

The Gardens' Bulletin

ROYAL BOTANICAL GARDENS

Founded 1941

Hamilton, Canada

Volume 26, No. 4

December, 1972

THE EASTERN HEMLOCK

The distribution and vigour of the Hemlock [*Tsuga canadensis* (L.) Carr.]
population of the Royal Botanical Gardens

W. John Lamoureux, Conservationist and Co-ordinator of Education

Eastern Hemlock leads a double life — downgraded by the forest industry because of its bad attributes as lumber, but prized by the naturalist because of its ability to attract birds and wildlife to feed or nest in its branches (Fig. 1). The hemlock is a graceful conifer in youth, with a characteristic crown in maturity. Maturity can mean 700 to 800 years.

It is generally true that hemlock is a tree of the native forest with moderate levels of air humidity. Once established, however, the tree can persist after the surrounding forest has been cut away, so hemlock is quite often found standing after the more valuable trees have been logged.

Eastern Hemlock is one of four recognized hemlock species in North America. In latitude its northern limit of growth is in the Gaspé and at the Lake-of-the-Woods, excluding the James Bay watershed. While it extends south to the mountains of Georgia in the higher elevations, at lower altitudes it is close to its southern boundary in southern Ontario. Indeed, most parts of Kent and Lambton counties have only scattered pockets of hemlock in forest habitats comparable to those in which they occur more frequently farther north. In longitude Eastern Hemlock ranges from Cape Breton Island almost to the eastern boundary of Manitoba.

Hemlock will regenerate successfully from seed only under forest conditions; this being so, the hemlock population once established is generally self-perpetuating. It will compete and grow with the maple, cedar, beech and other shade-tolerant trees of the native forest (Fig. 2).

In July and August of this year, Gardens' properties were surveyed for hemlock. The purpose of our survey was to assess three variables:

- (a) Topographic location of hemlock stands
- (b) Compass orientation of land supporting hemlock
- (c) The vigour of the present hemlock population

Again, as in *Giant Trees of the Gardens* (Gardens' Bulletin, Vol. 25, No. 1, 1971,) the Tamsalu-Johns' survey maps and their location identification numbers were used to provide an orderly distribution census. The first question the survey sought to answer was — Where are the hemlocks individually and collectively? In addition, diameter classes, mortality and vigour, local habitat, individual tree ages, and associated trees were investigated.

Numerically, the distribution of hemlocks in the four major areas of the Gardens is as follows: Hendrie Valley — 314; Rock Chapel — 72; South Shore of Cootes Paradise — 782; North Shore of Cootes Paradise — 413. Thus the



FIGURE 1. Eastern Hemlock twigs. Leaves whitish on underside, up to 0.7 inches long. Cones up to 0.75 inches long.

total number of hemlock growing in Garden's forested areas can be stated with reasonable accuracy as 1,581.

Diameter Classes

To discover what portions of the population fell into various size classes, the trees were measured for diameter breast high (dbh), using wood-beam calipers. The following arbitrary dbh classes were established:

- Class I — 0 to 2 inches
- Class II — 2 inches to 6 inches
- Class III — 6 inches to 10 inches
- Class IV — 10 inches to 20 inches
- Class V — 20 inches and over

The data for various areas have been arranged in graph form and appear in Fig. 3. The area with the largest numerical count of hemlocks over 20 inches dbh was the North Shore of Cootes Paradise where 16 such trees were found. Hendrie Valley and the South Shore each has a relatively large population of hemlock between 10 and 20 inches dbh. Rock Chapel property has very few young hemlocks; only 1 tree in Class I was recorded. The other natural forest areas have quite strong populations of young trees; 151 Class I hemlocks were recorded on the South Shore.

Mortality and Vigour

The method chosen to assess vigour of the hemlock population was to count both standing dead trees and seriously defoliated specimens. A total of 5 dead trees out of 413 (1.2%) was recorded on the North Shore of Cootes Paradise. In comparison, 40 (5.1%) dead or seriously declining individuals out of 782 were found on the South Shore. Hendrie Valley disclosed 17 dead (5.4%) and 1 windthrow, while no dead hemlocks were recorded at Rock Chapel. In each area the greatest number of dead specimens fell into diameter Class II.

Vigour or growing success is influenced by climate, freedom from physical damage or fire, success in competition, ability to survive disease and pests, and soil and water conditions. If it is realistic to relate mortality to these factors, it seems that the Rock Chapel population has the best ratio of live trees to total population, followed by the North Shore, with the South Shore showing the highest mortality ratio. This gives rise to the question of why the South Shore population appears to possess the lowest vigour; it may be a combination of many factors including greater human use of the area.

Habitat

In regard to habitat, *Native Trees of Canada*, by R. C. Hosie, states the following: "Eastern Hemlock grows in different types of soil but requires a moist, cool location." This study confirmed the validity of the above habitat description with the addition that with very few exceptions, local hemlocks grow on sloping land (Fig. 2). This could be determined because the survey recorded the topographic site of the individual hemlocks. Of the total number of trees recorded, only seven trees at Rock Chapel and 16 individuals on the North Shore grew in flat areas. This may not be too relevant because much of the Gardens' natural areas is sloped; historically, the slopes were allowed to afforest while the flat uplands were being cultivated.

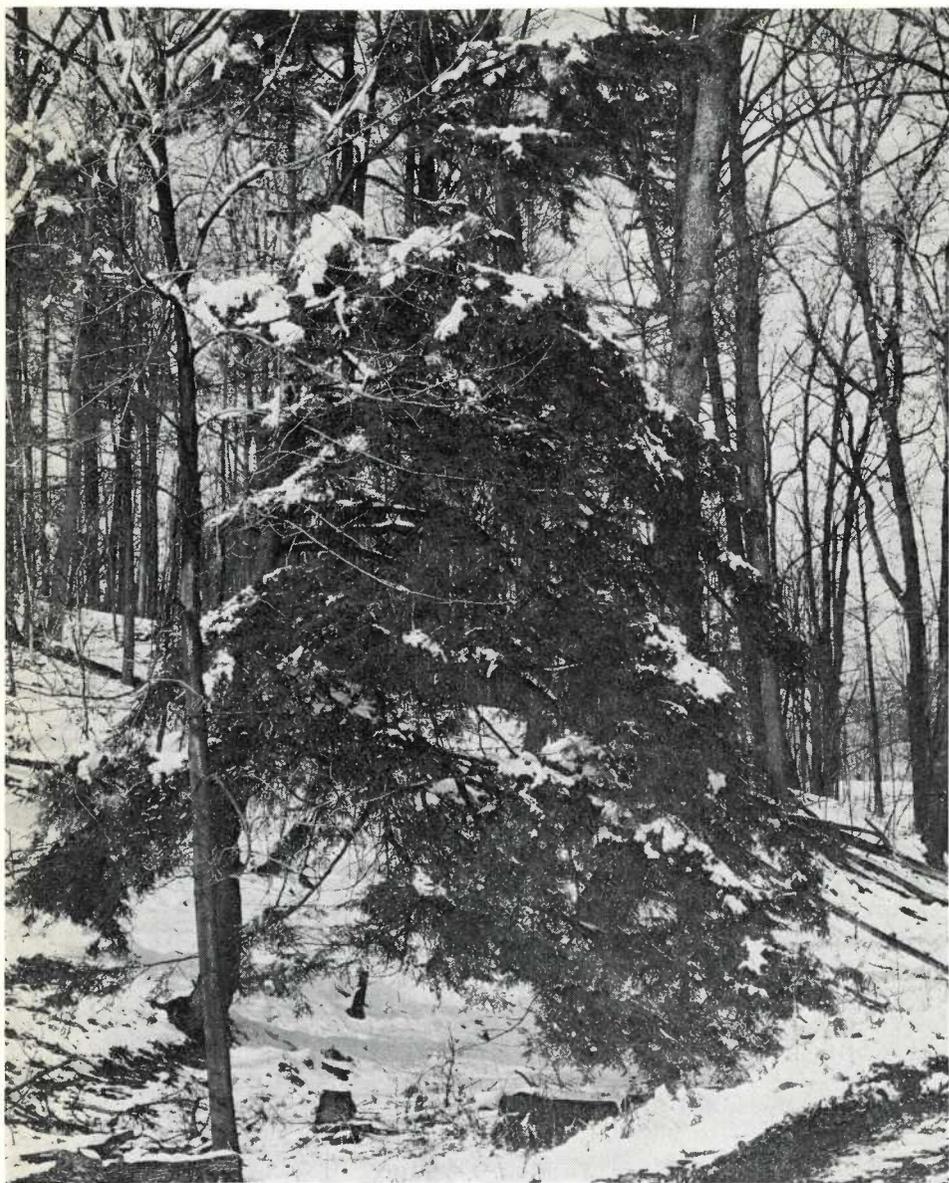


FIGURE 2. Eastern Hemlock as a coniferous component of the mature hardwood forest with live branches to the base of the trunk. Note "snow-shed" feature of boughs. Deer often bed down in the relatively snow-free area beneath the tree.

A more interesting aspect related to topography was that the survey team determined whether each individual tree grew on a west-facing slope, a north-facing slope, and so on, for the cardinal points. On the North Shore of Cootes Paradise the major concentration of hemlock occurred on the northeast-facing slopes. Only 2 individuals were recorded on south or southeast-facing slopes. At Rock Chapel most of the population is located on a west-facing slope. In Hendrie Valley most hemlocks are growing on northwest-facing slopes. Inci-

dentally, a considerable number of dead trees were recorded within the stands on this exposure. Again on the South Shore, the most prevalent growing exposures were on north or northwest-facing slopes. In this area, 26 hemlocks were recorded as growing on south-facing sites; 10 of these had been planted, the remainder as growing in one stand. Thus, although no dead hemlocks were recorded on south-facing slopes in the Gardens, it does not appear to be a favoured site for germination and colony development. The strongest stands were on north-facing exposures.

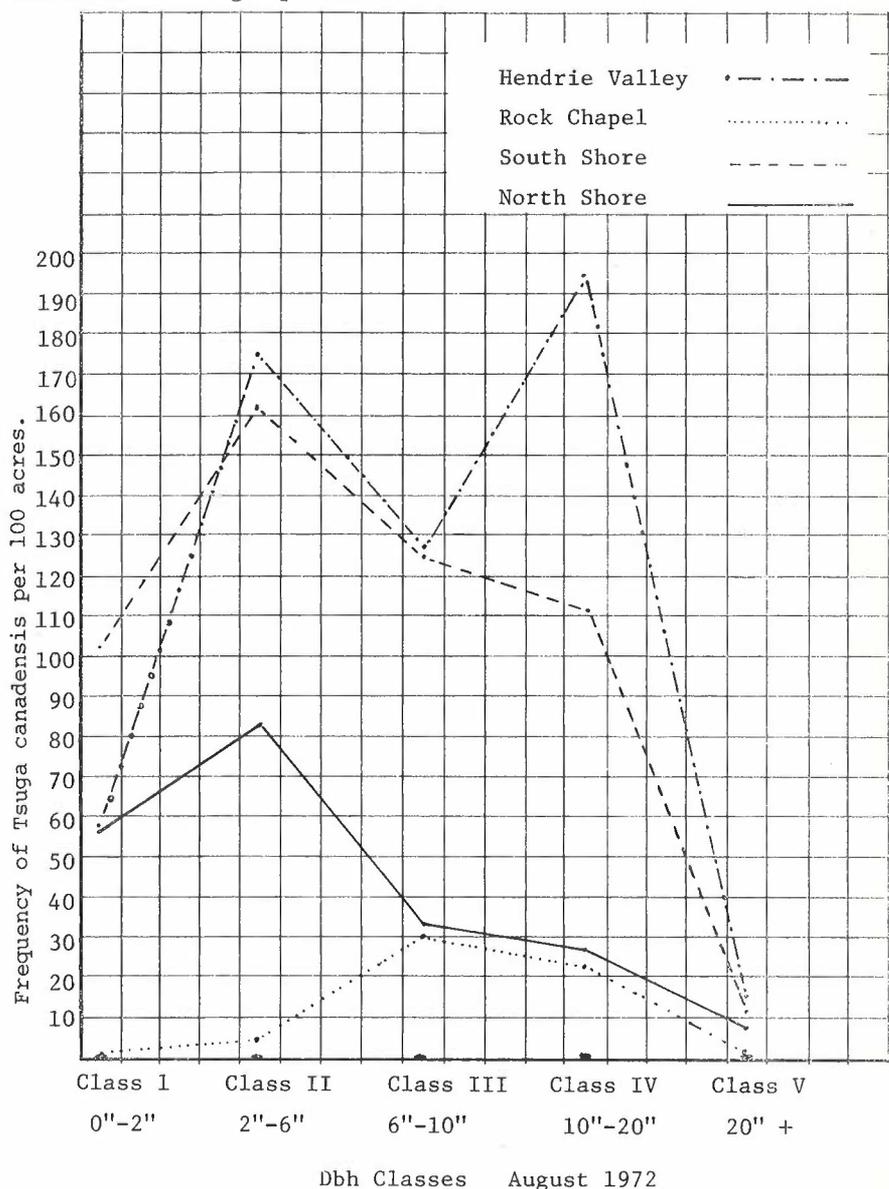


FIGURE 3. Graph showing frequency of occurrence of Eastern Hemlock at various diameter classes within four natural areas of the Royal Botanical Gardens.

Finally, because hemlock is shade tolerant, it was not surprising to find the greatest concentration of hemlock in the Royal Botanical Gardens on the South Shore of Cootes Paradise. That part of Cootes Paradise contains older, more mature forest than other parts of the Gardens' natural areas.

Age of Individuals

The determination of ages of hemlock by the use of the Swedish increment borer is very difficult. The wood of hemlock appears to be pressurized, and therefore, extracted cores are generally broken, twisted and deformed. The oldest hemlock tree on Gardens' property is probably the one listed in the Giant Tree survey of 1970. It is on the South Shore and has an extrapolated age of 230 years. On the basis of stump-ring counts, it is suggested that the average 10-inch diameter hemlock is about 70 years old. Hemlocks grow to a considerable age; some virgin trees recently harvested in the Parry Sound area have been up to 600 years old. This has been verified by Ministry of Natural Resources foresters.

Associated Tree Species

Local hemlock rarely occurs as pure stands encompassing a great area. Usually they grow mixed with hardwoods (Fig. 2). The team involved in this survey made a special point of noting the kinds of neighbours with which hemlock grow. Before the middle of this century, elm would have been commonly found growing along with, and overtopping the hemlock in parts of the Eastern Hemlock range. This survey shows few elms in hemlock habitat but many maples. At Rock Chapel the hemlock are found mixed with ash, basswood, white birch and below the Escarpment with maple. On the North Shore, white and yellow birch along with white pine and the oaks were recorded in hemlock areas, witch-hazel was the most common neighbouring shrub. In Hendrie Valley many witch-hazels grow in association with hemlock as do maple, oak and ash. On the South Shore, maple and oak were the most common adjacent trees with birch and beech in good numbers also.

Generally, nut trees, hornbeam, sassafras, and black cherry were very infrequent hemlock associates.

In conclusion, Eastern Hemlock grows in all natural forest areas of the Gardens; it appears to be growing successfully and has been recorded in surprising numbers. They inhabit mainly north-oriented slopes, and the ravine lands of Cootes Paradise seem to suit them well.

Most of the local population falls into the diameter Classes II, III and IV with some very large old specimens still growing actively. Although the study has provided illumination in some areas it has not clarified the situation regarding the low Class I population. Normally, trees occur in greatest numbers as seedlings and saplings. It is suspected that many seedling hemlocks are over-browsed by deer. Both the twigs and the foliage are winter food for deer, and moreover, deer tend to congregate in hemlock stands because the trees act as snow sheds, giving the animals access to ground surrounded by deep snows (Fig. 2). Thus seedlings are under heavy pressure and are often killed by overuse.

Succeeding phases of this hemlock study will include the effects of deer and consider the questions of low regenerative capacity — whether site and soil conditions may be limiting the germination and survival of Class I trees.

My appreciation is extended to the hemlock survey team comprised of Mr. James Law and Mr. John Bastaja.