



Restoration of the American Elm in the Upper Mississippi Watershed

The Forestry Sciences Laboratory, Northern Research Station (NRS), initiated a project in 2003 to restore the American elm in Ohio. American elm cultivars with high tolerance to Dutch elm disease (DED) were established in areas where the trees can naturally regenerate and spread. The process of regeneration will allow the American elm to co-evolve with the DED fungal pathogen to ensure this valuable tree species will not be lost from the American landscape. NRS partnered with Northeastern Area State and Private Forestry (NA) to expand the American elm restoration project in 2005 and 2007 by establishing restoration sites in Iowa, Wisconsin, and Minnesota. This effort is being carried out in partnership with Luther College in Iowa, the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service in Wisconsin, and the Carpenter St. Croix Valley Nature Center in Minnesota.

History of the American elm:

The American elm was once widely distributed throughout the eastern United States and was a preferred tree for use along city streets and in the yards of many homeowners. The Dutch elm disease fungal pathogen *Ophiostoma ulmi* was introduced into the United States in 1930 and has since destroyed millions of American elm trees in the United States and Canada. By 1976 only 34 million of the estimated 77 million elms present in urban locations before introduction of the DED pathogen remained, and far fewer are still present today.

The American elm's tall height coupled with its vase-like shape provides for a uniquely graceful tree that was a favorite for planting along city streets and boulevards. The crowns of mature elms would span roadways, houses, and park recreation areas and provide cleaner air and cooler temperatures. The American elm is one of few trees known that is capable of growing relatively well within the harsh urban environment of high summer temperatures, air pollution, and road salt present in northern latitudes.

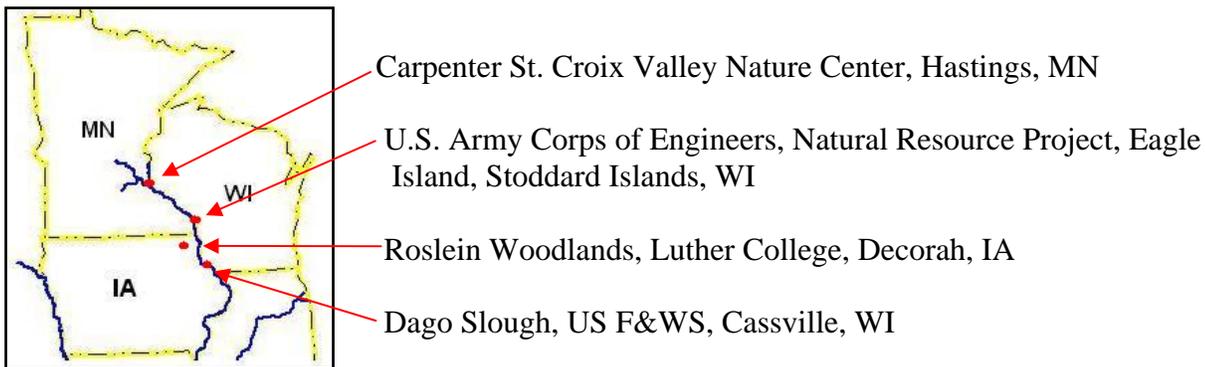
Research on the American elm from the 1970s to present focused on the identification of American elm isolates that could withstand the DED pathogen. More than 100,000 American elm trees were tested for resistance to DED. No trees were found that were resistant to DED; however, a few were identified that exhibited good levels of tolerance to the disease. A resistant tree would show no DED symptoms after injection of the fungus, whereas tolerant trees show disease symptoms the year of inoculation but no symptoms the next year. Some branches die after fungal injection, but are replaced after a couple of years. Out of more than 100,000 American elm trees screened for DED resistance, five trees were identified that exhibit the necessary levels of DED tolerance to withstand the disease. These five selections are used for the restoration effort.



Retention of the American elm into the future:

The identification of DED-tolerant American elms allows for the reintroduction of the American elm into urban areas. However, no effort is currently underway to restore the American elm into forested landscapes in the Eastern United States. In addition, and most importantly, only two individual American elm selections are primarily being used to reintroduce the elm into urban landscapes. The problem with this approach is that when the DED fungus mutates to a form that can overcome the tolerance mechanism in these two elm selections the disease will once again cause the loss of the American elm. It's not a matter of whether this will occur but when, since the DED fungus will continue to evolve while street trees will not since they do not propagate themselves. The American elm restoration project will allow the most DED-tolerant American elm trees identified to date to propagate, evolve, and develop mechanisms that can withstand new forms of the DED fungus. This project will ensure the retention of the American elm in forested landscapes and will provide future trees that are tolerant to new forms of DED for use in urban settings.

Sites for the Upper Mississippi Watershed portion of the project

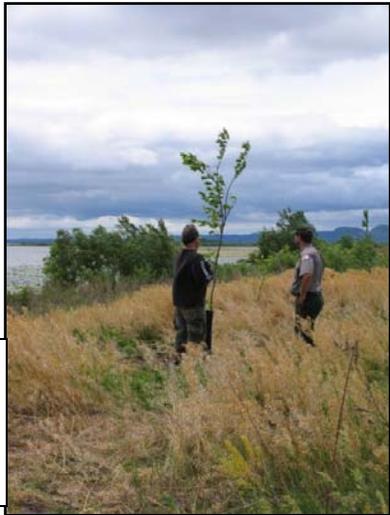


Establishment of American elm restoration Sites:

The sites in Ohio were established in 2003 and 2004. The sites at Luther College, Stoddard Islands, and the Carpenter St. Croix Valley Nature Center were established in June 2005. Three selected varieties of American elm were available for planting in 2005 in the Upper Mississippi Watershed: Valley Forge, Princeton, and Delaware. Twenty-one trees were planted on each site in 2005. Two other selections (New Harmony and R18-2) were not yet available in 2005, but seedlings from controlled crosses of Valley Forge x New Harmony and Valley Forge x R18-2, along with a few Valley Forge x Princeton, were added to the Upper Mississippi sites in 2007. Although the genetics of DED tolerance is not yet fully understood, a high proportion of crosses of DED-tolerant elms are DED tolerant when tested. In addition to adding to the existing sites, a new site was established on the U.S. Fish and Wildlife Service's Dago Slough area near Cassville, WI. For this fourth site, 10 each of Valley Forge crossed with Princeton, New Harmony, and R18-2 were planted. We hope to add Delaware to the site at some time in the future. The trees on all sites are protected from deer browse by deer fence "cages" or other appropriate protection. In addition to the Upper Mississippi project, in 2007 a small number of the controlled cross trees were planted at the Bad River Indian Reservation in Northern Wisconsin to assess cold-hardiness. The Forest Service is also initiating an elm restoration project on the Chippewa National Forest in Minnesota.



2005 Planting at Roslein Woodlands, Luther College. This site was an old field which is being reverted to trees.



2005 Planting on Eagle Island, Stoddard Islands, WI. This man-made island has recently been restored and is being planted to trees.

2005 Planting at the Carpenter St. Croix Valley Nature Center. Trees and grasses have been established on this old orchard site. The elm planting is adjacent to aspen and mixed hardwood woodlands.



2007 Planting on the U.S. F&WS Dago Slough area near Cassville, WI. This is a bottomland forest site within the floodplain of the Mississippi River. The site was cleared with a brush hog in 2006, and planting spots were scalped to control competing vegetation.

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