

Provincial (Nova Scotia) Status Report

on

Black Ash *Fraxinus nigra*

prepared for

Nova Scotia Department of Natural Resources

by

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EXECUTIVE SUMMARY

Species information

Black Ash are broad-leafed hardwood trees belonging to the Olive Family (Oleaceae). They are generally 18 to 21 m tall with large spreading or ascending branches. The leaves are opposite and compound with 7 to 11 oval to lance-shaped leaflets; leaflets have no stalk. Clusters of rusty hairs are apparent where leaflets join petiole. Trunk is gray in colour and smooth to corky on young trees and scaly on mature trees. Black ash usually produces inconspicuous flowers that appear in the spring before leaf-out in clusters at branch tips. Fruit is a winged, flatten, single seeded samara that is borne in terminal or lateral branches.

Distribution

Globally, black ash ranges from western Newfoundland west to southeastern Manitoba, and south to Illinois and northern Virginia. In Nova Scotia, black ash is currently known from all counties, except Yarmouth, Shelburne and Richmond counties. Historic records exist for Yarmouth and Shelburne Counties.

Habitat

In Nova Scotia, Black ash is typically found in poorly drained areas often along swampy woodland stream and river banks with moving water.

Biology

Black ash are wind-pollinated and flower before leaf-out in late May or early June. Seeds are produced at 1 to 8 year intervals and are dispersed from October to the following spring. In Nova Scotia, total seeds produced yearly per tree ranged from 2 to 1500. Black ash seeds stay in dormancy between 2 to 8 years and seedlings are poor competitors. Black ash can sprout vigorously from stumps after cutting; most regeneration is occurs through this means. Black ash is slow growing, moderately long-lived with a typical longevity of 130 to 150 years. Age or size at maturity is unknown. Black ash is particularly susceptible to fungal diseases, poor growth and stunting.

Population sizes and trends

Black ash is reported from 35-40 sites in 11 counties of Nova Scotia since 2000; other unconfirmed sites exist. Due to their sparse nature, it is likely that more populations will be discovered in the future with additional search effort. Mature individuals are poorly known and only 12 are known to occur, although it is likely that more are present. Total number of known specimens in Nova Scotia is approximately 1000.

Limiting factors and threats

Habitat loss and alteration of wet areas is likely the most prevalent threat for Black ash at present in Nova Scotia. Historical threats may have included over-harvest for cooperage. Other current threats may include selective harvest of mature black ash trees for crafts, transplanting trees from non-native stock and die back. Although not yet documented in Nova Scotia, serious future threat for all ash species exists from the exotic beetle, the Emerald Ash Borer, which is spreading quickly in Ontario and Quebec and severely decimating populations of ash in its path.

Special significance of the species

Black ash has unique features that enable it to be peeled into thin strips and bent which make it a preferred species for basketry, furniture, interior finish and as a veneer. Aboriginal Peoples of northeastern Canada and the United States historically and currently use black ash in basket making, including the Mi'kmaq of Nova Scotia. Several black ash hybrids and cultivars are used in landscaping.

Existing protection

Black ash is designated as a Yellow species in Nova Scotia. It has a provincial general status rank of s3, no Canadian national status rank and a global status rank of G5. It is ranked as S5 (secure) in Ontario and New Brunswick, S4S5 (apparently secure to secure) in Quebec, S3 (Vulnerable) in Manitoba, Newfoundland (Island), and Nova Scotia, and S2 (imperiled) in Prince Edward Island.

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SPECIES INFORMATION

Name and classification

Scientific name: *Fraxinus nigra* Marshall

Common names: Black Ash (English), Frêne noir (French), Wisqoq (Mi'kmaq), wikip (Maliseet), Swamp ash (English), Basket ash (English), Brown ash (English), Hoop ash (English), Water ash (English), American black ash (English), Canadian ash (English), Splinter ash (English)

Synonyms: *Fraxinus sambucifolia* (Lam.)

Family: *Oleaceae*, (the Olives)

Order: Scrophulariales

Class: Magnoliopsida (Dicotyledons)

Morphological description

Black ash is a broadleaved hardwood that reaches average heights of 2.45 to 15.5 m with a diameter at breast height from 2.0 to 38.6 cm across sites in Nova Scotia (Hill-Forde 2004); most specimens in Nova Scotia tend to be less than 10 m tall (Hill-Forde 2004). Mature trees can reach average heights of 15 to 21 m (Grimm 1962). It is a very slow-growing tree (Erdmann et al. 1987).

Black ash has stout ascending branches that tend to bend towards the trunk and form a narrow and open crown. The bark is grey and rough with rounded, soft, corky ridges on young trees. On older trees, the bark is grey with near-vertical, narrow, scaly strips (Muenscher 1946; Harlow and Harrar 1979). Roots are shallow and wide-spreading (Harlow and Harrar 1979) and are subject to windthrow (USDA and NRCS 2006).

Branchlets are stout and green with purple, raised lenticels when young. Branchlets become pale greyish brown or tan as they age with the lenticels still noticeably raised from the otherwise smooth hairless twig surface. The buds are dark brown to black and downy. In black ash, the first pair of lateral buds is separated from the terminal bud by a short internode; lateral buds are typically smaller than terminal buds. Terminal buds are ovate, pointed, 1/4 to 1/2 inch long and covered by 4 to 6 scales (Grimm 1962; Muenscher 1946).

Leaves are opposite and compound with 7 to 11 oval to lance-shaped leaflets. Leaflets are blunt at the base and stalkless; each is finely toothed and tapered to a long slender tip. Clusters of distinctive rusty hairs (i.e., rachis tomentose) occur where leaflets join the leaf stalk or rachis (Muenscher 1946). Leaves are dark green above and lighter below.

Flowers are small and inconspicuous and appear prior to leaf out in late May to early June. Black ash are usually dioecious, but can be monoecious. Female flowers occur in loose panicles and male flowers in tight dense clusters (USDA and NRCS 2006).

Fruit are elongated, winged, single-seeded samara borne in terminal or axillary clusters (USDA and NRCS 2006). The seed is flattened and completely surrounded by the wing. The seeds ripen from August to September and are dispersed through to early spring. Seeds must experience stratification to break dormancy.

Genetic description

Variants are not recognized in Black ash (USDA and NRCS 2006).

Heterozygosity of Nova Scotia populations (Kejimikujik National Park, Caledonia and Oxford) for Black ash was compared to those from New Brunswick, Quebec and Manitoba. All alleles found in seed from trees at Kejimikujik and Caledonia were also found in Oxford, and all Oxford alleles were found in New Brunswick populations. However, four alleles were present in New Brunswick populations that were absent in the Oxford samples. This implies that, although Nova Scotia black ash have retained high levels of heterozygosity, the small population size has led to a loss of some of the less common alleles (Simpson et al. 2008).

Black ash at one location in Cumberland County showed signs of hybridization, appearing to have the morphological characteristics of black ash and another ash species, although the other ash species was not identified (Hill-Forde 2004).

Fallgold, a seedless horticultural cultivar of black ash, is available at some greenhouses (Hill-Forde 2004).

DISTRIBUTION

Global range

Black ash ranges from western Newfoundland to southeastern Manitoba and southwards to Indiana and Virginia (Figure 1) (Benedict and David 2000, Ronald 2001).

Canadian range

Within Canada, black ash is found on the western coast of the Island of Newfoundland, New Brunswick, Prince Edward Island, New Brunswick, Quebec, Ontario and southeastern Manitoba (Wright and Rauscher 1965).

Nova Scotia range

Records for black ash in Nova Scotia are scattered, limited in accessibility and in many cases were incomplete or had been destroyed (Hill-Forde 2004; Appendix 1). In Nova Scotia, black ash has historically occurred from northern Cape Breton south to Lunenburg and Annapolis counties with relatively fewer individuals recorded in Digby, Shelburne and Yarmouth counties. Since 2000, individual trees or small stands are known from all counties in Nova Scotia (Figure 2), except Yarmouth, Shelburne and Richmond counties. It

is presumed that most of these recent records are naturally occurring; however there have been considerable efforts to transplant the species in areas where it does not currently occur using greenhouse stock, especially on Mi'kmaw reserve lands such as at Pictou Landing, Bear River and Eskasoni (Mark MacPhail & Frank Meuse Jr., pers. comm.).

New records of black ash continue to be documented as people become aware of its apparent rarity and speculated decline. It is thought that additional records are likely to be brought to light in the future, including in areas where the species is not currently known. The apparent absence from several counties may reflect a lack of survey effort rather than true absence.

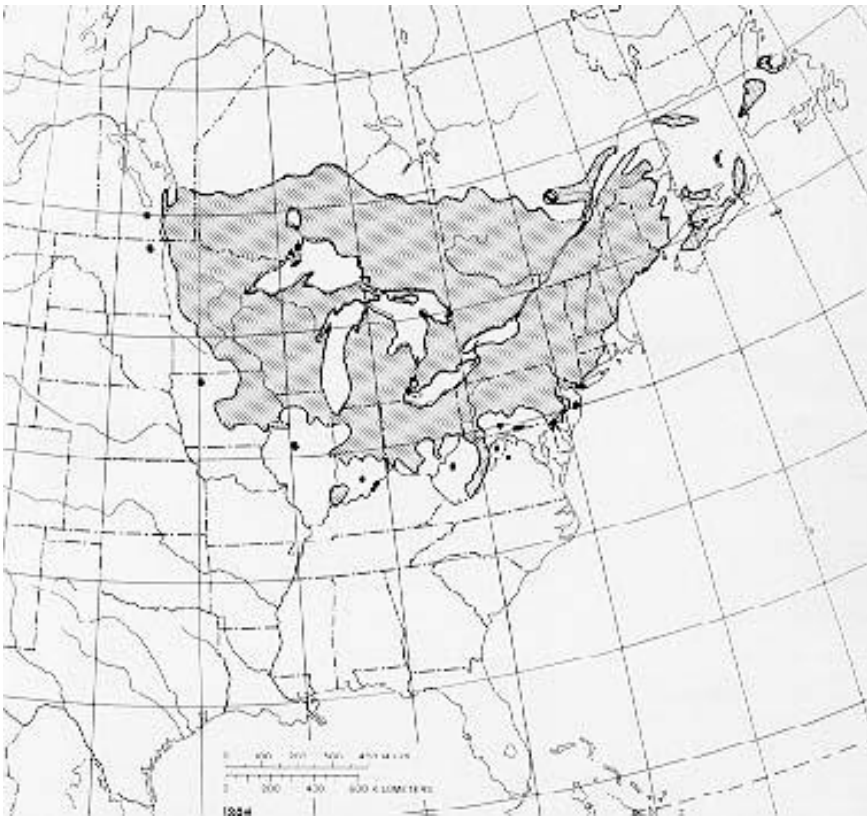


Figure 1: Global range of Black ash (*Fraxinus nigra*). Map taken from Wright and Rauscher (1965).

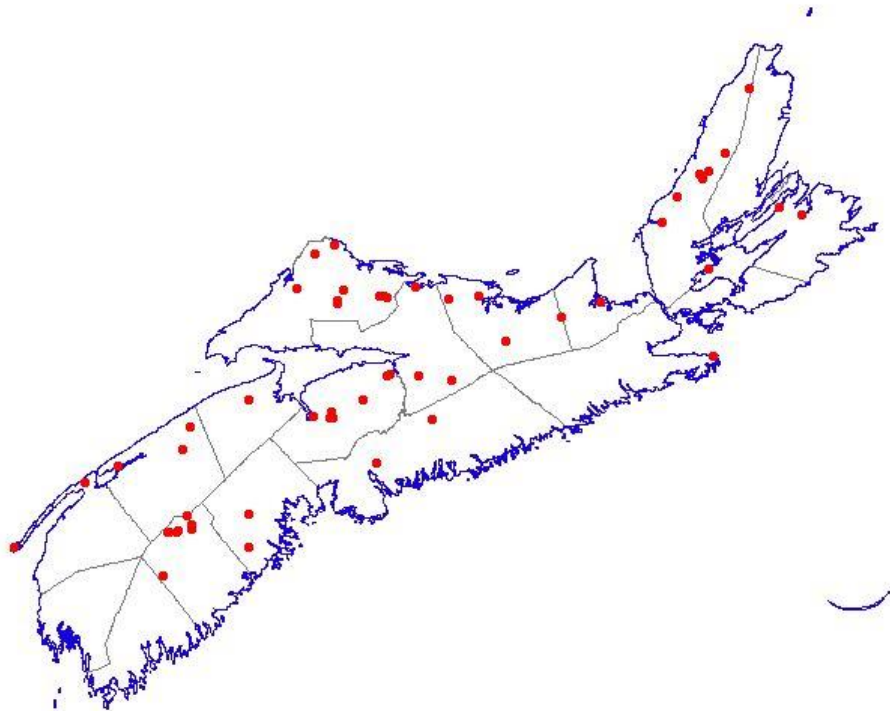


Figure 2: Distribution of *Fraxinus nigra* in Nova Scotia (includes only records for which coordinates were available).

HABITAT

Habitat requirements

Black ash is typically found in poorly drained areas that are often seasonally flooded (Erdmann et al. 1987). It is most common on peat and muck soils (Lees and West 1988), but also grows on fine sands over sands and loams (Erdmann et al. 1987). Although this species can tolerate still semi-stagnant conditions, there is a preference for swampy woodland stream and river banks with moving water. It is often associated with species such as Red maple (*Acer rubrum*), Speckled alder (*Alnus rugosa*), Balsam poplar (*Populus balsamifera*), and Black spruce (*Picea mariana*). The species is shade intolerant, and seedlings, saplings and sprouts tend to regenerate only in partially opened forest canopies (Erdmann et al. 1987).

Habitat trends

There has been no assessment of habitat alteration or destruction specific to black ash; however there has been ongoing destruction of wet and/or riparian areas for resource harvesting or development. Several environmental assessments associated with road construction or mine development have detected Black ash in advance of development and measures have been taken, where possible, to preserve the plants and their habitat.

Low-lying areas with shallow peat (i.e. shrub swamps) and wet areas around streams of less than 50 cm stream bed are not subject to provisions in Nova Scotia Wildlife Habitat and Watercourse Regulations and may be harvested, which is more likely to occur when the wet area/swamp is small and surrounded by merchantable timber. The degree of harvest of these sites has no doubt increased with the intensity and frequency of use of clear-cutting.

The establishment of large hydroelectric dams in some areas of Nova Scotia in the 1930s (e.g. Mersey, Medway and Tusket Rivers systems), likely had altered the hydrology of black ash habitat as some areas were drained and other areas were newly flooded (Eaton and Boates 2002).

Habitat protection/ownership

Habitat ownership patterns for black ash are incomplete and only verified for a few records. Black ash does however occur on private, provincial crown and federal crown lands in Nova Scotia, including in provincial and national parks. Being located with a park however does not imply that the species has protection; one specimen in a provincial park in Queens County had been deliberately cut to the ground near a bridge (although sprouting has since occurred).

According to Townsend (2004), using permanent sample plots, 43.7% of merchantable Black ash occurred on small private woodlands and 56.3% occurred on provincial crown lands. No merchantable black ash occurred on large private holdings or on federal crown lands.

Black ash within riparian areas along the stream and rivers are afforded some protection by Nova Scotia's Wildlife and Watercourse Protection Regulations, although limited tree removal may occur.

BIOLOGY

Life cycle and reproduction

Black ash trees bare inconspicuous flowers which appear before leaf-out in late May or early June. Flowers are small, elongated clusters of petal-less, purplish flowers. The wind-pollinated flowers can have either both male and female components (stamens and pistils

together in one flower), or only stamens or pistils on individual flowers (Erdmann et al. 1987). Seeds ripen from late August to September, and are dispersed from October to the following spring (Schopmeyer 1974; Lees and West 1988; Burns and Honkala 1990). Seed production averages between 27.7 and 36.3 kg seeds/45.4 kg of fruit (Schopmeyer 1974). Good seed crops in black ash are produced irregularly at 1-8 year intervals with poor seed production in most years (Erdmann et al. 1987). In Nova Scotia, total seeds produced yearly per tree from 1998 to 2001 ranged from 2 to 1500 (Hill-Forde 2004). Black ash can flower at about 3 inches (8 cm) in diameter at breast height (Wright 1953) and at 30-40 years of age (Heinselman 1981). Viability of seed from Nova Scotia (28%) was less than that for New Brunswick (59%) (Simpson et al. 2008.)

Under natural conditions, Black ash seeds stay dormant in the seed bank between 2 to 8 years and require stratification to germinate (Erdmann et al. 1987, Wright and Rauscher 1965). In culture, black ash germination can be shortened to less than one month with an average viability of 78% after 15 years of storage (Smith et al. 2000). Seedlings are poor competitors and must out-compete grass, brush, and hardwood to successfully establish.

Black ash has been described as moderately long-lived with a typical longevity of 130 to 150 years (USDA and NRCS 2006, Heinselman 1981).

Vegetative Reproduction

Black ash respond to damage by producing fast-growing sprouts from stumps up to 30 cm in diameter (Erdmann et al. 1987). Sprouts originate from adventitious buds on the sides of the stump and at the root crown. Trees also will root sucker (USDA and NRCS 2006). Trial and Devine (1994) found that 69.4% of regeneration was through sprouting and only 13.5% from seed.

Physiology

Black ash is a moderately shade tolerant riparian, mid-successional species. It is suggested that shade tolerance decreases with age (Erdmann et al. 1987). Erdmann et al. (1987) suggest that seedlings develop best under 45% to 50% of full sunlight conditions.

Black ash population dynamics are reported to respond to spring water fluctuations. Sexual reproduction is more likely to occur in sites less prone to flooding (Tardiff et al. 1994). Stump sprouting is more prevalent in more frequently flood sites (Tardiff and Bergeron 1992; Tardiff and Bergeron 1999).

The literature suggests that black ash is fire sensitive (Grimm 1984) and is top-killed by even moderate-severity surface fires (Heinselman 1981); however there are black ash in northwestern Quebec that have likely survived a fire (Tardif and Bergeron 1999). Black ash is also reported to sprout vigorously after fire (Heinselman 1981).

Dispersal/migration

Black ash seeds are wind dispersed (Wright 1953). The timing of Black ash seed release and weather conditions can affect the dispersal distances. Sutherland et al. (2000) reported that winds can transport seeds 328 feet (100 m) or more away from the parent tree. Curtis (1959) called winter-shed fruits "ice boats" and suggested that long-distance dispersal is likely under icy conditions.

Interspecific Interactions

Seed predators of Black ash include song bird, game birds and wood ducks. White tailed deer and moose browse black ash branches and twigs (Burns and Honkala 1990). Black Ash is also food plant for the larvae of several species of Lepidoptera

Studies indicate that black ash tolerates heavy browsing or clipping. Where complete browsing of the season's growth of stems occurred in Minnesota, Black ash increased output by 19% within the year. Output increased by over 300% in successive clippings. Both the number of twigs and the average length of twigs increased with clipping (Aldous 1952). Erdmann et al. (1987) suggest that black ash trees can withstand even heavy winter browsing.

POPULATION SIZES AND TRENDS

Most of the Black ash stands in Nova Scotia consist of few small trees with poor crown development. Black ash trees are sparsely distributed across most of Nova Scotia, with several relatively large concentrations near Caledonia, Wentworth and Shubenacadie. Stand sizes range from 1 to 673 individual trees; in most cases, only a single specimen exists. Few data exist that provide changes in population sizes over time.

In the 1950s, Black ash was estimated to comprise 0.130% of the hardwood in the province. However, by the 1990's, Black ash dropped to 0.006% of Nova Scotia's hardwoods (Hill-Forde 2004). Between 1953 and 1957, a survey of Nova Scotia forests was completed where the cubic feet and percentage of black ash in each county was estimated (Hawboldt and Bulmer 1958). At that time, black ash was most common in Inverness, Pictou, Annapolis, Guysborough and Victoria counties and very rare in Digby, Shelburne and Yarmouth Counties.

Based on only records for which coordinates exist, the extent of occurrence (EO) is estimated at 41964.63 km². The area of occurrence (AO) is estimated at 10.07 km². These figures are expected to increase as additional populations are reported and/or confirmed in the future.

Search Effort

Generally, the specific locations of known Black ash trees have not been well documented and rarely could their presence be re-confirmed. Fortunately, data quality has improved greatly since 2000 and will make future assessments easier. Due to the extensive

distribution of the species across Nova Scotia and its sparse occurrence, field surveys were not widely conducted. Considerable efforts were made to compile existing records and to verify newly reported sites.

Extensive measures were taken to work with the Mi'kmaq in Nova Scotia to seek information about unknown sites, recent changes in population health and long-term knowledge about Black ash populations

Abundance

There are approximately 1000 known individuals of black ash in Nova Scotia; this rough estimate includes seedlings, saplings, and many small, stunted mature individuals. Only about 15 mature and/or reproductive individuals in Nova Scotia are documented, but the true abundance of mature individual is thought to be higher. Relative to small immature individuals however, the abundance of mature individuals is thought to be quite small. Some published material suggested that only hundreds of individuals persisted in Nova Scotia in the past, but this likely reflects under-sampling, lack of consistent survey effort and comprehensive data management issues.

From Permanent Sample Plot (PSP) data from 1999 to 2004 (n=3255 PSP), the total provincial merchantable volume of Black ash was 7656 m³ of 141,062,221 m³ for all hardwood (Townsend 2004).

Fluctuations and trends

Due to the longevity of Black ash, short-term fluctuations in population size or distribution are unlikely. However because of the infrequency of seed production and the tendency for ashes to have mast seed crops, bursts of seedling recruitment should be periodically expected. It is likely that most recruitment from seed will occur during years of high seed production and further be enhanced by conditions that reduce interspecific plant competition, including that of both anthropogenic and natural origins.

Although it is often stated and hypothesized that Black ash in Nova Scotia are in decline, concrete evidence of decline is absent and few populations have been revisited multiple times. Existing information about decline is contradictory. One population near Caledonia is reported to be of good health and not experiencing decline (Hill-Forde 2004); whereas, Black ash has disappeared from 7 of 9 permanent sample plots monitored by the Department of Natural Resources from 1965 to 2005; however, DNR foresters feel that the numbers of Black ash within the plots is too small on which to base conclusions regarding population trends (Lawrence Benjamin, pers. comm). Hill-Forde (2004) speculated that decline of Black ash occurred in Colchester County from the 1960's to present. In the 1960's, Black ash was described to occur along the county's slow moving rivers (source unknown); however in the early 2000s, only one location of black ash (n=2 trees) was found along the Salmon River and its tributaries. Hill-Forde (2004) attributes this loss to agricultural development.

Hill-Forde (2004) hypothesized that Black ash was decimated in Nova Scotia during the late nineteenth and early twentieth centuries by the cooperage trade. It is also known that the Maliseet from New Brunswick specifically targeted Black ash saplings for cooperage (Bell 2006). Unfortunately, species-specific data regarding forest composition are limited or lacking from that time period. Mi'kmaw basket makers agree that black ash is rare in Nova Scotia, but could not recollect any discussions with elders suggesting that the species has declined over time (Frank Meuse, Jr. & Todd Labrador, pers. comm). Although some Nova Scotia Black ash has been used in basketry, most basket makers have obtained Black ash from New Brunswick or Maine over the last 80 years (Mark MacPhail, pers. comm).

Rescue Effect

Naturally occurring rescue of Nova Scotia Black ash by New Brunswick populations is thought to be unlikely, in part due to its rarity, slow growth and poor competitive ability. Heavy seeds and restricted seed rain would also limit its ability to spread. Further, relatively few Black ash occur in southeastern New Brunswick and habitat is limiting along the isthmus connecting the two provinces. Populations in Maine are also reported to be small and in decline.

Considerable effort has been placed on seed collection and propagation of Black ash across its range in Canada. There are initiatives at the Atlantic Forestry Centre in Fredericton to collect and store seed of all ashes for eventual conservation and restoration purposes in the face of decimation by the emerald ash borer. They have an objective of preserving 90-95% of the common genetic diversity for the species in their program (Lyons 2008). Propagated seedlings have been widely shared within Nova Scotia and many have been planted in yards, parks, small woodlots and on reserve lands, although it is unclear whether this will have a positive benefit to native populations.

LIMITING FACTORS AND THREATS

Habitat Loss and Alteration

Black ash is expected to decline in response to the loss and alteration of wet forested areas or riparian zones along rivers and streams, including through forestry, agriculture and hydroelectric development. Although dieback is identified as a separate limiting factor and/or threat, some attribute its occurrence as a response to fluctuating water levels which can result from types of habitat alteration that impact water tables.

In Nova Scotia, Black ash occurs in wet areas and/or riparian zones along rivers and streams and are to a large degree protected from direct impact large scale forestry activity as a result. There may however be indirect effects of clear cuts on Black ash by altering runoff and water table levels. Erdmann et al. (1987) reported that clear cuts on organic sites often result in less natural regeneration of Black ash due to rising water tables of from increased competition with early successional vegetation. Palik et al. (2011) found

increased rates of die back closest to roads and suggest it may be from hydrological changes or road salt. Clear cuts support high concentrations of deer in winter which can browse on seedlings and stump sprouts (Erdmann et al. 1987).

Emerald Ash Borer

The Emerald ash borer (*Agrilus planipennis* Fairmaire) is an exotic beetle from Asia first discovered in 2002. The larvae feed on the inner bark of ash species and disrupt water and nutrient flow; where adult beetles eat ash foliage and cause little damage. Affected species include Green ash (*Fraxinus pennsylvanica*), White ash (*F. americana*), Blue ash (*F. quadrangulata*) and Black ash (Liu et al. 2003). Ash trees of all sizes are susceptible ranging from 5 cm diameter at breast height (dbh) to 90 cm dbh. The Emerald Ash Borer is usually only detected one year or more after attack (Ontario Ministry of Natural Resources 2010).

Since 2002, in the United States, it spread to Ohio (2003), Indiana (2004), Illinois (2006) and Pennsylvania (2007) killing over 20 million ash trees by 2007 (Haack et al. 2002; Canadian Food Inspection Agency 2010). In August 2002, the Canadian Food Inspection Agency confirmed the presence of the Emerald Ash Borer near Windsor, Ontario. Since that discovery, the Emerald Ash Borer spread rapidly to five counties in southwestern Ontario and to the city of Toronto by 2008. By October 2010, it was also documented in Ottawa, Sault Ste. Marie, north of Sarnia, and the Montérégie region southeast of Montreal. Federal regulatory measures prohibiting the movement of wood from affected areas in Ontario and Quebec have been established to slow the spread of Emerald Ash Borer (Canadian Food Inspection Agency 2010). Estimates show the emerald ash borer has killed several hundred thousand ash trees in Essex County, Ontario, and 8 to 10 million ash trees in southeastern Michigan (Ontario Ministry of Natural Resources 2010).

Unfortunately, little is known regarding the factors that impact the rate of spread of Emerald Ash Borer populations (Haack et al. 2002), but rate and direction of spread is thought to be correlated with the spatial distribution and prevalence of the ash tree host, which includes other *Fraxinus* species (including non-native ones growing in suburban and urban areas) (MacFarlane and Meyer 2005; Muirhead et al. 2006). Spread has been attributed to the movement of infected wood (Muirhead et al. 2006).

If not effectively controlled, it is expected that the Emerald Ash Borer will spread across the entire range of ash, causing widespread and high levels of tree mortality. Studies are ongoing to seek ways to control the beetle through the use of insecticides through foliage application or tree injections and the use of biological control using predators, parasites, or diseases. One of the most challenging areas of investigation has been the attempt to find a reliable early detection method (Ontario Ministry Natural Resources 2010).

Targeted Harvest

It has been suggested that historic harvest of Black ash in the late 1800s for barrel staves has contributed to a long-term decline of the species in Nova Scotia (Hill-Forde 2004). Few

data or direct observational evidence exists to corroborate this hypothesis, although circumstantial evidence does indicate that considerable harvest of all *Fraxinus* species, among others, did occur for this purpose. This has not been a threat for over a hundred years. Additionally, the ability of Black ash to sprout from stumps after cutting should have mitigated decline to some degree. Other historic uses for Black ash included basketry, axe handles, canoe ribs and snowshoes, although these were expected to have negligible impact on Black ash populations in the past.

Presently, a small amount of Black ash is selectively harvested for woodcrafts and basketry, although the degree to which this occurs is unknown. It is expected that larger, healthier (straighter) mature trees may be targeted for these purposes which may result in a decline in tree health through high-grading, especially where trees of such qualities are highly limited (Erdmann et al. 1987).

Ash Rust (*Puccinia sparganioides*)

One of the main factors contributing to a decline in Black ash near Fredericton over the last 15 years is ash rust (*Puccinia sparganioides*) whose alternate hosts are the *Spartina* ssp which occur in coastal salt and freshwater marshes. The rust can increase and go unnoticed on cordgrass and, in a favorable year, cause serious damage to nearby ash. Spores released from cordgrasses can infect ash trees up to 48 km away. Severely infected ash trees may appear scorched and rust infections of the twigs, petioles, and leaves can result in defoliation. Repeated severe infections can cause large branch mortality leading to the death of trees (Powell and Beardmore 2007). Ash rust was historically recorded to have caused moderate damage to *F. americana* trees in the Wolfville area (Creelman 1966).

Die Back

Across the global range of Black ash there has been concern of a generalized decline in ash health and quality since the 1920s (Woodcock et al 1993, Benedict and David 2000, Palik et al. 2011), with many potential, but as of yet unproven, causes (Palik et al. 2011). Potential causes range from variation in environmental conditions, air pollution, senescence and diseases or pests such as Emerald Ash Borer or Ash Rust (Tardif and Bergeron 1997; Trial 1994, Palik et al. 2011). Larger and older trees tend to experience more dieback and poor crown condition than the younger, smaller trees (Hill-Forde 2004, Palik et al. 2011). Also, ash stands on higher, drier sites are usually in better condition than lower wetter stands (Hill-Forde 2004).

Hill-Forde (2004) reported interannual variability in die-back in Nova Scotia populations of Black ash, with improvements in dieback up to 30% of affected trees between 2001 and 2002. Given the marked improvements among years, this suggested at least a proportion of die back in Nova Scotia can be attributed to interannual variation in environmental conditions, such as weather or moisture levels. Similar patterns of die back recovery were observed in Maine by Trial and Devine (1996) in 1993. Despite apparent localized recovery, die back is reported to continue to occur over a broader geographic scale

Limited Survey Effort

The sparse, wide-spread nature of Black ash in Nova Scotia makes it difficult to assess population health. Its limited commercial value and tendency to produce small stunted trees exacerbates these issues since it receives little attention from the forest industry. Concerted efforts to locate new sites and to revisit existing sites must be made, with particular attention paid to site persistence, general health, size and reproductive rates or capacity.

SPECIAL SIGNIFICANCE OF THE SPECIES

The wood of Black ash has unique features that enable it to be pounded and peeled into thin strips. It is strongly ring-porous and easily bent, which make it ideal for basketry, barrel hoops, snowshoe frames and canoe ribs. It is also used for furniture, interior finish and as a veneer.

Aboriginal Peoples of northeastern Canada and the United States historically and currently use black ash in basket making. Black ash basketry is common in Maine, New Brunswick, Nova Scotia, and New York; the Passamaquoddy, Penobscot, Maliseet, Micmac, and Mohawk peoples utilize black ash in their baskets (Benedict and David 2004).

Several black ash hybrids and cultivars are used in landscaping. In Nova Scotia, a seedless cultivar called 'Fallgold' is sold in greenhouses for its long display of golden yellow fall foliage (Hill-Forde 2004). Other Black ash hybrid cultivars, 'Northern Gem' and 'Northern Treasure' are also available in Canada and may also be sold in Nova Scotia.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Fraxinus nigra is designated as a Yellow species in Nova Scotia (Nova Scotia's General Status Ranks, 2009). A "yellow" designation indicates a species is sensitive to human activities or natural events. Black ash has no legal protection in Nova Scotia or Canada because it is not listed under the Nova Scotia Species at Risk Act or the Species at Risk Act.

Black ash growing within Kejimikujik National Park and Historic Site and are protected by the Canada National Parks Act.

Black ash has a global status rank of G5 (demonstrably secure globally), a Canadian national status rank of NRR (unranked) (NatureServe 2009) and a provincial status rank of S3 (ACCDC, 2009). A S3 ranking means that the species is 'Vulnerable' due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

In the rest of Canada, *Fraxinus nigra* is ranked as S5 (secure) in Ontario and New Brunswick, S4S5 (apparently secure to secure) in Quebec, S3 (Vulnerable) in Manitoba, Newfoundland (Island), and Nova Scotia, and S2 (imperiled) in Prince Edward Island.

In the United States, Black ash has a national status of N5?. Within the individual states it is assessed by Nature Serve as indicated in the table below (Table 2). The species is designated as Special Concern in Rhode Island (Enser 2002), as Conservation Concern in Delaware (McAvoy 2003) and as Endangered in North Dakota (North Dakota Parks and Recreation Department 2000)

Table 1: NatureServe sub-national status ranks for *Fraxinus nigra* for individual states in the United States.

NatureServe Subnational Status Rank*	Explanation of Status Rank	State
S2	Imperiled	Delaware, North Dakota, Rhode Island
S2S3	Uncertainty exists as to whether or not the rank should be S2 or S3	West Virginia
S3	Vulnerable	Maryland, Virginia
S4	Apparently secure	Iowa, New Jersey
S5	Secure	New York, Pennsylvania
SNR	Unranked (conservation status not yet assessed)	Connecticut, Illinois, Maine, Massachusetts, Michigan, Minnesota, Ohio, Vermont, Wisconsin
SH	Possibly extirpated (Historical)	District of Columbia

*NatureServe, 2009

TECHNICAL SUMMARY

Fraxinus nigra

Black ash

Frêne noir

Range of Occurrence in Nova Scotia: Recently known from all counties in Nova Scotia, except Yarmouth, Shelburne and Richmond Counties

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	41964.63 km ²
• <i>Specify trend in EO</i>	Likely stable
• <i>Are there extreme fluctuations in EO?</i>	no
• <i>Area of occupancy (AO) (km²)</i>	10.07 km ²
• <i>Specify trend in AO</i>	Unknown
• <i>Are there extreme fluctuations in AO?</i>	no
• <i>Number of known or inferred current locations</i>	~35 to 40
• <i>Specify trend in #</i>	Unknown
• <i>Are there extreme fluctuations in number of locations?</i>	no
• <i>Specify trend in area, extent or quality of habitat</i>	Habitat quality may have declined

Population Information	
• <i>Generation time (average age of parents in the population)</i>	unknown
• <i>Number of mature individuals</i>	Approximately 12 known; expected to be more but less than 100 of known total
• <i>Total population trend:</i>	unknown
• <i>% decline over the last/next 10 years or 3 generations.</i>	unknown
• <i>Are there extreme fluctuations in number of mature individuals?</i>	Probably no
• <i>Is the total population severely fragmented?</i>	no
• <i>Specify trend in number of populations</i>	unknown
• <i>Are there extreme fluctuations in number of populations?</i>	unknown

- List populations with number of mature individuals in each:

County	NSDNR (Appendix 1) 2000-2010		FNFP ^a 1993-2002	Other ^b
	Mature	All stages		
Cape Breton	0	3	10	16
Inverness	0	7		
Victoria				
Richmond	0	0	0	
Antigonish	1	2		
Pictou	1	13	24	1
Colchester	1?	2	2	12
Cumberland	3+	115+	82	0
Guysborough			228	31
Halifax	1+	674-675		
Hants	3	36	2	0
Lunenburg			0	2
Queens	3	56-71	73	0
Shelburne				
Yarmouth				
Digby	1?	1		
Annapolis	1	1	35	0
Kings				
Max total	15+	926+	456	62

^a Black ash identified in Hill-Forde (2004) associated with First Nations Forestry Program (FNFP); it is unclear whether these include transplants individuals on reserve lands ^b Other Black ash identified in Hill-Forde (2004) outside the FNFP

Threats (actual or imminent threats to populations or habitats)

Clearcutting is probably the main threat to Nova Scotia's cedar populations.

Rescue Effect (immigration from an outside source)

- Status of outside population(s)?

New Brunswick

[other jurisdictions or agencies]

- | | |
|--|----------------|
| • Is immigration known or possible? | seems unlikely |
| • Would immigrants be adapted to survive in Nova Scotia? | probably |
| • Is there sufficient habitat for immigrants in Nova Scotia? | yes |
| • Is rescue from outside populations likely? | no |

ACKNOWLEDGEMENTS AND AUTHORITIES CONSULTED

The author would like to thank all those who contributed information to this report. DNR staff, such as Lawrence Benjamin (Ben), Eugene Quigley and Permanent Sampling Plot staff provided and confirmed current field observations of Black ash. Benjamin Lawrence, in particular, compiled and verified records, created the distribution map and provided estimates of extent of occurrence and area of occupancy. Many other individuals, noted below, also provided personal observations of Black ash or records from existing museum databases. I wish to express considerable thanks to the Mi'kmaq individuals from across Nova Scotia who shared their good-faith insights on the current and past status of Black ash in hopes that through their effort the species would persist into Nova Scotia's future at levels that could sustain cultural use.

Bancroft, Bob. Wildlife Biologist, Pomquet Harbour, NS.

Benjamin, Lawrence. Technician. Wildlife Division, Nova Scotia Department of Natural Resources. Kentville, NS.

Blaney, Sean. Botanist and Assistant Director. Atlantic Canada Conservation Data Centre, Sackville, NB.

Bland, Allan. Forestry Technician. Nova Scotia Department of Natural Resources, Windsor, NS.

Cameron, Rob. Protected Areas Branch, Nova Scotia Department of Environment, Halifax, NS.

Denny, Shelley. Biologist and Research Coordinator. Unama'ki Institute of Natural Resources, Eskasoni, NS.

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Mills, Ann. South Shore Naturalists Club, Bridgewater, NS.

Newell, Ruth. Herbarium Curator, Harriet Irving Botanical Gardens, Acadia University, Wolfville, NS

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Simpson, Dale. Manager, National Forest Genetic Resources Centre, Natural Resources Canada, Canadian Forest Service – Atlantic, Fredericton, NB

Taylor, Barry. Associate Professor and Curator of Herbarium, Department of Biology, St. Francis Xavier University, Antigonish, NS.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Donna Hurlburt is a self-employed consultant who works extensively on the ecology of rare and endangered species, the use of Aboriginal traditional knowledge in environmental decision-making and in the engagement of citizens in policy decisions. She holds a PhD from University of Alberta in Environmental Biology and Ecology and a MSc in Biology from Acadia University. She has authored several COSEWIC (Committee on the Status of Endangered Wildlife in Canada) Status Reports and three province of Alberta status reports. She is a current member of the COSEWIC Aboriginal Traditional Knowledge Subcommittee (ATK SC), incoming co-chair of the ATK SC, and a member of several COSEWIC Species Specialist Subcommittees. She is a technical advisor for the Soapweed and Yucca Moth recovery team in Alberta and a member of the Nova Scotia Blanding's Turtle Recovery Team.

COLLECTIONS EXAMINED

The following herbarium collections were consulted:

- E.C. Smith Herbarium (ACAD)
- Nova Scotia Museum of Natural History (NSPM)
- Herbarium, St. Francis Xavier University
- Canadian Museum of Nature
- Mount Allison University Herbarium

Appendix A. Known Nova Scotia black ash based on available sources.

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
1276	IN307	North Aspy River IBP	Inverness			0	Polletts Cove-Aspy Fault Wilderness Area	CS Blaney et al.	Jun 19, 2001	
1286	IN300	E of road, S side of river at Cranton Bridge Pool, St Anns Harbour; NE, SW and Margaree Rivers	Inverness	Rich riparian balsam poplar, sugar maple forest	n	1		CS Blaney CD Spicer.	Aug 9, 2001	Sighab database; Specimen @ Acadia Herbarium; small tree
1295	IN414	Margaree Forks	Inverness	Overtopped by other trees, lots of white ash		5		John Gillis	Jul 4, 2003	3 stems within 1 m area; stems 2-4 m tall; 2-4 cm diameter; leaves are shriveled (n=3); 1 stem = 3 m tall, 3 cm diameter (n=1); 1 seedling 70 cm tall (n=1); not thriving;
237	PI160	Welsford Rd bridge, West Branch, River John	Pictou	Floodplain white ash – chokecherry thicket	n	1		CS Blaney & Archibald	Jul 9, 2003	Specimen @ Acadia herbarium; sighab database; ACCDC; beaver cut tree of same size was 30 years old
1033	QU485	Caledonia	Queens	Near abandoned railway		44	private	L Benjamin	Sept 10, 2003	Studied by First Nations Forestry Program (marked with tags); seedlings to trees > 15 cm dbh; DO NOT PUBLISH LOCATION; appear healthy
1296	IN199	Hillsboro/Glendyer Stn	Inverness	wetland		1		David Stoddart	Jan1, 2003	Sighab database; Single young tree
		Coxheath	Cape Breton			1+		Mark MacPhail	July 7, 2007 (week of)	Not doing well, lots of competition and die back
967	CB701	Coxheath	Cape Breton			1+		David Stoddart	Jan 1, 2003	Number of small

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
										black ash trees; also large area of Canada yew
968	CB702	Barachois	Cape Breton	Fen in wetlands coverage		1		David Stoddart	Jan 1, 2003	Single young black ash
387	CU410	Along River Philip between Oxford Junction & Hwy 104	Cumberland	Rich riparian sugar maple forest	y	1+		CS Blaney RM Whittam	May 27, 2001	Specimen @ Acadia Herbarium; sighthab database; seedling common; few mature trees noted; fairly common
428	CU410	NE of River Philip Centre, 10 km SSW of Oxford	Cumberland	Disturbed floodplain		3+		Fairbanks and Harries (compiled by Cindy Spicer)	Jul 15, 1989	Several trees S Blaney has locations about 2 km on each side of this Heinrich Harries record; the herbarium record at Acadia indicates that seedlings were common at this site & that the species was fairly common but no counts provided
429	CU23	Maccan Marshes; waterfowl impoundment area; E of hwy, 12.5 km SW of Amherst	Cumberland	Mixed marsh-edge swamp forest with hardwood elements		1		H Harries	Jun 29, 2006	
1051	QU493	Moose Pit Road	Queens		Y – 1 tree	34		C Hearn showed to Alton Hudson showed to L Benjamin	Aug 29, 2006	
1052	QU494	Swampy area east side of road; few trees on west side near waypoint; Near Peter Point	Queens	Swampy area; sloping organic rM swamp	Y – 1 tree	20	Federal Crown - Kejimikujik National Park	C Hearn showed to Alton Hudson showed to L Benjamin	Aug 30, 2006	AE Roland also mentioned this site in a park report (Basquill only notes 5 trees)
600	CU561	Wallace River	Cumberland	Lots of blackberry &	Y – in past seed	37 + regen + 2	private	Neily and Quigley	Jan 1, 2006	ACCDC; many seeds appeared attacked by

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
				hawthorne enroute near river	collection from ground, none on trees; Seedlings <30 cm tall					worm; 15 trees (7.1 to 20 cm dbh), oldest tree was 40 (15.4 m tall); largest tree was well formed with significant clear bole; from centre point of plot n=37 black ash (including 15 in plot) Three trees were pinned by a blowdown and looked to be dying; some regen ,30 cm tall (not counted); some regen less than 3 years; in another nearby plot (n=2) at 9 & 12 dbh
826	HX628	Waverley	Halifax			2-3 (perhaps more)		Eugene Quigley	Jan 1, 2005	
424	CO363	Brookfield	Colchester			1		Eugene Quigley	Jan 1, 2003	
425	CO344	Reynolds Bridge, Stewiacke R.	Colchester			1		Eugene Quigley	Jan 1, 2006	
601	CU562	Chapman Settlement	Cumberland			1		Inventory Crew	Jan 1, 2005	
602	CU563	Wentworth Centre	Cumberland			1		Inventory Crew	Jan 1, 2005	
286	DI172	Western Light Road	Digby		Y(?)	1		Anne Mills	Dec 14, 2006	
1053	QU495	Gold Mines trail; Kejimikujik NP	Queens	Organic depression with fresh water influx; mbs swamp		1	Federal crown	Sean Basquille	?	
835	HX421	Conrod Road	Halifax	Wet; larch		673		L Benjamin et al.	Jun 27, 2007	Most small, larger tree tops dead; largest dbh = 15 cm
255	PI187	Heathbell Road	Pictou	Wet; larch; showy and		10		Archibald & L Benjamin	Jun 27, 2007	Small trees; 6 cm dbh

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
				yellow lady slipper						
1054	QU496	Westfield	Queens			5		Charles Hearn	Aug 29, 2006	
411	AP199	Middleton	Annapolis			1		T Duke and L Benjamin	Jul 13, 2007	
		Tyndal Road #1	Cumberland	overstory red maple with sm fir. Shrub layer speckled alder, some winterberry & alder-leaved buckthorn; herb layer = 80% cinn fern; organic substrate		16		Eugene Quigley	Aug 1, 2007	Plot 1; Irving land; 1-5 m tall; poor specimens with dead branches & broken tops
		Tyndal Road #2	Cumberland	50% sensitive fern, trees in poor condition; soil under 29 cm organic & water		6		Eugene Quigley	Aug 1, 2007	Plot #2
		Smileys Provincial Park	Hants	Poison ivy		1	NS Crown	Al Bland		Poor specimen
		Musquodoboit	Halifax						31 Jul 62	From NS Museum; beside river
		Lake Martha	Hants						14 Aug 96	From NS Museum
		Avondale	Pictou						27 Jul 83	From NS Museum; terrace of Barneys River
		Piedmont	Pictou						10 Apr 83	From NS Museum
		Portree	Inverness						13 Jun 81	From NS Museum; along NE Margaree

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
		Margaree Valley	Inverness						19 Aug 83	From NS Museum; terrace of Barney;s River
		Windsor	Hants						10 Oct 1866	From NS Museum; King Edgehill Campus
		Mabou Harbour	Inverness						11 Aug 51	From NS Museum
		Coldbrook	Kings						02 Jul 56	From NS Museum; by bridge
		Hayes Cove	Hants						16 May 79	From NS Museum; oxbow beside river
		Roxville	Digby						16 Aug 55	From NS Museum; east of
		Hayes Siding	Hants						27 Jul 55	From NS Museum
		Sweets Corner	Hants						20 Jul 50	From NS Museum
		Wentzells Lake	Lunenburg						18 Jul 55	From NS Museum
		New Albany	Annapolis						11 Aug 54	From NS Museum; near railway
		Pictou Landing Reserve	Pictou			20+	Federal crown (reserve land)	Mark MacPhail; W McKay	16 Jul 07; Jan-Feb 01	From NS Museum; confirmed by email to D. Hurlburt; some native, some transplanted We've identified more than twenty black ashes on the Pictou Landing woodlot," says Bill. " Rather than cut them down, we've taken seeds from them and planted hundreds of black ash striplings across the province." http://www.coastalcommunities.ns.ca/magazine/bac

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
										kissues/v6_i3.html
		Eskasoni Reserve	Cape Breton			1+	Federal crown (reserve land)	M MacPhail	16 Jul 07	plantation
		Bear River Reserve	Digby			1	Federal crown (reserve land)	F Meuse	27 Dec 07	Outside of home; transplanted in 2005 http://www.novansnow.com/article-170410-Tree-of-life.html
		Latties Bk, Five Mile R	Hants	Swampy forest at edge of floodplain	n	1		CS Blaney & N Hill	4 Jun 02	Acadia Herbarium
		N of hwy bridge at Wentworth Centre, near Tidd Pool, Wallace R	Cumberland	Base of red maple; hemlock, trembling aspen, white pine slope at mouth of small creek along river	n	1		CS Blaney & TM Popma	8 Jul 03	Acadia Herbarium; ACCDC
		N. side of river; 2.0 km W of Hwy 4 at Wentworth Centre; Wallace R	Cumberland	White spruce, alder, chokecherry floodplain	n	50		CS Blaney, P Neily & E Quigley	20 Aug 03	Acadia Herbarium; ACCDC; locally common; 20 small to medium trees, mostly healthy but partly bare on top
		Along river near N end of River Philip Centre	Cumberland	White ash, sugar maple floodplain forest	?	1		CS Blaney, TM Popma, & SP Basquill	3 Jul 03	Acadia Herbarium; ACCDC; small but healthy tree
		0.3 km E of bridge at Bridgeville; East R of Pictou	Pictou	Sugar maple, white ah intervale	n	1		CS Blaney & TM Popma	15 Aug 03	Acadia Herbarium; ACCDC; small tree
		Oxford Junction; small trib to River Philip; E side of Oxford/R Phillip Hwy; 0.3 m N of intersection of Thomson Stn Rd & River Phillip Rd	Cumberland	Narrow rich ravine	n	1?		RE Newell	28 Jul 00	Acadia Herbarium

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
		2.5 km W of South Maitland; Five Mile R	Hants	Seepy swamp between hills	Y (early fruiting)	1		CS Blaney	19 Jun 00	Acadia Herbarium; small tree
		Herbert R; NW of Woodville	Hants	Alder-ash riparian thicket	n	1		CS Blaney	27 Aug 00	Acadia Herbarium; 1 small tree
		Between McKay Section and Ashdale road crossings; Meander R Map 11 E/04 Lay/Lon: 45 00 40 N 63 56 32 W UTM: Zone 20 425747E 4984606N	Hants	Rich, swampy white ash – sugar maple forest	n	1		CS Blaney	17 Jun 00	Acadia Herbarium; 1 small tree
		Northfield	Lunenburg		n			JF Donly	31 Oct 61	Acadia Herbarium
		Camperdown	Lunenburg		n			JF Donly	11 Sep 59	Acadia Herbarium; sapling tree cut down for road buiding
		NE between Hatchery and Rock pools; Margaree	Inverness	Edge of woods	n			JF Donly	8 Oct 61	Acadia Herbarium; sapling growth
		Karsdale	Annapolis	pasture	n			JW Johnson	6 Sep 62	Acadia Herbarium
		Malagawatch	Inverness	Edge of brook	n			JS Erskine	3 Aug 62	Acadia Herbarium
		Island Lake	Lunenburg	Roadside swamp	n			JF Donly	20 Nov 58	Acadia Herbarium
		Near bridge, Coldbrook	Kings	Roadside ditch	n			JS Erskine	2 Jul 56	Acadia Herbarium
		SE corner of Wentzell's Lake	Lunenburg	Swamp by lake	n			JS Erskine	18 Jul 55	Acadia Herbarium
		East of Roxville	Digby	Bank of brook	n			JS Erskine	16 Aug 55	Acadia Herbarium
		Gore	Hants	Second growth woods	n			EC Smith; JC Taylor; DH Webster; LB Slipp	18 Aug 53	Acadia Herbarium
		By the railway; Albany Station	Annapolis	swamp	n			JS Erskine D Erskine	30 Jul 45	Acadia Herbarium; lateral leaflets 8 or 10, commonly 10
		Near James River Station	Antigonish	Beside brook	n	1 (+?)		HG Perry RH Wetmore GC Hicks	4 Sep 25	Acadia Herbarium

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
								AR Prince		
		Portree; NE Margaree River 46E24N 60E58W Map 11K/7	Inverness	Scarp of high terrace along river				KNH Greenidge	13 Jun 81	St Fx Herbarium; sapling
		Pomquet Harbour	Antigonish			1	Private	B Bancroft	07	Map on file; dbh=7.75 inches; ht = 30 ft; excellent health but not perfect form
		Eighth Lake	Queens				?	MJ Shcheoanek A Dugal	31 Aug 76	Canadian Museum of Nature
		Five Mile River	Colchester				?	AS Pease B Long	19 Jul 20	Canadian Museum of Nature
		Millers Creek Mine Extension Wetland 1 - is centered on 4986583 N, 414881 E (NAD 83). Wetland 2 - 4986791 N, 415335 E (NAD 83). Wetland 7 - 4986870 N, 413244 E (NAD 83) Wetland 10 - 4986382 N, 412497 E (NAD 83) Wetland 12 - 4986261 N, 413494 E (NAD 83).	Hants	Wetland #1 - 4.22 ha and is predominately of mixedwood treed basin swamp with minor basin marsh components. Wetland 2- 0.12 ha, decid. treed basin swamp. It is a long narrow shallow hummocky pool situated in a small valley between two small ridges.		30		Environmental Assessment Fundy Gypsum	August 20, 2007, Wetland 2 - May 31, June 11, and August 21, 2007 Wetland 7 - June 11 and August 20, 2007 Wetland 10 - May 29, June 13 and August 21 2007, Wetland 12 - May 31, June 11 and August 22, 2007	http://www.apwps.ca/comments/dnr.pdf http://www.gov.ns.ca/nse/ea/millers.creek.gypsum.mine_RegistrationSections_Appendices A-G.pdf Wetland 1 - Thirteen sapling (2.5 - 10-cm dbh) and 5 seedling (<2.5-cm dbh) black ashes found within wetland #1. The saplings are located throughout the wetland. Fundy Gypsum will work in cooperation with the Confederacy of Mainland Mi'kmaq (CMM) to monitor these individual black ashes.

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
				<p>Dominant trees (>10 cm dbh) immediately surrounding this wetland include red maple (<i>A. rubrum</i>), red spruce (<i>Picea rubens</i>) and yellow birch (<i>Betula alleghaniensis</i>). Eastern hemlock (<i>Tsuga canadensis</i>) is also present</p> <p>Wetland 7 is a complex of 4 basin marshes with a treed swamp component. Emergent cattails (<i>Typha latifolia</i>), duckweed (<i>Lemna minor</i>), Hemlock Water-Parsnip (<i>Sium suave</i>)</p>						<p>Wetland 2 - One sapling (2.5 - 10-cm dbh). The saplings are located roughly in the center of the wetland</p> <p>Wetland 7 - A single mature (14-cm dbh). The tree was located on the edge of one of the basin marshes in the treed swamp component.</p> <p>Wetland 10 – Four sapling (2.5 - 10-cm dbh) The saplings are located roughly in the center of the wetland.</p> <p>Wetland 12 - Six sapling (2.5 - 10-cm dbh) The saplings are located roughly in the center of the wetland, and will not be removed by the Project</p>

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				<p>and sedges (e.g. <i>Carex ludida</i>, <i>Carex echinata</i>, <i>Scirpus cyperinus</i>) characterize wetland 7. No trees >10 cm diameter at breast height (dbh) are growing within the marshes, however, several tree and shrub species including red maple (<i>Acer rubrum</i>), Canada Holly (<i>Ilex verticillata</i>), balsam fir (<i>Abies balsamea</i>) and red spruce (<i>Picea rubens</i>) dominate the treed swamp component.</p> <p>Wetland 10 - 0.72 ha and is predomin</p>						

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
				<p>ately mixedwood treed basin swamp</p> <p>Wetland 12 - 1.53 ha, mixedwood treed basin swamp. The wetland is dominated by rm, bf, rs, yellow birch some speckled alder (beaked hazelnut (<i>Corylus cornuta</i>), black holly (<i>Ilex verticillata</i>) and wild raisin (</p>						
		Highway 104 Bypass, Antigonish, NS , West River, Wetland 19 (no coordinates)	Antigonish	<p>Wetland #19 - mixedwood treed basin swamp and tall shrub basin swamp (0.54 ha); Dominant spp: <i>Acer rubrum</i>, <i>Abies balsamea</i>, <i>Picea mariana</i>:</p>	n	1	DOT?	Final Report, Environmental Assessment: Highway104 at Antigonish, 2005 by Jacques Whitford Environment Ltd,	June and August 2002	1 sapling encountered during the field survey; Some timber harvesting adjacent to wetland as well as blueberry fields. Wetland receives potentially contaminated runoff from ditches along Highway 104; suggests that plant might have been destroyed

EONUM	WILDNUM	Locality	County	Habitat	Regen	n	Ownership	Observer(s)/ Source	Date Last observed	Observers Comments
				<i>Alnus incana</i>						and new black ash planted elsewhere – but not clear. http://www.gov.nz.ca/nse/ea/highway104/hy104_ear_eport-AppendixC.pdf http://www.gov.nz.ca/nse/ea/highway104/hy104_ear_eport-AppendixI.pdf
		West Caledonia 331119 4915412 330959 4915056	Queens		n	5	private	A Lavers	13 Dec 07	One is 18 cm dbh; others quite small
		Baddeck	Victoria	swamp	?	2 (+?)	?	Macoun 1883	9 Jul 1898	<i>P. ferrugineum</i> , (Huds.) Hepp. On bark of black ash trees in a swamp at Baddeck, Cape Breton Island, N.S., July, 1898; Var. <i>discolor</i> , Willey. on black ash bark at Baddeck, Cape Breton Island, N.S., July 9th, 1898. (Macoun.)