Dutch Elm Disease
(Ophiostoma ulmi, O. novo-ulmi)

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Hosts:

North American elm species (*Ulmus* spp.). The American elm (*U. americana*) is especially susceptible. Some American elm cultivars and cultivars of Asian elms cross-bred with American elm have varying levels of resistance to DED.

General Information:

Dutch elm disease (DED) has been present in Maine for decades and has devastated American elm trees in rural areas and in communities across the state where this species was once commonly planted for its excellent urban tree qualities. DED persists in elm trees still commonly growing on roadsides and in field edges and is less frequently encountered in the forest. The fungus that causes DED cannot infect an elm tree on its own and relies on elm bark beetles for spreading spores (DED is an insect-vectored disease). The vectors of DED in Maine are the native elm bark beetle, *Hylurgopinus rufipes* and the European elm bark beetle, *Scolytus multistriatus*. Adult beetles lay eggs on a DED-infected elm in early summer. Beetle larvae hatch and feed under the bark where they overwinter and will emerge as adults the next early summer. The DED fungus makes spore-producing structures in the larval tunnels and adult beetles are coated with spores as they emerge from the host tree. The beetles then move to the crown of a healthy elm tree to feed, transporting DEDs spores and infecting the tree. The beetles then lay eggs that will hatch as grubs, overwinter in the tree and emerge covered in spores, completing the disease cycle. Despite DED, the American elm is able to persist due to the low occurrence of disease in younger trees (the reason for this is not known). This allows some trees to survive until the age of seed production. Before seed-bearing trees are killed by DED, a new age cohort of elms becomes established and will grow until DED returns to the area. Some large and healthy elms remain on the landscape in Maine. The reason they have not been infected may be that they have some level of resistance or that they have escaped infection due to their seclusion from other elms.

Left: Early DED symptoms on a mature elm (orange arrows); Middle: A closeup of early DED symptoms in the upper crown; Right: An elm twig with brownish staining of the inner bark (cambium), indicating DED infection. Photo credits: MFS

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Symptoms and Signs:

The fungus that causes DED infects water-conducting tissues, initiating a defense reaction in the host elm that blocks water transport, first leading to discoloration, wilting and possible early defoliation followed by expanded wilting and killing of branches (flagging). As the disease progresses in the tree, wilting and branch mortality expand with trees dying within two to three years. Elm trees have a habit of connecting their roots with neighboring elm trees (root grafting). This allows DED to rapidly spread among neighboring trees. Trees infected through root grafts typically die in that same year since water is restricted to the whole tree.

Left: Roadside elm trees in various stages of decline due to DED. Elm trees (yellow arrows) with advanced wilt symptoms involving most or all of the crown and recently killed elm trees. DED may have spread between closely neighboring trees via root grafts. An elm tree (red arrow) with early symptoms of DED (the partial crown wilt indicates DED spread by an insect vector). This tree was dead by mid-summer of the following year; Right: A lone healthy elm tree, with the classic American elm upside-down 'vase shape' in Aroostook County. Photo credits: MFS

Management:

Managing DED in rural and forest environments is very challenging due to the high occurrence of the host, the disease and its insect vectors. Efforts to manage the disease include prompt removal of infected trees followed by chipping, debarking, burning or burying the wood. Pruning infected branches eight to ten feet below symptomatic wood (may be indicated by staining of the cambium) may be effective, although since DED is a disease of the vascular system, the disease can advance within the tree quickly. Thus, the benefit of pruning should be carefully considered with respect to further spread of the disease. If wood is intended to be used for firewood, it should be debarked or cut to length (preferably split) and thoroughly tarped until autumn of the following year to prevent beetle emergence. However, if DED is common in the surrounding environment, these measures may not be effective in saving remaining elms. Root flare injections of formulations containing the active ingredients thiabendazole or propiconazole may be applied by a licensed and insured commercial pesticide applicator to protect high-value trees. There is little evidence that these injections are curative and should only be considered for disease prevention. Injections are not effective in preventing DED transmitted via root grafts.

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