

The Spread of Dutch Elm Disease in Minnesota and North Dakota

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Dutch elm disease is presently at epidemic levels in many areas of Minnesota and is rapidly spreading toward North Dakota. If this devastating disease of elms is to be controlled in North Dakota, comprehensive statewide control programs must be established and implemented this spring.

Dutch Elm Disease (DED) has been a serious and recurrent urban tree problem in the United States ever since it was first reported in Ohio in 1931. Since then, DED has spread from the east to the west coast, from Texas to Canada and today we can find the disease in 41 states (4). The disease owes its name to the fact that it was extensively studied in Holland after it was reported there in 1921; hence, "Dutch" elm disease.

Nationally, deaths have risen to about 1,000,000 elms a year, and presently the greatest losses are occurring in Maine, Minnesota and California (7). For example, in the St. Paul-Minneapolis area alone, approximately 80,000 trees became diseased in 1976, and elm losses are expected to reach 180,000 in 1977 and near 400,000 in 1978 (1).

Dutch elm is a vascular wilting disease incited by the fungus, *Ceratocystis ulmi*. The American elm, *Ulmus americana*, is the most susceptible elm species in North America. Infection usually occurs through feeding injuries made in the spring by bark beetles which carry spores of the fungus on their bodies. The two most common vectors of the disease are the European elm bark beetle, *Scolytus multistriatus*, and the native elm bark beetle, *Hylurgopinus rufipes*.

There is presently no cure for DED; however, with the recent advances in research, promising new leads for a cure are being tested. Therefore, until a cure is found, much emphasis should be

placed upon the establishment, enforcement and continued development of effective control programs.

One might wonder how the Dutch elm disease developed so quickly, and why only on elm species? In general, this situation has developed as the result of a dynamic interaction between an abundant susceptible host, an aggressive parasite, and an environment which favors infection and subsequent disease development. Hence, these three components of the interaction can be thought of as the "basic requirements" of the disease epidemic.

But more specifically, the answer may be found by looking back in the history of DED, to the early 1900's. Before the fungus and the European elm bark beetles were introduced into the United States, they were causing minor problems on elms in Holland and other areas in Europe and England. At this time in the United States, there were no pathogens similar to the DED fungus afflicting the elm species, and actually the elms were relatively resistant to native disease organisms. The general resistance of elm species to native pathogens is believed to be the result of natural selection through time, yielding individuals best suited for growth and development, survival and reproduction. Thus, when the "Dutch" elm disease was introduced to the United States, our native elms exhibited no resistance to the foreign pathogen and were generally very susceptible.

It is essential for us in North Dakota to realize that DED has reached epidemic levels in many

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areas of Minnesota and that the disease is spreading rapidly. The current situation there has developed slowly but steadily since 1961, when the disease was first reported (6). The nature of DED development is such that for several years after its introduction into an area the losses are insignificant. However, in general after 5 to 10 years, the fungal population becomes established and future development of the disease will depend upon several factors:

1. Density, spatial arrangement and relative health of the native and planted elm species.
2. Population of bark beetles carrying inoculum.
3. Environmental conditions.
4. Intensity of control programs.

In St. Paul, Minnesota, the disease was first reported in 1961, but after seven years only 30 trees had become diseased. Then in 1968, the

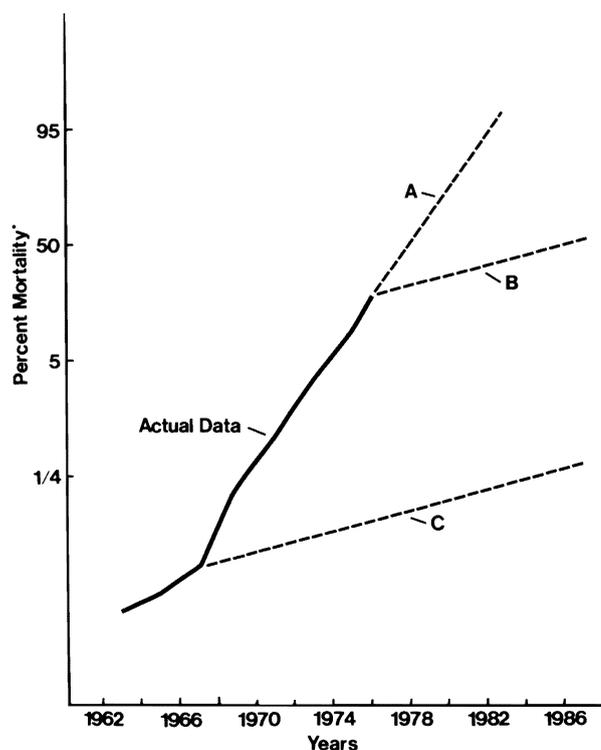


Figure 1. Actual and projected Dutch elm disease development for St. Paul, Minnesota.

- A. Projected disease development without intensive control measures.
- B. Projected disease development if intensive control measures are initiated in 1977.
- C. Projected disease development if intensive control measures had been initiated in 1967.

Based on data by Shrum and French (6).

*Obtained from logit values (8).

annual losses began to increase sharply, and by 1971, 405 additional trees were diseased. In 1975, the losses were 6,300 trees, and with the epidemic in full swing, 18,000 trees succumbed to DED in St. Paul in 1976 (6)! Figure 1 illustrates the DED development curve for St. Paul for 1963-1976. In addition, the graph predicts the future progression of the epidemic depending upon the intensity of control achieved.

From the graph we can see that if control measures remain the same as now practiced, the epidemic will continue to develop at its present rate, and 95 per cent of the elm trees in St. Paul will be lost by 1983. In contrast, if an intensive control program is effectively implemented, the 95 per cent mortality mark will be delayed until 1999 (6).

The cost of diseased tree removal is very high. Assuming a conservative \$150 per tree removal cost, St. Paul must spend approximately \$2.3 million to cut and destroy the trees that have become diseased this year. It is imperative that all the elms that have become diseased or weakened to date be removed before the spring of 1977. This point cannot be overemphasized because of the fact that the beetles prefer to breed under the bark of dying and diseased trees. Thus, unless St. Paul removes all diseased trees, these same trees will provide the primary disease source in the spring of 1977. Secondly, the dead trees are public nuisances or hazards that have caused human injury and deaths in several states (1).

Why has the disease continued to spread so quickly in Minnesota? Primarily, the answer is that the public was not convinced of the urgency to develop effective control programs until the last few years. As early as 1967, the public was warned of the developing epidemic in Minnesota. Thousands of towns and cities in the United States where DED had already struck provided support for the warnings; but no improvement in Minnesota's control program was implemented at that time. It is unfortunate that it took Minnesota so long to enforce an effective control program and allocate sufficient funds to support the necessary work. It is also unfortunate that so many elms died in an unnecessarily short time to finally convince the people of the need for control programs.

Today in North Dakota, we are at the same relative developmental stage with respect to DED as Minnesota was in 1966. We are at a critical point in the development of a potential DED epidemic, and the control programs we conduct in the next few years will greatly influence the future occurrence and spread of DED in our state. Indeed, it is important that we learn from the previous episodes of DED in the United States, especially

Minnesota. We must not make the same mistakes, but rather strive to protect our elm tree resource and not allow a DED epidemic to develop.

The most common elm species in North Dakota are the American and Siberian elm, *Ulmus americana* and *Ulmus pumila*, respectively. Of these two species, the American elm is more susceptible, but isolates of the fungus have been reported which attack the Siberian elm. These two species are important urban shade trees in the majority of North Dakota's towns and cities; thus, the impact of a future disease epidemic would be aesthetically and economically disastrous.

Already DED has been found in four cities in North Dakota. The disease was first recorded at Mandan in 1969, and discoveries since have been made in Valley City, Fargo and Minot. To date, 58 elms in North Dakota have been found to be diseased, all of which have been destroyed (2). DED in North Dakota is summarized in Table 1.

Table 1. Number and location of Dutch elm infected trees in North Dakota.

Years	Mandan	Valley City	Fargo	Minot
1969	1	—	—	—
1970	3	—	—	—
1971	8	—	—	—
1972	14	—	—	—
1973	9	1	2	—
1974	3	—	0	—
1975	8	—	1	—
1976	4	—	1	3

Although the actual number of trees that has been found to be positive for DED in North Dakota is minimal, the disease is nevertheless present and spreading. Evidence of its spread is the fact that in 1976 three trees became diseased in Minot, the first report of DED in that area.

Fortunately, the occurrence and spread of disease so far has been held to a minimum, but to insure comprehensive control in the future it is important that good sanitation practices are followed in all communities where substantial elm populations exist.

In Mandan, where DED has occurred repeatedly, the city has responded with a good ordinance to control the spread of DED and provide for the protection of their elms. Mandan's ordinance declares:

"Dutch elm disease fungus, elm bark beetles, any living or standing elm trees harboring the fungus or beetles, and dead elm trees, or parts thereof, that have not had the bark removed or been sprayed, to be public nuisances and when found on either private or public property they must be removed immediately. Determination of the existing nuisances shall be the responsibility of the city forester who will order, direct, supervise and control the removal of public nuisances by spraying, removal, burning or by other means necessary (5)."

The ordinance prohibits the transportation of any bark-bearing elm wood without written permission of the city forester, interfering with or refusing to permit the forester to enter one's premises to inspect for public nuisances, and permitting a public nuisance to remain after being directed by the forester to remove the nuisance. The ordinance is enforced by the city government, and any person who does not comply with the law is subject to fines and/or imprisonment. The entire cost of their control program, including the

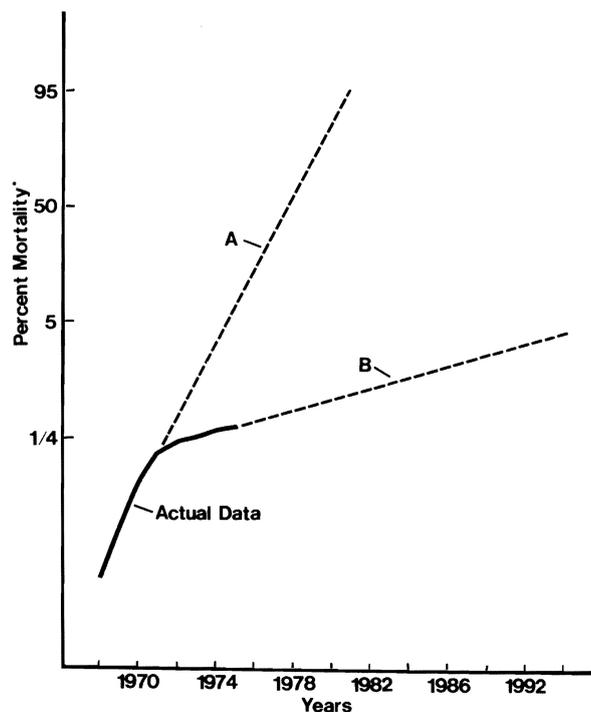


Figure 2. Actual and projected Dutch elm disease development for Mandan, North Dakota.

- A. Projected disease development that would have occurred if intensive control had not been initiated in 1972.
- B. Projected disease development if intensive control is maintained in the future.

*Obtained from logit values (8).

removal of public nuisances and spraying, when done **at the direction of the forester**, shall be paid by the City of Mandan out of general funds.

In the spring of 1971, a control program for Mandan's 15,000 elms became functional as outlined above. A graph of the disease development in Mandan from 1969-1976 is shown in Figure 2. The graph clearly illustrates how the intensive control program in Mandan significantly reduced the rate of disease development from 1972 to the present.

Although the occurrence of DED in Mandan so far has been small, the relative value of their control program is clearly shown in Figure 2. After 1972, we find a drastic reduction in the infection rate, which indicates that the control measures have been successful. Also, if we extend the disease development line beyond 1976 we see that only five per cent of the total elm population (750 trees) will have become diseased by 1994.

In Fargo, Valley City and Minot, the occurrence of DED has been minor, and these communities have responded differently to the disease. In Fargo, where four trees have become diseased, both a Department of Forestry and a DED control ordinance have been established. In addition, Fargo employs a forester and a crew that manages all of the city's trees and shrubs and gives special attention to the DED program. The forestry department practices a good sanitation program that is primarily concerned with (1) the detection and removal of diseased and weakened elms, (2) regular pruning to remove dead and weakened limbs, and (3) public education. Both Fargo and Mandan have good control programs and it is imperative that they continue to serve as examples for the rest of North Dakota and influence comprehensive **statewide** DED control.

In 1973, one tree was found infected with DED in Valley City. The city promptly removed and destroyed the tree, but failed to establish a control program to protect the rest of their elms. Although additional infections have yet to be discovered in Valley City, it is important that the city protect its elm resource in the future by maintaining at least a good sanitation control program. This is true for other cities in the state as well.

In the fall of 1976, three trees in Minot were identified positive for DED. Presently, the city is considering an ordinance similar to the ones effective in Mandan and Fargo. It is crucial for Minot to establish a sound DED control program soon. There is a potentially dangerous situation in that city which could favor a large scale epidemic. Thousands of elms are growing along the Mouse river and many are overmature and/or unhealthy.

Compounding the problem, these trees have been further weakened in recent years by repeated floods and a continuous dike built along the shores of the Mouse. In building the dike for flood control, many trees were covered with soil at their bases and these trees are slowly dying. Thus, many elms in the Minot area have been weakened and now provide excellent places for beetles to breed and multiply. If these beetles carry the DED fungus, we can expect more healthy trees in Minot to become diseased. A good control program would prevent this situation by removing the weakened trees before the spring of 1977.

What is the outlook for DED control in North Dakota? It is favorable if the towns and cities where elms exist follow the examples of Mandan and Fargo and establish effective control programs. Such programs will reduce the spread of the disease considerably and provide additional time for research and replanting other species. In addition, these programs will minimize the aesthetic and economic losses resulting from the rapid removal of diseased trees. The cost of maintaining statewide DED control programs is a sound investment, as that spreads the economic burden required for the removal and replacement of trees over many years. If such programs are carried out, there will be no "invitations" to DED made in North Dakota, and our beautiful elms will be protected.

A brighter side of DED is summarized nicely in the following quote by J. R. Feucht:

"Never before have people, communities and even governmental agencies been so aware of the value of trees. Never before have they realized that a variety of species should be planted in a city rather than planting alleys of one species only to be endangered by one disease (3)."

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