COSEWIC
Assessment and Update Status Report

on the

Dwarf Hackberry
Celtis tenuifolia

in Canada

Photo/image: M. J. Oldham/NHIC

THREATENED
2003

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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Previous report:

Klinkenberg, B. 1985. COSEWIC status report on the dwarf hackberry *Celtis tenuifolia* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 36 pp.

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Dwarf hackberry — Photo provided by M.J. Oldham, (NHIC) Peterborough, ON.

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COSEWIC
Assessment Summary

Assessment Summary – November 2003

Common name
Dwarf hackberry

Scientific name
Celtis tenuifolia

Status
Threatened

Reason for designation
A shrub of dry sandy or calcareous alvar woodland habitats found only at six disjunct and fragmented sites adjacent to the Great Lakes. Fewer than 1,000 plants have been documented. Threats include potential loss of habitat due to quarrying operations and sand pit expansion in eastern Ontario sites and significant losses in some years due to beetle infestations.

Occurrence
Ontario

Status history
Designated Special Concern in April 1985. Status re-examined and uplisted to Threatened in November 2003. Last assessment based on an update status report.

COSEWIC
Executive Summary

Dwarf Hackberry
Celtis tenuifolia

Species Information

Dwarf hackberry (*Celtis tenuifolia*) is a small tree or shrub of the Elm family with stiff, often divaricately branched twigs and grey bark. Its leaves are variably toothed along the terminal part of the blade. Its globose, orange-brown fruit has a sweet outer layer and contains a single seed; the fruit often remains on the trees through the winter. Common hackberry (*Celtis occidentalis*) also occurs through much of its range in Ontario.

Distribution

It ranges from the lower Mississippi to the Atlantic piedmont, with its distribution becoming scattered in the north with about 20 disjunct populations in the lower Great Lakes region. Six of these isolated populations occur in southern Ontario.

Habitat

In Ontario it occurs on dry, calcareous soils, sand spits and dunes or areas of shallow limestone bedrock (alvars), in open woodlands.

Biology

Dwarf hackberry is a perennial woody plant. Flowers are unisexual, both on the same plant, self-compatible and wind-pollinated. The fruit is mostly bird-dispersed. It occurs on very dry sites. Three of the populations occur with common hackberry, and intermediates exist that suggest the possibility of hybridization between these two native species.

Population Sizes and Trends

Six populations are known in Ontario with about 893 reproductive individuals. Populations appear to have remained steady from previous counts 10 years ago, with the observed increase likely representing a better knowledge of this species' distribution.

Limiting Factors and Threats

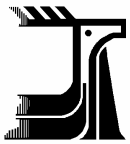
Bark beetles are known to cause a high level of mortality, 10% per year over two years was recorded in 1989-90. This past problem was not evident in the recent observations. The quarrying of limestone in areas of alvars in eastern Ontario and the potential of expanding sand extraction in another site are threats to the habitat of this species.

Special Significance of the Species

Dwarf hackberry occurs on sites of extreme drought and with a number of other rare species of plants. It is host to several rare insects, including beetles that have only recently been recognized in Canada. While not currently available in the landscape trade, it has potential for use in areas of extreme drought.

Existing Protection or Other Status Designations

It currently does not have protection under the Ontario Endangered Species Act, being listed only as Vulnerable there, and Special Concern in Canada.



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. On June 5, 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 and include 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 organizations (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership, chaired by the Canadian Museum of Nature), three nonjurisdictional 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
(After May 2003)

Species	Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* 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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Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

Update
COSEWIC Status Report

on the

Dwarf Hackberry
Celtis tenuifolia

in Canada

2003

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SPECIES INFORMATION

Name and Classification

Scientific name: *Celtis tenuifolia* Nutt.
Synonym: *Celtis occidentalis* L. var. *pumila* (Pursh) A. Gray
Common name: dwarf hackberry
Family: Ulmaceae (Elm Family)
Major plant group: Dicot flowering plant

Dwarf hackberry, *Celtis tenuifolia*, is a small tree or shrub. In the north, there is only one other species of *Celtis*, *C. occidentalis*, a medium to large tree. Analysis of morphological and molecular data did not suggest the occurrence of hybridization within three species of *Celtis* in the southern United States (Buck & Bidlack, 1998). However, in the Ontario populations that are sympatric with *C. occidentalis*, intermediates in a few characteristics (e.g., pedicel length, leaf l:w ratio, tip attenuation and serration distribution), suggest that some exchange may be taking place. The unclear distinction of the species of *Celtis* has been noted, as well as being taxonomically complex and in need of revision (Flora North America, 1997).

Description

Dwarf hackberry is a scrubby, many-branched shrub or small tree with one to a few trunks; it is commonly up to 5 m high, occasionally up to 10 m, and resembles witch-hazel (*Hamamelis virginiana*) in form when multi-trunked. Typical of many members of the family, trunks are composed of relays of oblique branches that secondarily become erect (i.e., all axes are sympodially plagiotropic). In vigorously growing individuals without interference or damage to branches (the exception in this species), the result is a silhouette that is similar to the vase form of American elm. Twig arrangement is also typical of the family, being two ranked and alternate (following the same arrangement of leaves the year before); in this species they are typically short and stiff and under some conditions they become divaricately branched or clustered, especially in response to browsing. Leaf bases are only slightly oblique (cf. strongly oblique in *C. occidentalis*:), with three distinct veins at the base; margins are entire to toothed mostly above the middle (cf. distinctly toothed to the base); blades ovate with a short tapered tip (lanceolate with a broad base and attenuate-falcate tip, 3.7-6.3 cm long cf. 4.2-12.0 cm). The bark is grey and smooth, developing small knobs and/or small fissures with age (cf. developing a thick corky pattern of knobs and ridges, sometimes recurved). Plants monoecious with unisexual flowers that appear with expanding leaves; fruit matures in late summer, globose, orange-brown coloured and smooth, sweet and sugary (cf. subovoid, olive-purple, becoming puckered, tasteless to bitter), pedicels 3-8 mm long (cf. 9-18 mm).

DISTRIBUTION

Global range

Dwarf hackberry is a North American species with a distribution primarily from the lower Mississippi Valley to the Atlantic piedmont and coastal plain. Its distribution is from eastern Texas and Oklahoma to southern Missouri across to Virginia and south to the gulf coast. There are outlying populations in western Illinois, northern Indiana and Ohio, and southern Michigan and Ontario (Figure 1). Keddy (1984) provides a general global distribution and Dunster (1992) shows detail of disjunct populations and limits of glaciation, duplicated below:

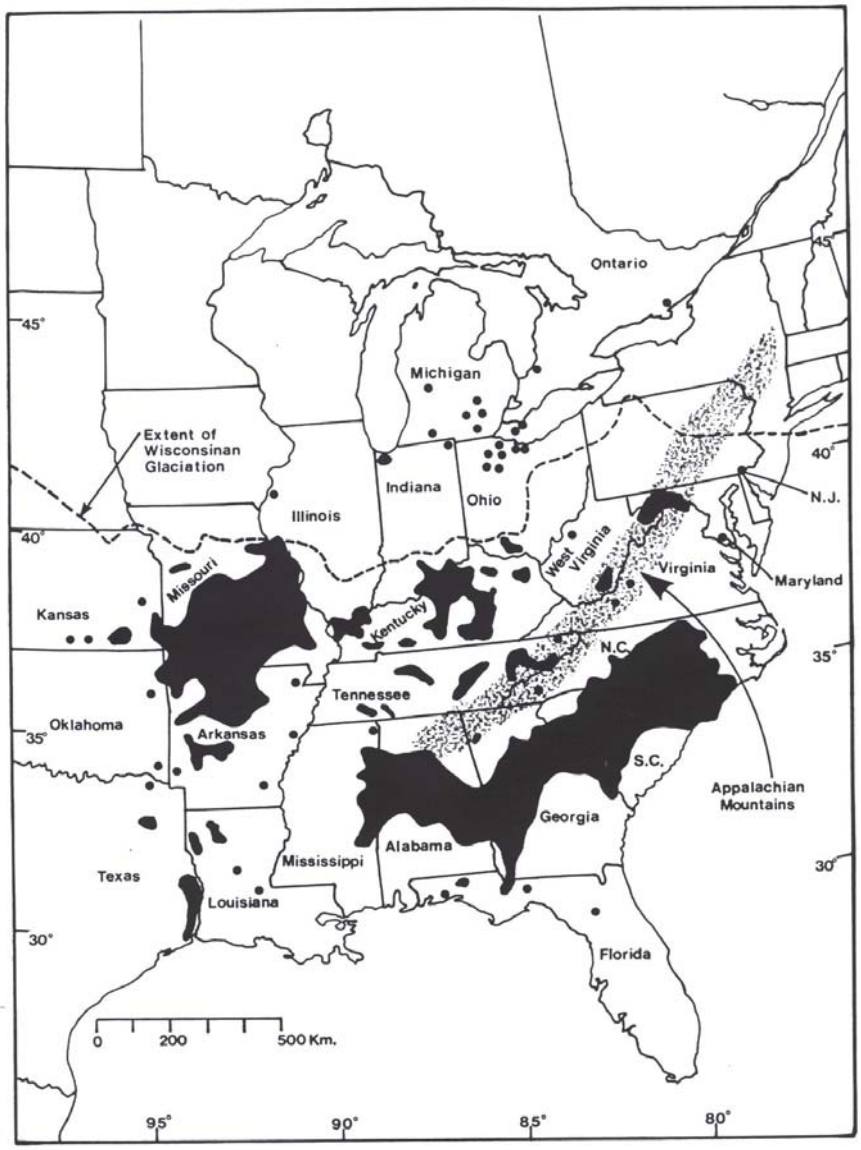

Figure 1. Global distribution of *Celtis tenuifolia* (Dunster, 1992).

Canadian range

In Canada, the species is known in only six non-contiguous locations, all in Ontario, and many of these have been recognized only recently. The first collection was in the Port Franks area in 1907. At Point Pelee it was not collected until 1963 (Pt. Pelee National Park, 1991), and then later described as widespread but uncommon (Maycock et al., 1978). Core (1948) did not list this species for the Erie Islands. It was first collected on Pelee Island in 1958; Campbell & Reznicek (1977) also reported it as a recent record for Pelee Island. The Point Anne population was not documented until 1982, and the other two sites in the Belleville area were not documented until 1991 and 1993 (Figure 2). The species' range covers an extent of occurrence of about <5,000 km^2 (excluding the region between the disjunct localities in southwestern Ontario and eastern Ontario); the species occupies about 18.5 km^2 of habitat.

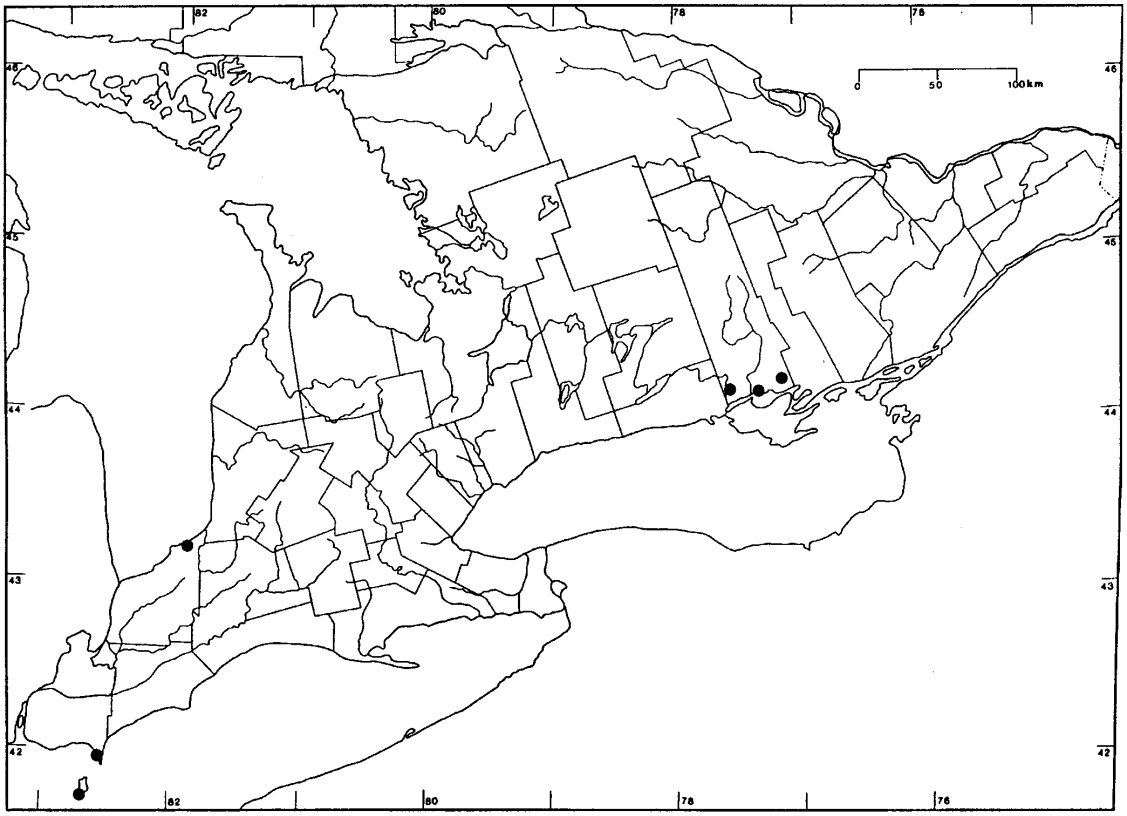

Figure 2. Distribution of *Celtis tenuifolia* in Canada (only in southern Ontario).

HABITAT

Habitat Requirements

In Ontario, this species occurs in two similar types of habitats, 1) dry, sandy sites with open woods near lakeshores of Lake Erie, Lake Huron and slopes above the Trent River: Grand Bend, Point Pelee, Fish Point (Pelee Island) and Stirling Slope; and 2) dry calcareous sites (clay-loam over limestone, i.e., alvars) in open woods: interior Pelee Island, Point Anne and Lonsdale. The sandy soils tend to have a large calcareous component and a pH above 7. The open habitats appear to be early successional woodlands and/or open due to extreme droughty conditions.

In Ontario, the species occurs in dry open woodlands with the following species: *Quercus velutina, Q. muehlenbergii, Q. prinoides, Q. rubra, Juniperus virginiana* and *Rhus aromatica* (Klinkenberg, 1984). Wagner (1974) noted the following additional species as associates in Michigan: *Carya ovalis, Ceanothus americana, Juglans nigra, Lonicera tatarica, Pyrus coronaria, Pyrus malus, Quercus coccinea, Rhus glabra*, and *Sassafras albidum*.

Trends

There has not been a significant change in the habitats of these specific sites, although some are threatened by expansion of limestone quarrying or sand extraction operations. Similar habitats were surveyed on Pelee Island and the alvar sites of eastern Ontario and some extensions of known populations were found; it is questionable that these are actual population expansions since the last survey—they more likely represent discoveries of previously unknown but well established populations (i.e., Stirling Slope and Lonsdale).

Protection/Ownership

Fish Point and parts of the Grand Bend population are protected as provincial parks; Point Pelee is a national park; part of the Port Franks area of Grand Bend is a Nature Conservancy of Canada nature reserve; parts of the site of the Grand Bend population, inland Pelee Island, Point Anne, Stirling Slope and Lonsdale are privately owned. The expansion of limestone quarry operations in eastern Ontario is reducing potential habitat for this and other significant species.

BIOLOGY

General

Dwarf hackberry is a drought-tolerant small tree or shrub occurring in open woodlands, including alvars and near-shore sand deposits. It is wind-pollinated, bird-dispersed and a food plant for a number of host-specific and often rare insects.

Reproduction

This species is monoecious with unisexual flowers, solitary or in clusters of two or three. The flowers, appearing in late May to early June, are wind-pollinated. The fruit, a drupe with a single seed and sweet mesocarp, matures in late summer and is primarily bird-dispersed, but mammals, also, are known to consume the fruit of *Celtis* (Cypher and Cypher, 1999). Self-compatibility was confirmed on one isolated individual in the author's garden in Guelph. Elais (1970) suggests that some species of *Celtis* may be apomictic but no confirmation of this is known. No other form of asexual reproduction was observed. Three of the populations occur with common hackberry, and forms that appear to be intermediates exist, which suggests the possibility of hybridization between these two native species.

Survival

Individual trees could be expected to survive for several decades. Dunster (1992) aged 16 of the largest trees at Northville (part of the Grand Bend population) and Point Pelee; she found ages between 40 and 64 years (adjusted to the height of coring). Trees in dynamic locations are likely more short-lived; along the west shore of Point Pelee and Fish Point the loss of trees has been documented following changing lake levels and severe storms. Dunster (1992) found a high level of infestation of bark beetles and an annual mortality associated with the beetles of 10% at Point Pelee, during two years of observation. She also found very low survival for 1-3 year old seedlings.

Physiology

This perennial woody species occurs primarily below the southern limits of glaciation, with the outlying populations in the Great Lakes region being the exception. One would expect that the individuals in these populations might be limited by the occurrence of localized moderate microclimates. However, in cultivation, the species thrives much further to the north, with known specimens in Ottawa and Guelph. In Guelph, seedlings readily establish from a single parent tree in nearby uncultivated areas. Thus, it is not restricted even at early life stages from far cooler climates than in its natural range. Most of the sites where it occurs are dry and calcareous, and thus with a high pH. Exceptions include a few sites on sand dunes in the Grand Bend area where the soils are slightly acidic (Dunster, 1992), although Wagner (1974) found pH readings of 8+ at this site. The adaptations of this species allow it to maintain a relatively high rate of photosynthesis during prolonged droughts even though it exhibits reduced stomatal conductance (Kubiske and Adams, 1993).

Dispersal

Dwarf hackberry is wind pollinated. Its seeds are likely most effectively dispersed by fruit eating birds (who consume the whole fruit and defecate the seed later), though mammals are no doubt responsible for some local dispersal. Dunster (1992, Figure 2)

maps the occurrence of the Great Lakes disjunct populations and the Mississippi flyway (i.e., of migrating birds), showing the high coincidence between the two. Raccoons (*Procyon lotor*) have been documented as ingesting *Celtis occidentalis* fruit, but germination rates of seeds were significantly lower that non-ingested controls (Cypher and Cypher, 1999); however, it was recognized that the benefits of dispersal may outweigh a reduction in germination rate.

Nutrition and Interspecific Interactions

This species thrives on dry and often calcareous sites. The local site conditions may help maintain open wooded habitats, reducing the development of heavy shading that would likely cause it to decline.

A number of butterflies, gall insects, a scale, twig borers and bark beetles use this species as their host plant. Many have a minor impact but some, especially the bark beetles (Bright et al., 1994), are associated with a significant level of mortality (Dunster, 1992); one species of gastropod was observed voraciously browsing on seedlings (Dunster, 1992).

Adaptability

Dwarf hackberry tolerates dynamic conditions with periodic disturbance as well as drought and poor calcareous stony or sandy soils. It can be cultivated easily and transplanting cultivated plants for re-introductions should not be a significant challenge, if such action is considered a viable recovery strategy.

POPULATION SIZES AND TRENDS

Populations were resurveyed in 2002 and compared with earlier records (Table 1). While there are some large populations, a high rate of turnover was observed at Point Pelee, with a10%/year mortality over two years, in 1989-90, due to mortality caused by bark beetles (Dunster, 1992). However, this may be a cyclical occurrence; significant levels of mortality were not observed in any population in 2002. Since the first status report of 1984, the Point Anne site has been confirmed and two additional sites in the nearby region have been documented.

Most of the numbers likely represent a steady population size, with some possible local increases. For example, Fish Point lost one large specimen along the west edge of vegetation due to lake action in the 1980s, maintained 4 mature individuals away from the lake and gained several new non-reproductive saplings. Point Pelee was more difficult to assess, with a dispersed population and insufficient time to re-inventory the entire 4+ km long site, however, numerous individuals were observed where surveyed. Monitoring of a few precisely located groups of individuals would give a better determination of trends. The Ipperwash to Pinery population is the largest in numbers and range and appears to be maintaining a steady size. The Pinery site was surveyed

for only one day and included about a third to a half of the known area of this species. The Hastings County populations contain individuals that appear to be old in mature habitats, so these sites are likely recent discoveries of established populations rather than a recent expansion of the species. A local naturalist showed us one population and two field volunteers helped find the individuals in the three sites over two days, so the counts likely represent close to the full populations of those sites, though other regional alvars are possible sites of undocumented populations.

Table 1. Actual counts of Ontario populations of *Celtis tenuifolia.*

#	Population	Klinkenberg, 1984	Dunster, 1992 * [+other]	2002
1a.	Essex Co., Pelee Is., Red Cedar Savannah	1	--	Only C. occ. found
1b.	Pelee Is., Fish Point	5	--	5+7+?; +Co/Ct?
2.	Point Pelee National Park	widespread and uncommon sporatic stands within 3 X 10 km area	136+48+715	33+5+2 in one area; +Co/Ct?
	Lambton Co.,			
3a.	Ipperwash Port		3b. 473 +781+1813	3b: 655+655+few
3b.	Franks/Northville			3c:34+25+150
3c.	Pinery Provincial Park			
4.	Hastings Co., Point Anne	--	[1st obs.1982,few trees]	2+0+5; + Co/Ct? 7+0+6
5.	Stirling Slope	--	[1stobs.1991,1-few (+1 outlier)]	23+2+few
6.	Lonsdale	--	[1st obs.1993, 6 plants]	2+1+2; + Co/Ct? 4-1-1

*size classes: reproductive trees+saplings/non-reproductive+1-3 year seedlings.
Co/Ct? = forms that are intermediate between the two species, with *C. occidentalis* present in these habitats.
For an estimate of the total Ontario population, see the Technical Summary [it is estimated that there may be about 35 trees at site 3b].

LIMITING FACTORS AND THREATS

Twig-boring insects were found to be associated with a significant level of mortality (10% per year) at Pt. Pelee (Dunster, 1992). There were no observations of significant mortality in 2002; the bark beetle may be of local and cyclical occurrence. Shade, due to successional forest development, is a potential limiting factor; however, these populations occur on droughty sites (sand spits, dunes and alvars) and with the recent summer droughts they have survived well, as other forest species that could cause shading have been held in check. In 2002, no evidence of decline of individuals due to shade was observed. In eastern Ontario, there is the threat due to habitat being lost to quarry operations; at Stirling Slope, the expansion of the adjacent sand pit is a threat. The intensification of cottage development on Pelee Island is another potential threat.

SPECIAL SIGNIFICANCE OF THE SPECIES

There are no listings for this species in the Native American Ethnobotany Database, but there are 14 for *Celtis occidentalis* for a variety of medicinal purposes, as well as its use in various food preparations. No doubt the tasty fruit of this species was also consumed and possibly used for similar medical purposes. Dwarf hackberry was found to be the host to several beetles not previously recorded in Canada (Bright et al., 1994), as well as butterflies and other insects. Being extremely drought-tolerant, it performed well in cultivation under the extreme summer heat and drought of the past few summers. It is currently available only through native plant nurseries but has potential for wider use as a small landscape tree.

EXISTING PROTECTION OR OTHER STATUS

NatureServe (2003) lists this species at globally secure (G5), nationally unranked for USA (N?) and imperilled (N2) for Canada. At the sub-national level, it is listed as imperilled (S2) in Ontario and New Jersey and vulnerable (S3) in Michigan, Ohio, Illinois and North Carolina. Only in Pennsylvania is it ranked as apparently secure (S4); for all other states in its central range it is ranked as reported (SR) or unranked (S?).

In Canada it is listed as Vulnerable in Ontario and as Special Concern nationally.

SUMMARY OF STATUS REPORT

Dwarf hackberry is known to occur in six populations in southern Ontario, as part of about twenty disjunct populations in the southern Great Lakes region that are separated from the main distribution of the species south of the limits of glaciation in eastern North America. As a species of severe and dynamic habitats, only a few individuals appear to reach a maximum age of 40-65 years, with much mortality of juveniles and some continuing losses of reproductive individuals due to natural or human disturbance. In 2002, populations appear to be holding steady compared to the inventory of 1984 and precise counts in 1989-90; increases likely represent more rigorous surveying and the finding of previously unknown sites. Habitats of the six sites appear secure except for the threat of limestone quarrying on alvar sites and sand extraction in eastern Ontario.

TECHNICAL SUMMARY

Celtis tenuifolia
Dwarf hackberry micocoulier rabougri
Range of Occurrence in Canada: Ontario

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* Based on polygon around sites, excluding the large area between the southwestern and eastern Ontario populations.	<5000 km²
• *Specify trend in EO*	Stable
• *Are there extreme fluctuations in EO?*	No
• *Area of occupancy (AO) (km²)* Based on an approximation of habitats occupied.	<20 km²
• *Specify trend in AO*	Stable
• *Are there extreme fluctuations in AO?*	No
• *Number of known or inferred current locations*	6
• *Specify trend in #*	increase, but likely reflecting old populations not previously known vs. expansion
• *Are there extreme fluctuations in number of locations?*	No
• *Specify trend in area, extent or quality of habitat*	Stable
Population Information	
• *Generation time (average age of parents in the population)*	several decades
• *Number of mature individuals*	893 (based on counts and additional estimates)
• *Total population trend:*	Stable
• *% decline over the last/next 10 years or 3 generations.*	N/A
• *Are there extreme fluctuations in number of mature individuals?*	No
• *Is the total population severely fragmented?*	Ontario populations and others at northern range widely separated
• *Specify trend in number of populations*	Slow increase based on new discoveries of old sites
• *Are there extreme fluctuations in number of populations?*	No

List populations with number of mature individuals in each:

Pelee Island	5	Pt. Anne	2
Pt. Pelee	136	Sterling Slope	24
Ipperwash-Pinery	724	Lonsdale	2

Threats (actual or imminent threats to populations or habitats)	
Bark beetles (10% mortality/year: Dunster, 1992). Loss of habitat through limestone quarrying, sand extraction and cottage development.	
Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* **USA:** Imperilled, vulnerable to apparently secure.	
• *Is immigration known or possible?*	Possible, via migratory birds
• *Would immigrants be adapted to survive in Canada?*	Yes, if from northern populations
• *Is there sufficient habitat for immigrants in Canada?*	Yes
• *Is rescue from outside populations likely?*	Possible but unlikely
Quantitative Analysis	N/A
Current Status COSEWIC: Threatened	

Status and Reasons for Designation

Status: Threatened	**Alpha-numeric code: Met criteria for Endnagered, B1ab(iii,v)+2ab(iii,v) but was designated Threatened, B1ab(iii,v)+2ab(iii,v); C2a(i)' D1_2. because it is not at imminent risk of extirpation.**
Reasons for Designation: A shrub of dry sandy or calcareous alvar woodlands habitats found at only six disjunct and fragmented sites adjacent to the Great Lakes. Fewer than 1000 plants have been documented. Threats include potential loss of habitat due to quarrying operations and sand pit expansion in eastern Ontario sites and significant losses in some years due to beetle infestations.	

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Mike Oldham provided current records from the Natural Heritage Information Centre (Peterborough, ON). Gerry Waldron and Paul O'Hara provided insight from their field observations and assisted with field studies, especially in eastern Ontario. Ed Heuvel showed us the sites on the Stirling Slope. Parks Canada and the Ontario Ministry of Natural Resources provided access to the lands that they manage and their staff (Vicki McKay for Pt. Pelee and Alistair MacKenzie for Pinery) provided valuable input from their recent records. Katherine Dunster allowed the use of her distribution map.

LITERATURE CITED

Bright, D.E., R.E. Skidmore & K.J. Dunster 1994. Scolidae (Coleoptera) associated with dwarf hackberry, *Celtis tenuifolia* Nuttall, in Ontario, Canada. Coleopterists Bulletin 48(1):93-94.

Buck, G.W. and J.E. Bidlack 1998. Identification of *Quercus* and *Celtis* species using morphological and electrophoretic data. Proc. Oklahoma Acad. Sci. 78:23-33.

Campbell, C.A. & A.A. Reznicek 1977. New vascular plant records on Pelee and East Sister Islands, Essex County, Ontario. Can. Field-Nat. 92(1):384-390.

Core, E.L. 1948. Flora of the Erie Islands: an annotated list of vascular plants. F.T. Stone Laboratory, Ohio State University, contrib. No. 9.

Cypher, B.L. and E.A. Cypher 1999. Germination rates of tree seeds ingested by coyotes and raccoons. Amer. Mid. Naturalist 142(1):71-76.

Dunster, K.J. 1992. The Ecology of Two Northern Marginal Disjunct Populations of *Celtis tenuifolia* Nutt. in Ontario, Canada. PhD thesis, University of Toronto. 192 pp.

Elais, T.S. 1970. The genera of Ulmaceae in the southeastern United States. J. Arnold Arb. 51:18-40.

Flora North America Editorial Committee, 1997. Flora of North America North of Mexico, vol. 3. New York and Oxford (also see website).

Keddy, C.J. 1984, *Celtis tenuifolia*, in G.W. Argus, K.M. Pryer, D.J. White & C.J. Keddy (eds.), Atlas of the rare vascular plants of Ontario. National Museum of Natural Sciences, Ottawa.

Klinkenberg, B. 1984. Status Report on Dwarf Hackberry (*Celtis tenuifolia* Nutt.). A Rare Species in Canada. COSEWIC, 31pp.

Kubiske, M.E. & M.D. Adams 1993. Stomatal and nonstomatal limitations of photosynthesis in 19 temperate trees species on contrasting sites during wet and dry years. Plant Cell and Environment 16(9):1123-1129.

Maycock, P.F, A.A. Reznicek & D.R. Gregory 1978. Flora of Point Pelee National Park, Essex County, southern Ontario. Parks Canada, Cornwall.

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

Point Pelee National Park, 1991. Summary of Dwarf Hackberry (*Celtis tenuifolia*), Point Pelee National Park.
Wagner, W.H. Jr. 1974. Dwarf Hackberry (Ulmaceae: *Celtis tenuifolia*) in the Great Lakes Region. Mich. Bot. 13:73-99.

Pertinent Web Sites

Environment Canada: Species at Risk in Canada. www.speciesatrisk.gc.ca/Species/English/SearchDetail.cfm?SpeciesID=247
Flora North America, volume 3, *Celtis*: http://hua.huh.harvard.edu/cgi-bin/Flora/flora.pl?FLORA_ID=12395 accessed June 13, 2002).
Native American Ethnobotany Database, compiled by Daniel Moerman. www.umd.umich.edu/cgi-bin/herb/ (accessed January 17, 2002).
NatureServe Explorer, an online encyclopedia of life [web application]. 2001 version 1.6, Arlington, Virginia, USA: NatureServe. Available: http://www.natureserve.org /explorer (accessed January 17, 2002).
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 and click on Species as Risk.

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.

AUTHORITIES CONSULTED

Mike Oldham of the Natural Heritage Information Centre was consulted for current records. Parks Canada and the Ontario Ministry of Natural Resources were contacted for permission to study the populations on lands under their management and discuss management options and records that they maintained locally.

COLLECTIONS EXAMINED

Collections made by the author and deposited at the University of Guelph Arboretum were reviewed. Other collections are summarized by Klinkenberg (1984). New sites at Stirling Slope and Lonsdale were revealed by the NHIC records. A total of 61 person hours were spent in the field revisiting the 6 known sites and nearby areas of similar habitat. The Hastings County sites were surveyed with a team of 3 individuals plus a local naturalist who knew the Stirling site. In general, most of the time was spent at sites where the population records were more precise. It should be noted that due to the size of the Point Pelee National Park habitat, the entire area was not surveyed and only about one-third to one-half of the area of Pinery Provincial Park could be surveyed in the course of one day of fieldwork.