

Oak Decline in High Park, Toronto

October 2002

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A significant number of oaks in High Park have died or declined in health over the last several years. There are currently 238 dead trees marked for removal. Not all of these trees have died this year - most of the trees started to show signs of stress several years ago. In recent years it has been observed that crowns have thinned, leaves exhibit chlorosis, and limbs have died. Under normal circumstances, dieback of a certain number of trees could be explained as part of natural process - ageing and naturally present adverse environmental factors. However this year the mortality of oak species, mostly black and red oaks, has been significantly higher than in past years. When mature oaks come under stress it is expected that trees or branches will die. This process is known and described as Oak Decline¹.

The prolonged drought of the last five years, severe fall cankerworm defoliation for three seasons, and repeated anthracnose infection has all contributed to the decline of oaks. High Park is not the only place to have experienced large-scale decline and mortality of oaks. Several other areas throughout Southern Ontario have also reported Oak Decline including Whiteoaks Park, Mississauga and Iroquois Park, Oakville with 300 and 500 dead trees, respectively. Oak Decline has also been observed in residential and parkland oak trees in different areas of Toronto.



A group of dead oak trees in High Park.

The City of Toronto's Forest Health Care inspectors have been monitoring the trees in High Park since their decline became alarming in June this year. It was evident from the beginning that the decline of oaks was not caused by a single factor, but demonstrated signs and symptoms typical to Oak Decline. Oaks from the red oak group including black and red oaks are most affected. The mortality of black oaks is the highest, probably because they grow on the drier sites. White oaks are significantly less affected. Foliage developed normally until late spring and early summer when they suddenly wilted and browned. In affected areas decline and mortality occurred in patterns, depending on the severity of the stress, species distribution, the aggressiveness of Armillaria root rot and abundance of two lined chestnut and red oak borers. Most of the declining oaks also have signs of extensive wood decay on the main stem or large limbs.



Armillaria root rot infected tree.



Decayed oak tree stump.

Forest Health Care Inspectors have been in contact with representatives of the Canadian Food Inspection Agency (CFIA), Canadian Forest Service (CFS) and University of Toronto since the beginning of the investigation into Oak Decline in High Park. CFIA collected samples in July and sent these to a lab so it could be determined whether sudden oak death (SOD) was a cause of decline. This pathogen has not been detected yet outside of California and Oregon. Results were negative, meaning no pathogen of SOD has been isolated from samples.

In July 2002, Professor Martin Hubbes from the University of Toronto visited the site. His opinion is that no single pest is responsible for the death of oaks, but rather is a result of gradual weakening of trees over several years. Drought, age, repeated insect defoliation have stressed these trees and made them susceptible to secondary pest infestation.

In September 2002, Anthony Hopkin, a Forest Pathologist from CFS inspected the site with Vojka Miladinovic and Jozef Ric. He also supported the diagnosis of Oak Decline. This time we had a chance to look at some of the stumps of removed oak trees. The vast majority of them have shown signs of advanced wood decay, mostly close to the ground. A large number of tree stumps are hollow. Under the bark many galleries of two-lined chestnut borer (*Agrilus bilineatus*) and in several cases *Armillaria* (*Armillaria spp.*) root rot fungus rhizomorphs are evident. These pests are commonly associated with Oak Decline¹. Collected samples of decayed wood were sent to the CFS lab for identification of decay organisms. We are interested what species of *Armillaria* are present, because they vary in aggressiveness.

CFS offered their assistance in setting up permanent sample plots in the affected areas to monitor the development of the Oak Decline problem. These plots will cover several different areas in the park with approx. 200-300 oak trees each. These data will provide a better understanding of the progress of changing health condition and give guidelines for eventual management of Oak Decline in High Park.



Galleries of two-lined chestnut borer under the bark.



Larvae and tunnels of two-lined chestnut borer can be seen on the inside of the bark.

Forest Health Care Inspectors performed a preliminary count and survey in the most heavily affected areas of the park, management units 10A and 9A in late September 2002. This survey was not intended to provide statistically conclusive results, but was instead desired to help identify current tree health status and factors of decline. 100 oaks were counted (standing and also stumps of removed trees), identified by species, measured the size, inspected for symptoms and signs of decline and classified in 6 categories according to condition. The results of the survey are presented in the following chart.

| Category | Condition | White Oaks % | Black Oaks % | Red Oaks % | All Oak species % |
|--------------|--------------------------------|--------------|--------------|------------|-------------------|
| 1 | very good health | 0 | 0 | 0 | 0 |
| 2 | fair health | 1 | 19 | 13 | 33 |
| 3 | significant decline | 1 | 29 | 10 | 40 |
| 4 | advanced, irreversible decline | 0 | 1 | 6 | 7 |
| 5 | dead, current year mortality | 0 | 3 | 4 | 7 |
| 6 | dead, previous year mortality | 0 | 8 | 5 | 13 |
| Total | | 2 | 60 | 38 | 100 |

The total mortality from this and previous years is 20%. Seven (7) % of them (category 5) have died this year and 13% in previous years (category 6). Black oaks have the highest mortality (13%), following by red oaks (7%). The remaining living trees are showing a different degree of decline classified into categories from 1 to 4. Category 1 would represent trees in very good condition, although no tree met this classification. Trees included into category 2 (33%) are in the best condition. Category 3 (40%) represents trees with significant decline and dieback. Trees in category 4 (7%) are in worst health condition but still alive. Almost all of the dead trees (94%) have been infested with Armillaria and two-lined chestnut borer. A significant number of living trees (31%) have signs of advanced decay or other irregularities.

This preliminary survey cannot entirely represent the process of Oak Decline of all affected areas. A continued survey of wider scale would give us more conclusive results, but it certainly supports the opinion that Oak Decline in High Park is not caused by single pest and gives us certain indications that we can expect further mortality of oaks in the next season. This survey also serves as a base for monitoring the progress of the Oak Decline in upcoming years.

In conclusion, a significant number of trees in High Park have died and it is projected that continuing dieback will have a major impact on the overall plant community structure resulting in a reduction in area of oak woodland and an increase in area of oak savannah. There are numerous factors causing tree death and decline, and these are combined into a diagnosis referred to as Oak Decline. Media reports have raised the issue of Sudden Oak Death as a possible contributing factor but this could not be verified in spite of testing by Federal Authorities responsible for identifying quarantine pests in Ontario. Future reference to the causes of Oak Decline should refer only to drought and fall cankerworm infestation, with secondary agents including Armillaria root rot and two-lined chestnut borer.

1. Sinclair, W. A., Lyon, H. H., and Johnson, W. T. 1987. Diseases of trees and shrubs, Cornell University Press. 450 pp.