



Chippewa National Forest Elm Restoration Project

The Chippewa National Forest (CNF) and the Northern Research Station (NRS) initiated a project in 2007 to restore the American elm to the Forest's landscape. Dutch elm disease (DED) has greatly reduced or eliminated the American elm component of hardwood forests and riparian ecosystems on the CNF. The ecological significance of this reduction is exacerbated by the pending threat of emerald ash borer.

Over time, a few American elm cultivars possessing natural tolerance to DED have been identified and reproduced. A couple of these few known DED-tolerant cultivars, which represent a narrow genetic base, are being widely planted in urban areas. Since these cultivars are all from latitudes considerably south of the CNF, concerns over cold-hardiness prevent us from depending on these cultivars to successfully re-establish American elm in northern Minnesota.

In addition to concerns about cold-hardiness, we recognize that there is continuous pressure on the DED fungus to mutate, and a form may eventually develop that can overcome the defenses of these now-tolerant cultivars. The wild landscape has a broad genetic base, and "survivor" elms may have some level of tolerance to DED. In addition, the wild trees are free to regenerate, which allows natural selection to occur in the American elm species, providing an opportunity for it to adapt to changes in the disease. The objective of this project is to strengthen the tolerance to DED in the landscape of the CNF without narrowing the genetic base of the remaining elm population.

With a two-phase approach, we intend to combine the DED tolerance of existing elm cultivars with the cold-hardiness and genetic diversity of local American elm populations. We hope this effort will hasten natural selection for resistance, and the return of the American elm component in the landscape of the CNF. In Phase I, seedlings will be obtained from crosses of local American elm trees with DED-tolerant cultivars. These progeny will be tested for DED tolerance and evaluated for cold hardiness. In Phase II, clonal progeny from the cold-hardy trees that carry DED tolerance will be established in areas where the trees can naturally regenerate and spread.

Partners with the CNF in this effort are NRS, Delaware, OH; NRS, Grand Rapids, MN; Northeastern Area State & Private Forestry, St. Paul, MN; Region 9 of the U.S. Forest Service, Milwaukee, WI; State of Minnesota; and Leech Lake Band of Ojibwe.

Details on the project

During Summer 2007, known large living "wild" American elms on the CNF were evaluated and four of these "survivor elms" were selected to use in crosses. These trees are currently identified as BD1, SO1, SO2, and WR1. A team of biologists and silviculturists selected a planting site on

each district of the CNF, for a total of three sites. These sites are at least 1 acre and are located in natural plant communities where American elm occurred historically.

During February 2008, branch material from these four trees was collected and sent to the NRS office in Delaware, OH. There the branches will be forced into bloom and cross-pollinated with trees known to possess high tolerance to DED. The seed from these crosses will be sown and grown. Some of the resulting seedlings should possess both cold hardiness and disease tolerance characteristics. In total, we expect to produce 1,080 trees, as follows:

Valley Forge x BD1	90 progeny trees
R18-2 x BD1	90 progeny trees
Valley Forge x SO1	90 progeny trees
R18-2 x SO1	90 progeny trees
Valley Forge x SO2	90 progeny trees
R18-2 x SO2	90 progeny trees
Valley Forge x WR1	90 progeny trees
R18-2 x WR1	90 progeny trees
Valley Forge (a seedling from a 1975 chemical study)	90 trees
R18-2 (a selection by the Boyce Thompson Inst. & Cornell Univ.)	90 trees
Am 57845 (a randomly selected clone sensitive to DED)	90 trees
Unselected CAE seedlings	90 trees

During Summer 2008, the three selected sites on the Forest will be prepared for planting the following spring.

In Spring 2009, NRS in Delaware, OH, will ship seedlings to the CNF for planting. They will be planted on each site in 6 randomized blocks with 10-foot spacing. Each block will contain 5 trees of each selection/cross, for a total of 360 trees per site. Each plot will be fenced to prevent deer browse and deer antler rub. Competing vegetation will be controlled, and trees will be fertilized during years 1-4 and watered during years 1 and 2 if necessary.

Individual tree growth and condition will be monitored annually. When trees have attained an adequate size (probably spring of the sixth year), they will be tested for DED tolerance. This will be done by placing 150 μ ls of an aqueous suspension containing approximately 4×10^6 *Ophiostoma novo-ulmi* and *O. ulmi* spores into holes drilled into trunks of the test trees at approximately 4 feet above ground level. The fungal isolates used for this will be obtained from naturally infected trees on or near the CNF. Four weeks after inoculation, foliar symptoms (leaf wilting and foliage death) will be recorded, and percent of crown dieback will be evaluated once a year for the duration of the study.

The second phase of the project will use trees identified as DED-tolerant for establishment on the CNF. At this stage we will clonally propagate the progeny trees with the highest levels of DED tolerance for further testing and for planting to selected areas of the forest. We will also maintain and use the surviving DED-resistant and cold-hardy American elms from the Phase I test as a seed orchard for reforestation on the CNF and vicinity.

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