungus penetrate and begin to grow inside the termite within 4 to 14 days. Bio-Blast™ powder is mixed with water and injected into active termite galleries.
- **Nematodes**, mixed in a water solution and injected into the wood or soil near termite colonies, seek out the termites and destroy them. They will live up to two years. Applicators have reported effectiveness ranging from 50 to 95 percent.
- **Heat treatment** consists of covering the structure and raising the temperature above the temperature at which most termites cannot survive. Heat will only be effective for subterranean termites if they are above ground. The process consists of tenting the structure and setting up propane burners that blow hot air through ducts to the infected area inside. When the core of the wood reaches 130° for 35 minutes, most termites are killed. A Berkeley study found that 90-99 percent of termites were killed by heat treatment (*Journal Econ. Entomol.*, 89(4): 922-934).
- **Boric Acid** is an effective, least-toxic termiticide. It acts as an effective bait at concentrations of 0.15 percent, an antifeedant at concentrations greater than 0.25 percent, and kills by direct contact with concentrations greater than 0.5 percent.

Structural lumber used in new house construction and treated with boric acid is termite resistant; older houses may be made more termite resistant with remedial treatment with borate sprays or by injection into wood already in place. Termites in their galleries are killed when they come in contact with injected borates, and then groom themselves, ingesting the poison. Boric acid kills by inhibiting digestive enzymes and causing termites to starve to death.

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Bora-Care® and Jecta® are effective products for pre-and post-construction treatments to prevent and control termite infestations; Tim-bor® is an effect post-construction treatment.

## References

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