COSEWIC
Assessment and Update Status Report

on the

American Chestnut
Castanea dentata

in Canada

ENDANGERED
2004

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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COSEWIC
Assessment Summary

Assessment Summary – November 2004

Common name
American chestnut

Scientific name
Castanea dentata

Status
Endangered

Reason for designation
Once a dominant tree in well drained forests of the Eastern Deciduous Forest, this species was devastated by chestnut blight in the first part of the 20th century. The species is still present throughout most of its former range, but as a few scattered individuals that have sprouted from root crowns. Most of these succumb to the blight before reaching a substantial size, and fewer than 150 are large enough to produce seed. The species requires cross-pollination and seed set is reduced because mature individuals are widely scattered. Threats to the species include the continuous presence of the blight, aging and attrition of the root crowns, land clearing in some remaining sites, and hybridization with other species.

Occurrence
Ontario

Status history
Designated Threatened in April 1987. Status re-examined and designated Endangered in November 2004. Last assessment based on an update status report.

COSEWIC
Executive Summary

American Chestnut
Castanea dentata

Species information

American chestnut is a member of the beech family. It is the only species of chestnut native to Canada. It has elongate leaves tapered at both ends and large teeth along the margins. Flowers are arranged in catkins with numerous tiny male flowers and a cluster of several female flowers at the base of some of the catkins. When cross-pollinated with another chestnut tree by an insect pollinator, the female flowers develop into spiny bur-like fruits enclosing one to several chestnuts. This species once was a dominant tree in many areas of the eastern deciduous forests of North America, but has been greatly reduced by the introduction of the chestnut blight disease a century ago.

Distribution

This species occurs throughout eastern North America from southern Maine to southern Ontario and Michigan, south to Georgia to Mississippi. Remnants of once large populations of this tree still survive across most of its historical range in southern Ontario as well as most of the states within its range to the south.

Habitat

The typical habitat is upland deciduous forests on sandy acidic soils, occurring with red oak, black cherry, sugar maple and beech.

Biology

This species is a shade-tolerant forest tree needing a canopy cover for effective seedling establishment. It produces both male and female flowers on the same tree in late spring to early summer. It is insect pollinated and requires cross-pollination for seed set. Nuts are produced in the fall of the same year and are sought after by squirrels, chipmunks and large birds that also disperse the seeds beyond the parent trees.

Population sizes and trends

Remnant populations are rarely very large, typically single trees or small groups. It is estimated that there are currently 120-150 mature trees and 1,000 or more smaller,

non-reproductive individuals in Canada. It is inconclusive if the status has significantly changed since the mid-1980s.

Limiting factors and threats

The introduction of the chestnut blight fungus in about 1904 devastated populations of this species throughout its natural range, including its Canadian distribution in southern Ontario. Most individuals are stump sprouts that never reach fruiting size. Recovery planning has identified possible hybridization with Asian species in native stands as another potential threat.

Special significance of the species

American chestnut had a wide spectrum of uses by native peoples, from treatment of ailments to a staple food, to material for building and dyeing. Early settlers soon realized what an important tree this was and used it in similar ways. Its abundant production of nourishing nuts also was an important food for various mammals and birds of the forest.

Existing protection

It is ranked by the Natural Heritage Information Centre (Ontario) as S2 (imperiled), but has not yet been given official provincial status.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5th 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The Committee meets to consider status reports on candidate species.

DEFINITIONS (NOVEMBER 2004)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for atleast 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A wildlife species for which there is inadequate information to make a direct, or indirect, assessment of its risk of extinction.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.
** Formerly described as “Not In Any Category”, or “No Designation Required.”
*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

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Update
COSEWIC Status Report

on the

American Chestnut
Castanea dentata

in Canada

2004

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SPECIES INFORMATION

Name and classification

Scientific name: *Castanea dentata* (Marsh.) Borkh.
Common name: American chestnut, chestnut, or sweet chestnut
Family name: Fagaceae (beech family)
Major plant group: Dicot flowering plant

In addition to American chestnut, other species of *Castanea* occur in the southern US and other chestnuts are native to Europe and Asia. For more details on the taxonomy of this species see Ambrose and Aboud (1986).

Description

It is a large tree of the forest canopy reaching as much as 30 m in height; it has smooth, thin, dark grey-brown bark breaking into shallow fissures with age. Leaves are alternate, simple, 15-30 cm long and 5-10 cm wide, with a long tapered tip and base and widely spaced sharp teeth along the margins. Both leaf surfaces are smooth (lacking hairs) and green. Buds are short and ovoid (not elongate as in American beech). Male flowers occur on long catkins, female flowers are found individually or in small clusters at the base of some catkins, forming prickly burs at maturity containing 1-5 nuts. It hybridizes and can be confused with Chinese and other species of chestnut. The species is illustrated in Gleason (1963) and Waldron (2003); some other illustrations, such as in Farrar (1995) are confusing or inaccurate.

DISTRIBUTION

Global range

The global range is limited to eastern North America, extending across the north-eastern states from southern Maine to south-eastern Michigan, and southern Ontario, south to Georgia and Mississippi, east of the Mississippi River (Figure 1).

Canadian range

The Canadian range extends from just west of Toronto through London to Windsor and south, through much of the Carolinian Zone (=Deciduous Forest Region) of Ontario (Figure 2). Although this species is no longer dominant in its forest habitat, remnant stump sprouts or occasional trees are found through much of its historical range.

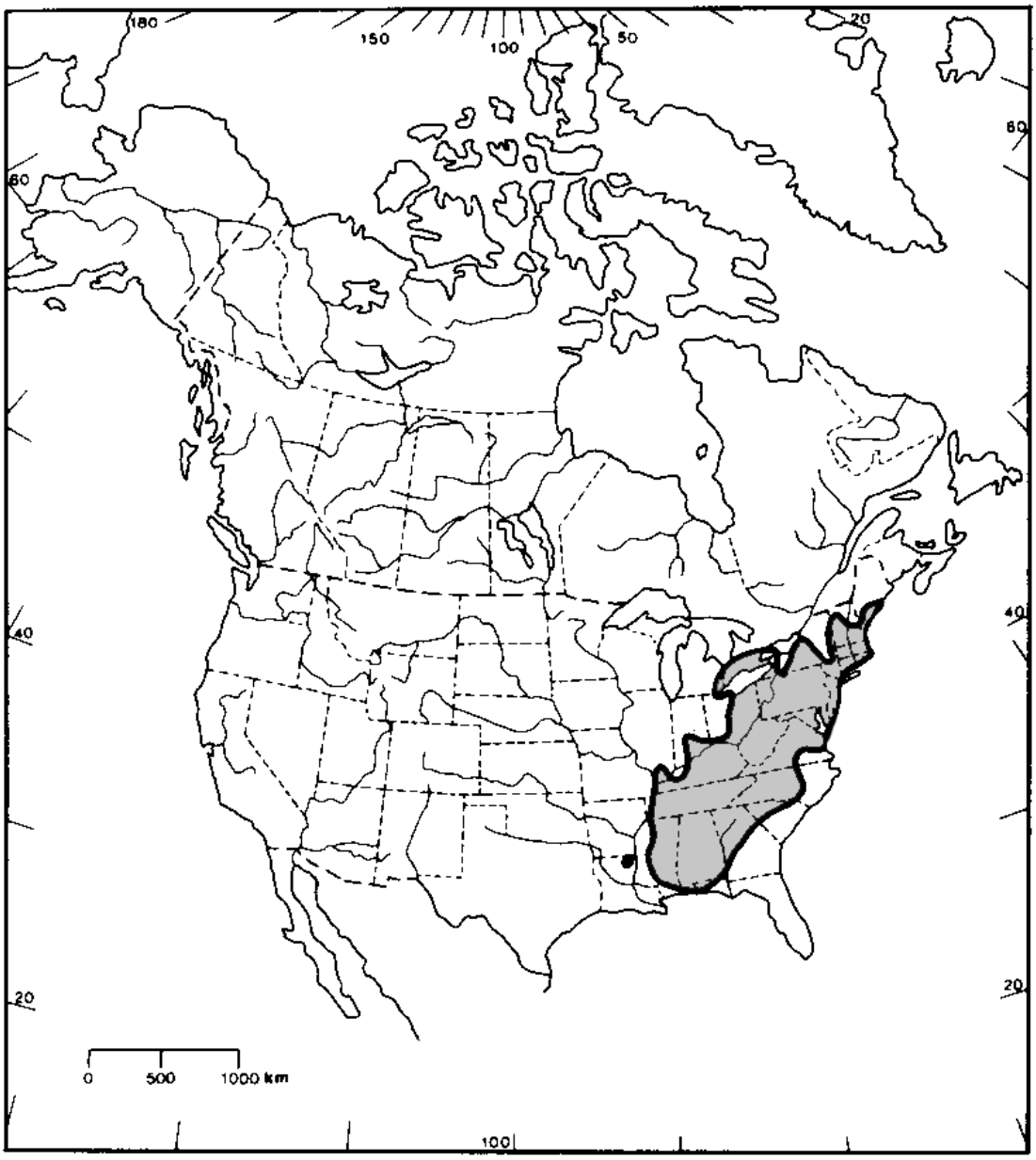

Figure 1. Global distribution of *Castanea dentata* (Argus et al., 1982-87).

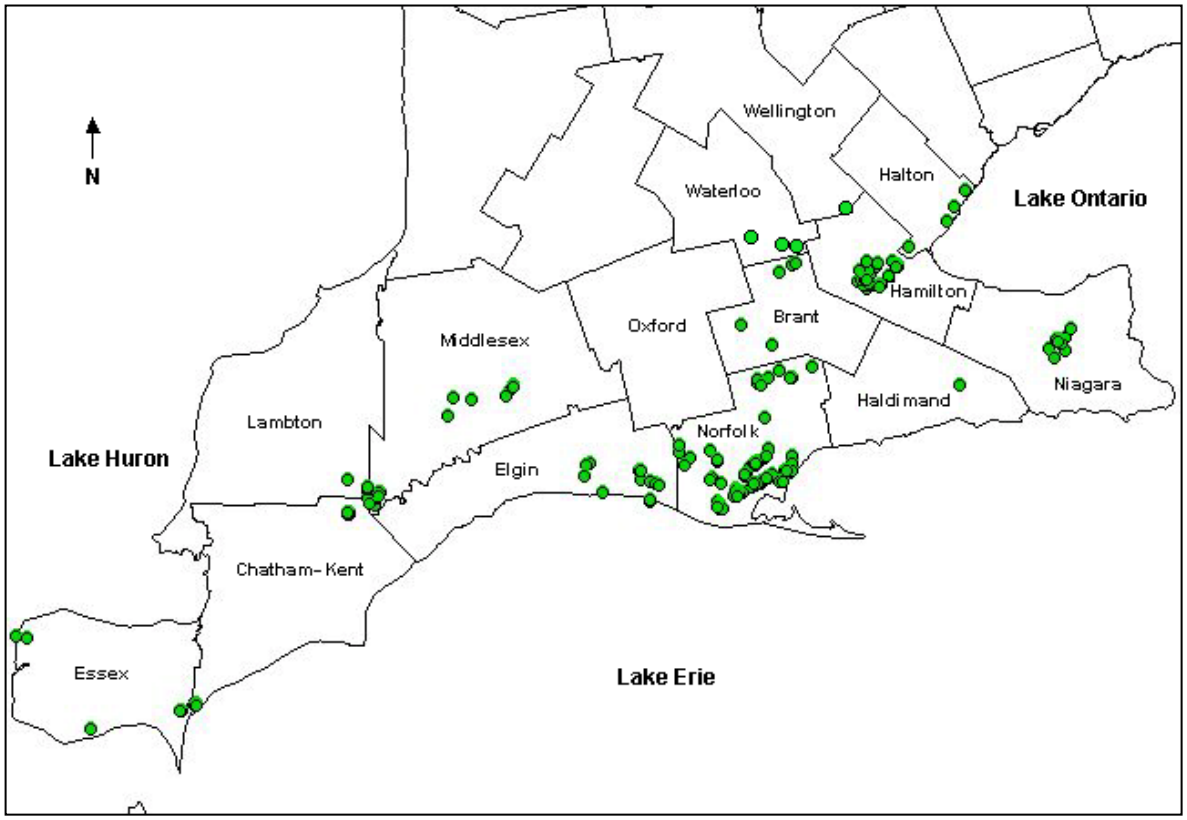

Figure 2. Distribution of *Castanea dentata* in Canada (Tindall *et al*, 2004, with additions).

HABITAT

Habitat requirements

Typical habitat is an upland deciduous forest on acid to neutral, sandy soil. Common associates, in order of highest frequency, are red oak (*Quercus rubra*), black cherry (*Prunus serotina*), sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), white oak (*Quercus alba*), red maple (*Acer rubrum*) and sassafras (*Sassafras albidum*). White pine (*Pinus strobus*), hemlock (*Tsuga canadensis*), shagbark hickory (*Carya ovata*) and black oak (*Quercus velutina*) are occasional associates. In Canada it is limited to the Carolinian Zone of extreme southern Ontario, where the growing season is long, temperatures extremes are moderated by the lower Great Lakes, summers are warm and moisture is well supplied and fairly uniformly distributed through the seasons.

Trends

Because of the occurrence of prime agricultural soils and the long growing season in southern Ontario, the Carolinian Zone has lost much of its natural habitat historically

to clearing for agriculture and associated human settlements. Throughout the Carolinian Zone there is a continuing loss or degradation of habitats and connections within the natural landscape.

Protection/ownership

Approximately 25% of the Ontario sites are under public ownership. Many of the private landowners are keen to protect and promote the conservation of this species. The Canadian Chestnut Council was founded in 1988 and provides a forum for the dissemination of information and planting stock among interested landowners and researchers. In the late 1990s the Ontario Soil and Crop Improvement Association conducted a special program on the distribution of chestnut seedlings to interested rural landowners, especially in farming communities.

BIOLOGY

General

American chestnut is potentially a long-lived, shade-tolerant forest tree; it requires a canopy cover for effective seedling establishment. While other members of the family are wind-pollinated, this species is insect-pollinated. Seedlings establish in the shade of mature forests by seeds that were likely dispersed and buried by squirrels. Soils tend to be light (i.e., sandy) and acidic. Its natural distribution is limited to the long growing season of the Carolinian Zone but it has successfully been grown further north.

Reproduction

Whereas other members of the family are wind-pollinated, this species is insect-pollinated. It is monoecious (both male and female flowers occur on the same tree), but self-incompatible, requiring cross-pollination for fruit set (Ambrose & Kevan, 1990). It is insect-pollinated and easily crosses with exotic species of chestnut such as *C. mollissima*. Flowering occurs in late spring to early summer and nuts mature in autumn of the same year. There is evidence that some individuals in natural habitats are the result of hybridization with Chinese or other chestnuts (Boland et al., 2000). As populations become smaller and more isolated, some large healthy trees are no longer within cross-pollination range and thus do not set fruit, restricting their reproductive potential. Seeds remain viable when they are kept moist and have been successfully stored for 3.5 years under controlled conditions (USDA Forest Service web site) but are normally only stored overwinter because they often begin germinating at the end of the stratification period. Seeds readily dry out and have reduced viability in nature unless soon covered by falling leaves or are buried by squirrels. In storage, seeds will dry out and lose viability if not kept moist. Chilling, through direct planting in the fall, or cold moist stratification, is necessary for good germination.

Although blighted or cut trees frequently re-sprout from the root collar, there is no evidence of clonal sprouting from the root systems beyond the collar region.

Survival

Despite the devastation that the chestnut blight has brought about, there are survivors throughout this species' range, including southern Ontario. Part of this can be explained by the frequent survival of root systems after the fungus has caused a girdling and death of the trunk; typically new growth arises from the root crown. These sprouts are also subject to blight cankers and trunk death, but often they grow large enough for flowering and fruiting before they also succumb to the blight.

Dispersal

Pollination is by insects but many isolated trees are beyond the range of pollinators for cross-pollination.

As is the case with many nut-bearing trees and shrubs, squirrels and chipmunks actively collect and bury or cache chestnuts, some of which are overlooked and successfully germinate and produce seedlings. Some native birds, such as wild turkeys and blue jays, may also be important in the dispersal of chestnuts.

Nutrition and interspecific interactions

This species typically occurs in mature forests with often dry but otherwise well-developed soils.

Although it is dependent on insects for pollination and squirrels and other animals for effective dispersal beyond the parent tree, neither appears to be limiting.

The chestnut blight fungus has had the most severe impact on American chestnut, reducing it from a once forest dominant in some areas of eastern North America to minor remnant stump sprouts and only occasionally a full sized tree. The forest animals that depended on the annual chestnut crop have lost a major food source.

Adaptability

American chestnut is a species of mature forest but does tolerate and thrive under moderate forest disturbance, such as selective forest harvesting. Seedlings can be successfully grown in cultivation and out-planted into appropriate soils and sites. However, it appears less tolerant of different soil types, doing poorly in alkaline clay-loam soils, such as are found in Guelph.

POPULATION SIZES AND TRENDS

The extent of the distribution does not seem to have changed significantly since the earliest records of 1817 (Moss & Hosking, 1983), even though numbers have been drastically reduced (likely greatly exceeding 50%) from when this species was a

dominant species in some areas of southern Ontario (e.g., Duncan, 1993; Morley, 2001). It is and was widespread throughout the Carolinian Zone but more predominant in some townships, such as in portions of Norfolk County and around Hamilton where the species was noted to be most abundant in the 1817 survey (Moss & Hosking, 1983). Duncan (1993) indicates that in the Dundas Valley, in the Hamilton area, American chestnut made up 25 or 30% of the forest. Potential habitat does exist in southern Ontario, but it is limited due to the high level of forest clearing.

Three surveys were conducted between the 1980s and 2001-02. In the most recent survey, selected populations were intensively documented, following a strategy of the American chestnut recovery plan (Boland et al., 2000). The occurrence of reproductive trees and blighted trees is compared in the appendix from the data of the original status report (Ambrose & Aboud, 1986), a survey in the 1990s (Boland et al., 1997) and the recent inventory (Tindall et al., 2004). Data were compiled and analyzed by Brian Husband. Although there are statistically significant differences in reproductive status and the occurrence of blight symptoms among the three surveys in some of the age classes, the different approaches to the three surveys may in part explain the differences, viz., the first survey's focus was on reproductive trees, the second, chestnut blight and its level of occurrence and virulence, and the third, a general assessment of the status of American chestnut (but dead trees were not recorded). Thus it is inconclusive whether the status of this species has significantly changed since the early 1980s although several large trees have been lost. It should also be noted that the devastation of this species is still within the time frame of a single generation of healthy trees.

In the most recent survey of 2001-2002, 682 individuals of all sizes were inventoried in detail, 85 of them were observed to be reproductive (individuals may have multiple trunks; counts are of individuals not trunks). An additional 13 trees of potential reproductive size and 7 smaller individuals were observed by the author in 2003. Some of these were in previously known sites, but four new sites were found while inventorying 24 county forests (total 1,306 acres) in an unrelated project in Norfolk County (Ambrose & Waldron, 2004). Another survey was recently conducted in 16 Long Point Region Conservation Authority forests (Draper, 2002). Of these, chestnut was recorded in 10 forests, 7 being new sites, but with only three trees over 8.5 cm diameter at breast height. This gives an idea of the number of undocumented populations in a core area such as Norfolk County. Nevertheless, we may be losing important individuals as large trees die and do not re-sprout, and many of the small sprouts that eventually die out; there is a continuing concern over the loss of genetic diversity until the blight can be brought under control. In summary, 101 trees of potentially reproductive size are known in 120 sites; it is estimated that there are 120-150 reproductive trees plus 1,000 or more smaller, non-reproductive individuals in Ontario. A comparison of sites with information from the first and last inventories is shown in Table 1. This table only includes those sites where a direct comparison can be made over this time period. For an additional estimation of trends, the appendix should be consulted.

Table 1. Ontario populations of *Castanea dentata* with comparative data.
Comparisons between surveys in 1979-1989 (first line) and 2001-2003 (second line, bold)

Site: no., name	# by size class (cm dbh) <10	<20	<30	<40	40+	flowers	seeds	seedlgs.	Blight	change, 1980s to 2000s
1. Scotland			1						no	
Jul 03			**dead**							**lost: tree cut down**
1a. Burford Nurs.	1				1	yes	yes		no	
Cinv: 2					**dead**					**decline: large tree died**
2. S. Glen Morris	2			1				yes		
Jul 03			**1**			**yes**	**?**	**no**	**no**	**decline: different tree**
5. Vienna	1				1	yes			no	
Cinv: 1										
6. Riverbend farm	1	2	2			yes		6	no	
Cinv: 3										
8. Springwater			1			yes			no	
Cinv: 13										
11. Arner			1		1	yes	yes	3	yes	**decline: large tree with healing canker died; sprouting**
Cinv: 2										
15. Walsh		1				yes			yes	
Cinv: 9										
16. Smith Tract	3	1				yes			no, yes	
Cinv: 1-2										
18. NW of Delhi		1								**lost: roadside fencerow removed**
Jul 03										
21. Wycombe		1?		1		yes			no	**same: original trees died and cut down, new tree to NW**
Jul 03				**1**		**yes**			**no**	
22. Backus Woods	11	7	2		1	yes	yes	3	yes	
Cinv: 75										
23. Spring Arbour			2			yes	yes		no	
Jul 03		**2**	**2**				**yes**	**yes**	**no**	**gain? original 2 trees died**
24. Armstrong Tract			1			yes			no	
Cinv: 10										
26. Sassafras Wds.	3	1				yes				
Cinv: 1										
27. Mineral Springs				2		yes	yes	3	no	
Cinv: 5-7										
28. Copetown		1				yes	yes		no	
Cinv: 2-3										
30. Gartshore			2			yes	yes		no, yes	
Cinv: 3+										
32. Cristie			1			yes			no	
Cinv: 1										
33a. Highgate	few		3							**loss: original 3 trees and sprouts all dead**
Oct 03 [W. Jay]										

Site: no., name	# by size class (cm dbh) <10	<20	<30	<40	40+	flowers	seeds	seedlgs.	Blight	change, 1980s to 2000s
34. Sunny Glades **Cinv: 9**	1		1			no			yes	
35. Smit's farm **Cinv: 2**	2			1	1	yes		1	no	
36. Warbler Wds. **May 03 [B. Bergsma]**		1			1 cut	yes			no	**decline; tree lost in housing devel.; sprout from cut tree?**
37. Mosa Tp. **Cinv: 2**			1			yes	yes		no	
38. Skunks' Misery **Cinv: 24**	300	3							yes	**[only part of site re-surveyed]**
40. Woodland Sch. **Jul 03**					1 **dead**	yes			no	**lost: stump where tree had been**
42. Clare Cycle **Cinv: 1**			1						no	
43. Hillcrest Park **Jul 03 + Cinv: 1**	1			1 **dead**		yes			yes	**decline: large tree dead, stump remains.**
44. Moore Rd. **Cinv: 10**	~20	1				yes	yes		yes	
45. St. Davids Gorge **Jul 03**		1	2			yes	yes		yes, no	**lost: one stump, others not found**
46. Short Hills **Cinv: 2**					1	yes		2	no	
47. N. Glen Morris **Jul 03**				1 **dead**		yes			0	**lost: tree dead, trunk 34cm dbh**

Second line notes: Cinv: 2001-02 chestnut inventory, numbers only, size and other data not available at this time. Month 03: observations by author or others as noted.

The loss of several large trees documented in Table 1 that were reproductive and healthy in the early 1980s is a concern; whether they are being replaced by recruitment is inconclusive. For an analysis of all the data from the tree surveys, see the appendix.

LIMITING FACTORS AND THREATS

The Chestnut Blight (*Cryphonectria parasitica*, formerly known as *Endothia parasitica*) was likely introduced on Asian nursery stock prior to its first observation in 1904 where it was observed killing American chestnut trees at the Bronx Zoo, New York City (Anagnostakis 1982). The blight spread rapidly throughout the range of American chestnut in the subsequent decades. It reached southern Ontario in the early 1920s and by the 1930s most American chestnut trees were infected and dying (web site,

Canadian Chestnut Council: http://www.uoguelph.ca/~chestnut/). The chestnut blight fungus has had a devastating effect on American chestnut in the last century, reducing the once locally dominant forest tree species to scattered remnant individuals or mere stump sprouts. Continuing loss of habitat in the Carolinian zone, including such activities as fenceline removal at sites 1 and 18 and the construction of a municipally approved housing development at site 36, are ongoing threats that result in the loss of trees. The lack of reproduction in many trees of potentially reproductive size is due to the considerable distance between such trees. Cross-pollination is thereby prevented and seeds are not produced.

Hybridization with exotic species may also be a significant factor, with preliminary evidence of hybrid origin of some individuals in some populations in Ontario. John Gerrath, a graduate student at the University of Guelph, is currently examining the collected specimens from the 2001-02 survey. However, it is uncertain whether this influence will be negative, by genetically swamping native stands and reducing their occurrence, or possibly positive, by giving some level of resistance to those surviving individuals. A comparison with the European chestnut is noteworthy here: it appears to have been strongly influenced by human activity, with movement beyond its original range as far back as Roman times, and hybridization with oriental species at an early time as well (Anagnostakis & Hillman, 1992). Selection of blight resistance in cultivated trees has been reviewed by Jaynes (1978). Hypovirulent strains of the blight fungus have moved through European wild chestnut populations and a natural recovery is occurring.

SPECIAL SIGNIFICANCE OF THE SPECIES

This was perhaps the most important deciduous forest tree species of eastern North America before the arrival of the blight fungus. Its lumber was easily worked and very durable, being used for a number of purposes from cabinetry and farm equipment to fence posts and rails. The nuts were an important food source for various wild mammals and birds as well as being valuable for both human and livestock food. There is considerable interest in both Canada and the United States in restoring this species to its former forest position.

Aboriginal peoples are reported to have made great use of this species in numerous medicinal remedies and as a staple food; the nuts were used directly or made into bread, a beverage or mixed with other staples such as corn. The wood had many uses in building and the bark was used to make a brown dye (Native American Ethnobotany Database, accessed May 2001).

EXISTING PROTECTION OR OTHER STATUS

The global ranking by NatureServe is G4 (apparently secure). In the American states, it is presumed extirpated (SX) in two peripheral states (Florida and Illinois),

critically imperiled (S1) in two states (Michigan and Kentucky) and District of Columbia, and imperiled (S2) or vulnerable (S3) in seven states (Delaware, Georgia, Tennessee, Indiana, Ohio, Maryland, and Maine) and Ontario (NatureServe, 2003). In Canada it has been designated as Threatened by COSEWIC in 1987, as well as listed as threatened by the province of Ontario. Ontario's Planning Act provides for the protection of significant portions of habitat of threatened species, but occupied habitats are being lost due to development. The Canadian Chestnut Council was founded in 1988 to bring awareness to the plight of this species and its potential for recovery.

There is currently a recovery team formed for this species and a recovery plan has been drafted (Boland *et al*., 2000); some of the information in the recovery plan has been summarized in this report. The current version of the recovery plan is available at: www.uoguelph.ca/~chestnut/ .The recovery plan proposes to: document all chestnut populations in Canada, promote recovery in the most critical of these populations, develop short-term management practices that will contribute to the conservation of the remaining genetic diversity of the species adapted to southwestern Ontario and assess more long-term strategies for managing chestnut blight. The latter includes seeking the identification or development of resistance in individual trees and working with potential biological controls such as naturally occurring hypovirulence in the blight organism.

Recovery through identification of natural resistance, and hypovirulent strains of the blight fungus that can be transferred to trees infected with virulent strains, is promising in principle. While early trials have been less than encouraging, signs of hope for these approaches remain (Griffin, 2000). Preliminary trials in Ontario with hypovirulence have been discouraging, whereas it has been very effective in controlling the blight in European forests and some positive results have been recorded in controlled settings in the US. *Ex situ* plantings of native chestnut are encompassed in the view of the recovery strategy, but have not been inventoried or assessed yet. Members of the Canadian Chestnut Council are actively pollinating naturally occurring trees and harvesting nuts for replanting. There is a difference of opinion within the recovery team as to whether breeding resistance into native trees via Asian species is a legitimate recovery action. Meanwhile, a breeding program is underway by the Canadian Chestnut Council, in partnership with similar operations by the American Chestnut Foundation.

TECHNICAL SUMMARY

Castanea dentata
American chestnut châtaignier d'Amérique
Range of Occurrence in Canada: southern Ontario

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* [calculation based on its occurrence in a little less than half of the 22,500 km² Carolinian Zone]	11,000 km²
• *Specify trend in EO*	Stable
• *Are there extreme fluctuations in EO?*	No
• *Area of occupancy (AO) (km²)* [calculation based on an estimated average of 10 hectares or 0.1 km² per site]	12 km²
• *Specify trend in AO*	Decline
• *Are there extreme fluctuations in AO?*	No
• *Number of known or inferred current locations*	120
• *Specify trend in #*	Probably declining. More sites known likely due to more intensive search effort.
• *Are there extreme fluctuations in number of locations?*	No
• *Specify trend in area, extent or quality of habitat*	Declining due to forest losses
Population Information	
• *Generation time (average age of parents in the population)*	Healthy trees can live for many decades. 20+ years to flowering but most large trees die
• *Number of mature individuals* [based on the recent survey with 85 reproductive trees + 16 counted by the author and Draper, 2002]	Estimated at 120-150
• *Total population trend:*	Probably declining
• *% decline over the last/next 10 years or 3 generations.*	>>50% in last 90 years
• *Are there extreme fluctuations in number of mature individuals?*	No
• *Is the total population severely fragmented?*	Yes, many mature trees are isolated and thus do not reproduce (due to self-incompatibility)
• *Specify trend in number of populations*	Uncertain but perhaps a slight decline.
• *Are there extreme fluctuations in number of populations?*	No
• List populations with number of mature individuals in each	101 documented individuals in 120 sites (not all populations have had complete counts)
Threats (actual or imminent threats to populations or habitats)	
- chestnut blight fungus - hybridization with Asian species of *Castanea* - general habitat loss and fragmentation in the Carolinian Zone	
Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?*	**Canada:** *ex situ* trees potentially stable; **USA**: Natural populations in jeopardy
• *Is immigration known or possible?*	Unlikely

• *Would immigrants be adapted to survive in Canada?*	Transplants: yes, if from appropriate source areas
• *Is there sufficient habitat for immigrants in Canada?*	Habitat is available for re-introductions
• *Is rescue from outside populations likely?*	No
Quantitative Analysis	N/A
Previous Status Assessed by COSEWIC in 1987 as Threatened	

Status and Reasons for Designation

Status: Endangered	**Alpha-numeric code:** **A4ace; B2ab(ii,iii,iv,v); C2a(i); D1**

Reasons for Designation: Once a dominant tree in well drained forests of the Eastern Deciduous Forest, this species was devastated by chestnut blight in the first part of the 20th century. The species is still present throughout most of its former range, but as a few scattered individuals that have sprouted from root crowns. Most of these succumb to the blight before reaching a substantial size and fewer than 150 are large enough to produce seed. The species requires cross-pollination and seed set is reduced because mature individuals are widely scattered. Threats to the species include the continuous presence of the blight, aging and attrition of the root crowns, land clearing in some remaining sites, and hybridization with other species.

Applicability of Criteria

Criterion A (Declining Total Population): Endangered under A4ace because there has been a well-documented decline of well over 50% in the number of mature trees within the last 70 years since chestnut blight spread across southern Ontario in the 1930s and 40s. Chestnut trees may reach fruiting condition in about 20 years, but usually succumb to blight as they reach maturity. Un-blighted trees lived for several hundred years. Seventy years thus represents fewer than 3 generations. Although American Chestnut occupies most of its former range, the AO has been reduced because the species now occurs as scattered individuals and some populations have been extirpated. Future losses will occur due to the deaths of root crowns.

Criterion B (Small Distribution, and Decline or Fluctuation): Endangered due to limited distribution, fragmentation and decline under B2 (a)+(b, ii-v) with EO about 11,000 km² but an AO of about 12 km². Severely fragmented because only about 150 mature individuals are known and since the species is self-incompatible pollination is severely limited. Continuing decline anticipated in the AO and the number of locations as individual populations are extirpated and land clearing continues. The quality of forest habitat is declining in the Carolinian Zone from a number of causes (forest fragmentation, pollution, global warming, invasive species, pest and diseases). The number of mature individuals is projected to decline as individual rootstocks age and die and are not replaced from seed.

Criterion C (Small Total Population Size and Decline): Endangered **C2ai** due to the small number of fruiting individuals (about 150) and very few mature individuals (<10) in any known population.

Criterion D (Very Small Population or Restricted Distribution): Endangered under **D1** due to the small number of mature individuals.

Criterion E (Quantitative Analysis): Not applicable.

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

A large number of individuals (listed in Ambrose & Aboud, 1986) enthusiastically provided information on locations of individual trees or populations during the original surveys in the late 1970s and early 1980s. Forestry staff in Ministry of Natural Resources (MNR) district offices shared information on known sites from their forest surveys. MNR also provided support funding for the original field surveys and staff time for the recovery planning process. World Wildlife Fund Canada provided funding for the earlier conservation biology study of this and other Carolinian species, as well as supporting the current recovery plan exercise, through the Endangered Species Recovery Fund, jointly with the Government of Canada's Millennium Partnership Fund. Dr. Colin McKeen provided his phytopathology skills in early assessment of and experimentation with naturally occurring hypovirulent strains of the blight fungus. Dr. Greg Boland advised graduate students to further our understanding of the dynamics of this disease and co-chaired the recovery team. Other members of the recovery team provided their expertise: Dr. Brian Husband, Ken Elliott, Gerry Waldron, and Melody Melzer. A large number of advisors provided input to the plan. The 2001-02 inventory was supervised by Drs. Husband and Boland; the summarized data and its analysis in the appendix were provided by the former. The fieldwork was organized by John McGrath and assisted by Jeff Tindall and Karen McKendry. The members of the Canadian Chestnut Council stand ready to assist and participate in recovery activities and studies. Andy Graham of the Ontario Soil and Crop Improvement Association reviewed the recovery plan and is ready to cooperate through his network of farm woodlot owners with chestnuts. Funding for the preparation of this status report provided by the Canadian Wildlife Service, Environment Canada.

Authorities Contacted

For the original status report all the MNR district offices within the range of this species were contacted and local records were obtained. More recent records were obtained from the Natural Heritage Information Centre as well as from individuals and the Canadian Chestnut Council.

INFORMATION SOURCES

Ambrose, J.D. 1987. *Castanea dentata. In* G.W. Argus, K.M. Pyer & C.J. Keddy (eds.). 1982-87. Atlas of Rare Vascular Plants in Ontario. National Museum of Natural Sciences, Ottawa.

Ambrose, J.D. & S.W. Aboud, 1986. Status Report on Chestnut (*Castanea dentata*), a Threatened Species in Canada. COSEWIC, Ottawa. 19 pp. + appendix.

Ambrose, J.D. & P.G. Kevan, 1990. Reproductive biology of rare Carolinian plants with regard to their conservation management, *In* G. Allen et al. (eds.) Conserving Carolinian Canada, proceedings of a workshop, Univ. of Waterloo Press, Waterloo.

Ambrose, J.D. & G.E. Waldron. 2004. Botanical inventory and natural heritage assessment of 24 Norfolk County forests. A report to Bird Studies Canada on behalf of the County of Norfolk (Ontario).

Anagnostakis, S.L. 1982. Biological control of Chestnut Blight. Science 215: 466-471.

Anagnostakis, S.L. & B. Hillman. 1992. Evolution of the chestnut tree and its blight. Arnoldia 52(2):2-10.

Argus, G.W., K.M. Pyer & C.J. Keddy (eds.). 1982-87. Atlas of Rare Vascular Plants in Ontario. National Museum of Natural Sciences, Ottawa.

Boland, G., J. Ambrose, K. Elliott, B. Husband, M. Melzer, & G. Waldron. 2000. National Recovery Plan for American Chestnut (*Castanea dentata* (Marsh.) Borkh.). Current version available at: www.uoguelph.ca/~chestnut/

Boland, G.J., M.M. Melzer, & D. Mooij. 1997. Location of American chestnut trees in southern Ontario; 1994-97. *In*: Biological control of chestnut blight with hypovirulence in southern Ontario. Eds. G.J. Boland, M. Melzer, and D. Mooij. Report to Ontario Forest Research Institute, Ontario Ministry of Natural Resources.

Duncan, B. 1993. The American chestnut: a Carolinian specialty. Wood Duck (Hamilton Naturalists' Club) 46(5): 78-79.

Draper, W. 2002. Botanical inventory and site assessment of 16 candidate natural heritage woodlands. Report for the Long Point Region Conservation Authority.

Farrar, J.L. 1995. Trees in Canada. Fitzhenry & Whiteside, Markham, Ontario.

Gleason, H.A. 1963. The New Britton & Brown.Illustrated Flora of Northeastern United States and Adjacent Canada, vol. 2. Hafner, New York.

Griffin, G.A., 2000. Blight control and restoration of the American Chestnut. J. Forestry 98(2):22-27 [special issue on chestnut loss and recovery].

Jaynes, R.A. 1978. Selecting and breeding blight resistant chestnut trees. Pages 4-6 *In*: Proceedings of the American Chestnut Symposium, Morgantown, West Virginia. January 4-5, 1978. Eds. W.L. MacDonald, F.C. Cech, J. Kuchok and C. Smith. West Virginia University Books, Morgantown, WV.

Morley, F. 2001. American chestnut in Spooky Hollow. Wood Duck (Hamilton Naturalists' Club) 55(4): 77-78.

Moss, M.R. & P.L. Hosking, 1983. Forest associations in extreme southern Ontario ca 1817: a biogeographical analysis of Gourley's Statistical Account. Can. Geographer 27:184-193.

NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: February 20, 2004.)

Tindall, J., J. Gerrath, M. Melzer, K. McKendry, B.C. Husband, & G. Boland. 2004. Ecological status of American chesntut (*Castanea dentata*) in its native range in Canada. Submitted to Canadian Journal of Forest Research.

Waldron, G. 2003. Trees of the Carolinian Forest: a guide to species, their ecology and uses. Boston Mills Press, Erin, Ontario.

Pertinent Web Sites

Canadian Chestnut Council. www.uoguelph.ca/~chestnut/
Environment Canada: Species at Risk in Canada.
www.speciesatrisk.gc.ca/Species/English/SearchDetail.cfm?SpeciesID=205
Native American Ethnobotany Database, compiled by Daniel Moerman.
www.umd.umich.edu/cgi-bin/herb/
NatureServe http://www.natureserve.org/explorer
Ontario Natural Heritage Information Centre (NHIC)
www.mnr.gov.on.ca/mnr/nhic/nhic.html
ROM/OMNR: Royal Ontario Museum/Ontario Ministry of Natural Resources Species at Risk Module. www.rom.on.ca/cgi-bin/cbcb/fastfact.pl?speciesID=27
USDA Forest Service:
http://64.233.167.104/search?q=cache:rBW0Y1U0IaAJ:ntsl.fs.fed.us/wpsm/Castanea.pdf

BIOGRAPHICAL SUMMARY OF REPORT WRITER

John Ambrose came to the University of Guelph Arboretum in 1974, after receiving a PhD in Botany from Cornell University. At the Arboretum, in addition to being the Curator, he developed a program based on the rare woody plants of the Carolinian Zone of southern Ontario, including field surveys, status reports and detailed studies of their population and reproductive biology. After 17 years there, he moved to the Toronto Zoo as Curator of Botany/Manager of Horticulture. There he developed new natural habitat exhibits and a naturalization program for peripheral lands of the site, in addition to his exhibit responsibilities. These reflect his growing interest in restoration ecology. In 1999 he left the Zoo to teach a new course in restoration ecology at the University of Guelph. He currently is self-employed and continues to work with endangered species recovery planning, serving on three recovery teams for Carolinian trees.

COLLECTIONS EXAMINED

All the major herbaria in southern Ontario as well as the national herbaria in Ottawa were searched for herbarium records; these were used to locate extant populations for the original status report and were recorded in that report. They, along with NHIC records and other more recent sight records, were the basis of the up-date survey in 2001-2.

The inventory crew spent two summers in the field making observations on known populations; the author spent several days revisiting selected sites missed by the inventory, plus 13 additional days in an unrelated project where chestnuts were found and reported here.

Appendix: Comparison of Reproductive and Blighted Individuals Over Three Time Periods

A) Incidence of flowering/fruiting; number of individuals reproductive (F) or non-reproductive (NF), with percentages shown in the diagram.

Survey	Tree dbh (cm)											
	0-9		**10-19**		**20-29**		**30-39**		**40-49**		**50+**	
	NF	F	NF	F	NF	F	NF	F	NF	F	NF	F
1986	383	2	11	12	5	17	0	16	0	4	0	5
1997	153	2	36	16	15	12	6	26	5	6	4	6
2003	182	10	76	24	18	18	4	21	3	4	1	8

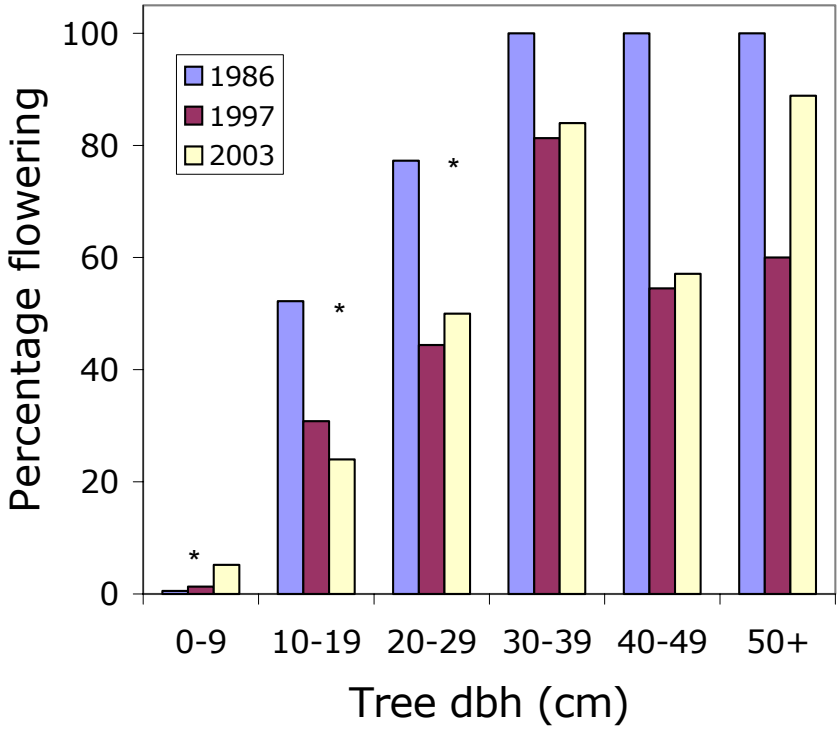

Chart 1. Percentage of reproductive trees by size class.
*indicates significant differences among the three surveys

B) Incidence of blight; number of individuals with blight (B) or no blight (NB) symptoms, with percentages shown in the diagram.

Survey	Tree dbh (cm)											
	0-9		**10-19**		**20-29**		**30-39**		**40-49**		**50+**	
	NB	B	NB	B	NB	B	NB	B	NB	B	NB	B
1986	350	32	17	7	14	8	11	4	3	2	4	1
1997	73	82	39	13	15	12	18	14	8	3	8	2
2003	130	47	67	39	17	20	15	9	0	8	6	3

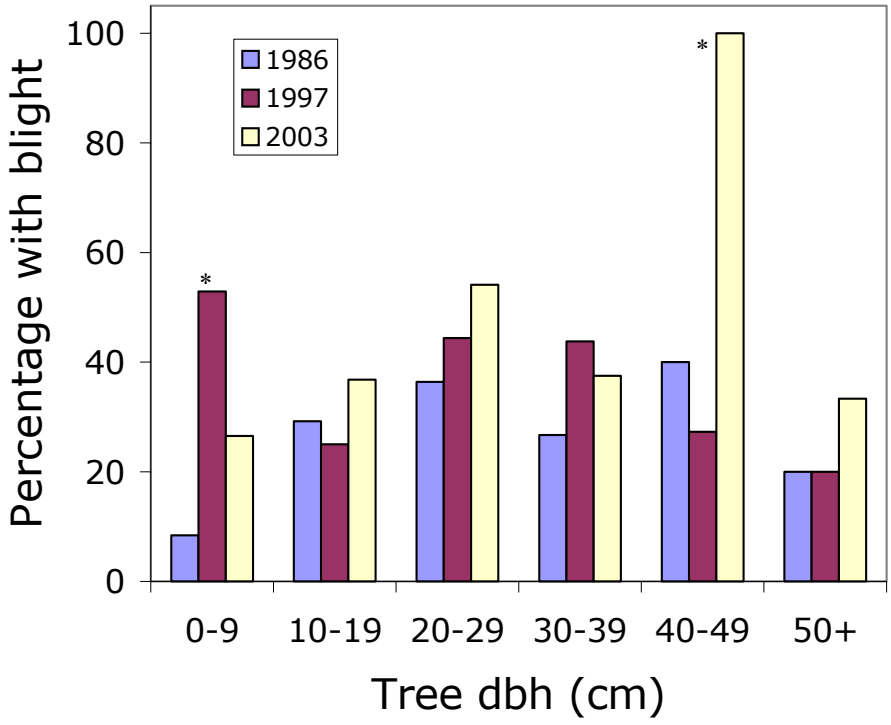

Chart 2. Percentage of blighted trees by size class.
*indicates significant differences among the three surveys

Brian Husband analysed the data of the three surveys referenced in the report and prepared the above charts. All statistics were based on Chi-square Contingency Analysis, which determines whether the frequency of trees with and without flowering or blight differs among the three surveys.