Common Causes of Oak Mortality

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Requests for assistance with dying oak trees often reach high levels in the hot summer months in Florida. So what's the problem? Is this mortality evidence of a sinister disease? Are our oak trees threatened?

Tops of oaks killed by *Ganoderma* in a group of living oaks.

"No… not exactly." While many oaks have died and more can be expected to die, we are not witnessing any particularly menacing or threatening disease. The causes of oak mortality are variable and often complex. Investigations over several years, however, have revealed some common causes in Florida.

In certain cases, root disease fungi such as *Armillaria*, *Ganoderma*, and *Phytophthora* are involved, singularly or in combination. And in most cases, environmental influences play a major role. *Armillaria* and *Ganoderma* are naturally occurring, mushroom-forming fungi that colonize and decay tree stumps and roots. They frequently enter roots of living trees when roots are cut or damaged during construction or site disturbance activities, when trees are subjected to natural environmental stresses (severe droughts, floods, defoliation by insects, etc.), or when the roots of living trees come in contact with decaying stumps or roots. *Phytophthora* species are microscopic soilborne fungi that feed on and destroy the roots of many plants and trees, especially in poorly drained or waterlogged soils. Over time (often years), infected root systems are progressively debilitated by these and sometimes other root-infecting fungi. Eventually, infected root systems are debilitated to a point beyond which they are incapable of supplying adequate moisture and nutrients to their trees' crowns, and tree death occurs.

Tree death may occur slowly over months or years with dying trees exhibiting progressive dieback and crown thinning, etc. Or tree death may occur "suddenly", or at least appear to do so. This latter mode of demise is commonly observed in the summer months of July and August because hot summer air temperatures and fully foliated tree crowns increase trees' transpirational water loss to the atmosphere, and debilitated root systems simply cannot supply the water "demanded" by actively transpiring crowns.

Fruiting structures of *Ganoderma* (“hoof-like” structures at tree bases) and *Hypoxylon* (silver-gray “crusts” on lower stems) on dead/dying oaks.

Dead turkey oaks – brown dead foliage indicates “rapid” death – typical of turkey oaks killed by *Armillaria* and/or *Phytophthora* in rain saturated soils.

Root disease scenarios are often compounded in Florida by the state’s variable and unpredictable rainfall. **Droughts** clearly add to tree stress, especially if root systems are debilitated by root diseases. Additionally, however, excessive rainfall resulting in water **impoundment** and/or **saturated soils** is often the “straw that breaks the camel’s back”. Water-saturated soil conditions result in reduced soil oxygen levels and the buildup of carbon dioxide and an array of chemicals not found or scarce in well aerated soils. Such anaerobic conditions are directly toxic to tree roots and cause physiological damage to roots in direct proportion to the severity and duration of the conditions. When trees with pre-existing root diseases are subjected to anaerobic soil conditions the deleterious effects are additive, and tree death is often unavoidable and rapid.

Another compounding and often poorly understood factor in the death of oaks in Florida is the presence of one or more species of *Hypoxylon* on dying trees. *Hypoxylon* species are opportunistic, secondary fungal pathogens that are common on a variety of hardwood species, especially on oaks. Research has demonstrated that certain species of *Hypoxylon* actually reside in the bark of healthy oaks. Only after severe physiological stress, when a tree’s water content drops below a certain threshold, do these fungi penetrate into the xylem (wood) of host

trees; “finishing them off”, so to speak. Stresses sufficient to initiate lethal infections are typically related to drought, but may include mechanical injury, flooding, and even root diseases. For all intents and purposes, *Hypoxylon* species are **indicators** more than they are **causes** of death. *Hypoxylon* species are usually recognized as small to large, irregularly shaped sheets or patches of black or silver-gray crust-like fruiting structures appearing on infected stems or branches as the bark sloughs off the ailing tree(s). At certain stages of fungus development, *Hypoxylon* species often appear as irregular sheets of brownish powder (asexual spores) prior to the occurrence of the crust-like sexual fruiting structures.

In part, these processes are natural, occurring in undisturbed and healthy forest ecosystems. Sadly, however, they are often initiated and exacerbated by the activities of man. “Development”-related site disturbances which result in root injuries, soil grade changes, water impoundments, or changes in soil water levels or movement are frequent villains.

The above having been said, evaluations of periodic oak mortality in Florida continue. Recently, a novel "bleeding" basal canker, apparently caused by *Phytophthora cinnamomi* (see above), has been confirmed on laurel oaks (*Quercus hemisphaerica*) in several north-central Florida counties. The role of this disease in flare-ups of oak mortality is unknown, but is likely not major. An information circular describing this disease is due out soon through the Division of Plant Industry (FDACS). *Xylella fastidiosa*, a bacterial pathogen known to occur in the vascular systems of oaks in Florida, but the role of this organism in oak mortality is not well understood and is likely to be limited. Oak wilt, caused by *Ceratocystis fagacearum* and "Sudden Oak Death" (SOD), caused by *Phytophthora ramorum* are of concern, but to date neither of these diseases has been detected in Florida.