# Abegweit First Nation

# Stewardship of Black Ash:

# Ecological Reporting

**A PEI Forested Landscape Priority Place Project**

March 31, 2023

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Prince Edward Island CANADA

Environment and Climate Change Canada
Environnement et Changement climatique Canada

macphail woods ecological forestry project

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Black Ash Leaves

# ACKNOWLEDGEMENTS


Black Ash in Forest Clearing

The fieldwork and data collection aspect of the **Black Ash Project** has been a joint effort between the **Abegweit Conservation Society** and the **Macphail Woods Ecological Forestry Project** through funding from the **PEI Forested Landscape Priority Place for Species at Risk** Funding.

There are also a number of other organizations that have been integral to the project. These include local land stewards such as: the Island Nature Trust, The Nature Conservancy of Canada, the Provincial Government, Lennox Island First Nation and various private land owners.

Thanks is also due to the Atlantic Canadian Conservation Data Centre and their staff. They provided many of the historic locations that helped to start the fieldwork. Several members of their staff participated in field visits to help improve biodiversity data. They have also been a resource to confirm obscure or unknown species.

Thank you to the long history of data collectors & GIS analysts from the Federal and Provincial Government. Their data informed the fieldwork as well as assisted in finding new black ash sites. Thank you as well to PEI Provincial Nursery staff for growing such wonderful black ash seedlings.

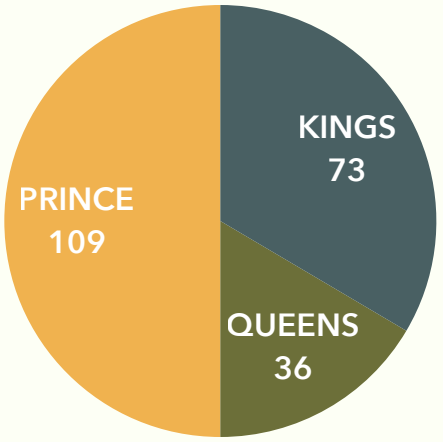

*Sphagnum squarrosum* - S5

# BLACK ASH PROJECT SUMMARY


As of March 2023, 56 of 218 potential black ash sites have been surveyed. 425 black ash trees have been recorded with a 12m accuracy, across 38 sites. Each surveyed site has been ecological assessed according the project-specific rubric and an ecological inventory was created cataloguing flora, fungi and fauna.

Additionally, over 1000 young black ash seedlings were delivered to the Macphail Woods Nursery in the Fall of 2022. These are currently being looked after by nursery staff in preparation for restoration plantings during the 2023 growing season. All the seedlings were grown at the Provincial Nursery prior to being delivered. Over 400 of the seedlings were not in prime condition, but they were planted and cared for at the Macphail Woods Nursery.  Their health will be reassessed in the spring.

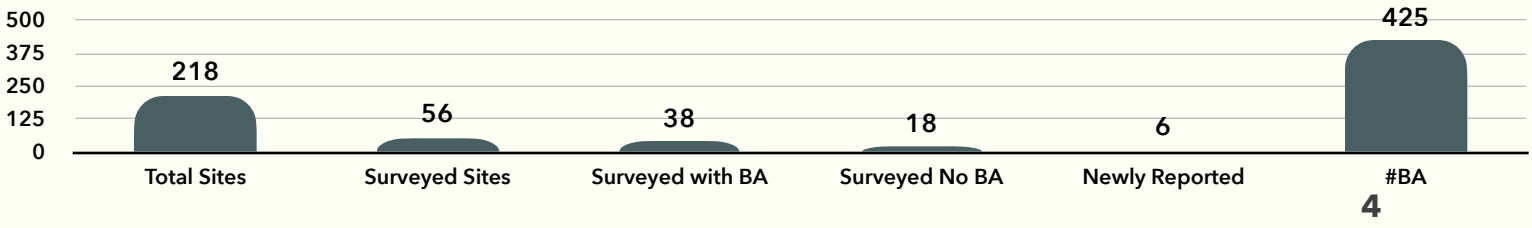
**SITES BY COUNTY**




Another aspect of the fieldwork has been capacity development within both organization involved. Training has been incorporated into the fieldwork regime as well as delivered at targeted training sessions. The training has focused on improving the skills of the field crews in identification of black ash and other native species, identification of invasive species, GPS/ navigation, ecological assessment and more.

Over the course of the project, several community building sessions were enacted to share knowledge about the work and findings of the black ash project through scheduled events, presentations, conferences and guided tours.

**ALL COUNTY SITES SUMMARY**



# Black Ash Project History

The Black Ash Project field data was collected between December of 2020 and March 2023 by a team composed of staff from the Abegweit Conservation Society and the Macphail Woods Ecological Forestry Project.

The initial dataset came from a variety of sources including Provincial records, the ACCDC, other environmental organizations, as well as some oral rumours. As of March 2023, there are 218 total potential sites, 56 of which have been surveyed with 38 of those having black ash present on-site. There have been an additional 6 "confirmed" sites by other organizations which have yet to be assessed and surveyed by this project's team.

**2020 SEASON**

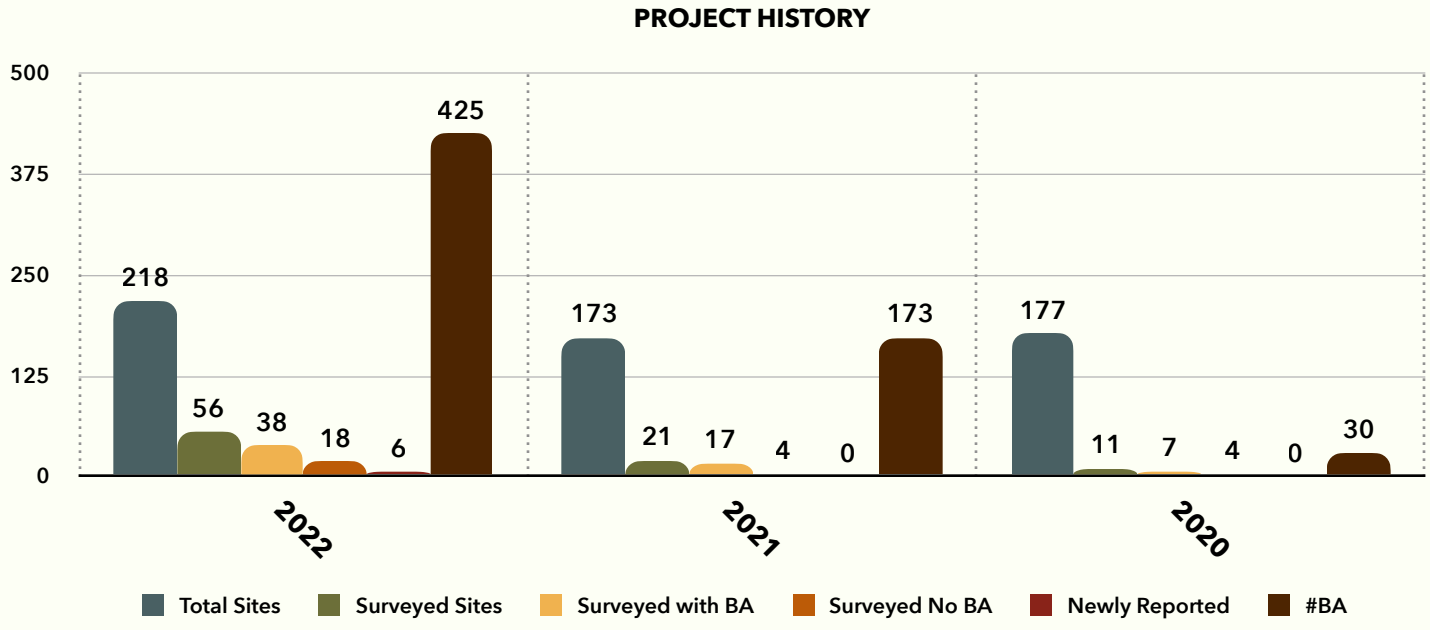
Beginning in the Winter of 2020, the first year of the project focused on gathering the historical database of black ash locations across the province, as well as creating an assessment rubric and a data collection system. A small number of sites were used to test the accuracy of the historical records as well as fine-tune the ecological assessment for the project.

**2021 SEASON**

2021 was focused on training staff from the Abegweit Conservation Society in field work activities, ranging from data collection to plant identification. Fieldwork was also expanded into Kings County where several larger population sites were found.

**2022 SEASON**

2022 was focused on field surveys & finding new sites. A much larger number of sites were visited during the field season, primarily in Queens and Kings counties. A number of new sites were found using GIS software to combine and contrast collected field data with existing Provincial data which resulted in 120 new black ash found.



# Black Ash Project Fieldwork


Swampy Surveys

As mentioned, the fieldwork portion of this project has been a joint effort.

Daniel McRae, from the Macphail Woods Ecological Forestry Project participated in all site visits, surveying a number of sites on his own. CJ Cleal, forestry manager for the Abegweit Conservation Society participated in many of the site assessments as well. Additional staff from both the Abegweit Conservation Society and the Macphail Woods Ecological Forestry Project also participated in some site visits.

**CHALLENGING LANDSCAPES**:

**Tough Terrain:** Black ash generally grow on poorly-drained soils in wet habitats. These landscapes are often littered with a variety of hazards and obstacles, slowing exploration as well as creating challenging working conditions. Ponds, rivers, swamps, marshes and other wetland habitats have all been visited over the course of the project. These habitats have high populations of mosquitos and other biting insects, as well as a variety of prickly and poisonous plants such as roses and poison ivy. These challenges often affected the accessibility of these sites as well as the speed of the survey team.

**Inaccurate or Unknown Locations:** The source data for black ash trees often had large ranges of inaccuracy for their recorded locations. Although this data was still integral in finding black ash specimens, a large part of locating trees was based on the skill of the field team. This has most likely resulted in some missed historic specimens, particularly for sites visited earlier in the project, when the team had less training and experience. This also contributed to a larger proportion of field surveying time used just in finding the black ash specimens, sometimes leaving little time left for in-depth assessment.

# Black Ash Project Data


Looking for Black Ash

**GATHERING DATA:**

Although data was initially collected using pen and paper, a cloud-based GIS mapping service, MerginMaps, has been used to create a customized data collection and map application which can be shared amongst the various organizations involved. This application was piloted for all the site assessment data during the 2021-22 field seasons with good results and feedback. 2023 will see the project shared through this service with other Island organizations to facilitate Island-wide work by various groups as well as keeping the data collection process open, accessible and transparent.

**LEARNING CURVE:**

This project has been an educational process for all involved. The survey team acknowledges that the data collected must be presumed to have a number of errors of omission and misidentification. The assessment rubric is a primarily qualitative survey, leading to errors of designation and interpretation.

Errors of omission are probably the most common during fieldwork. Black ash can be a difficult tree to identify depending on the time of year. Its lower average height also can contribute to poor visibility in some habitats. Most of the field team had seen few black ash prior to the projects start. There are a number of sites in the first season of the project, which may have black ash present that were missed. Other sites, with confirmed black ash, most likely have missed specimens. As for other errors of omission, time of year of fieldwork also has a great effect on biodiversity surveys, leading to low-diversity results which may not truly reflect the location's ecology.

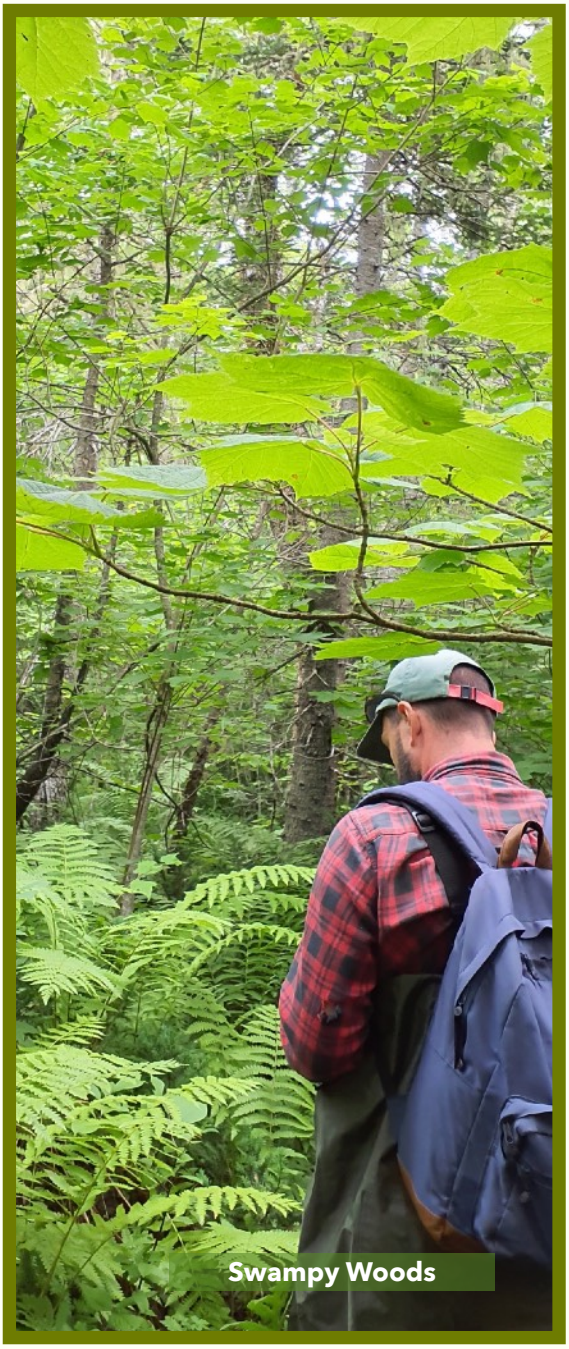
Errors of misidentification were minimized through help from other botanists (such as staff from the ACCDC). To further minimize misidentification, species were only included in the biodiversity survey if they could be confirmed to the genus or species. This minimized the potential for errors in species records, although left some records without detailed species data. As the project has progressed, the field team's identification skills have improved, reflected in more comprehensive biodiversity data across the 2022 field season compared to previous years.

# Ecological Assessment

The ecological assessment was initially developed between December 2020 and March 2021. It was based on the Macphail Woods stand assessment for forest surveys with some additional black ash specific data as well. A number of other data points for potential collection were discussed including chemical soil tests and climatic data.

Over the course of the 2021 field season, some of the more intensive data variables, requiring a lot of time and/or elaborate tools were omitted from the assessment. Fieldwork with the original expansive ecological assessment proved to be impractical for a number of reasons. Firstly, there were a number of variables which would have required equipment that the field team did not have access to. Secondly, finding the black ash on-site often proved to be time consuming, sometimes leaving little time left in the day for an in-depth assessment. Simplifying the ecological assessment allowed for more time in the field devoted to developing and enhancing skills for fieldworkers, such as plant identification and ecological assessment. The simplified assessment was further reviewed during the Winter of 2021-22 when field data was analyzed. This allowed for refinements in the assessment to better reflect what was seen by the field team.

The 2022 field season put the simplified and more qualitative assessment into practice. It proved to be a much more efficient process allowing for many more sites to be surveyed. The assessment will be further refined for the 2023 field season. A selection of sites will then be studied more intensely and quantitatively in future seasons.


Swampy Woods

**Fieldwork was done on-foot with a small toolset.**

- A digital measuring device for tree height and distance
- A digital camera for documentation
- At least one GPS unit with 10m accuracy on average
- 2022 field season sometimes used an additional GNSS receiver to increase accuracy
- Analog diameter measuring tools
- A small digital microscope for small flora & lichens
- 2 hand lens of 10x and 20x magnification
- A digital tablet for GIS mapping and data collection

# Ecological Assessment: General Definitions

## GENERAL SITE INFORMATION

| GENERAL | REFERENCE | Data Source |
|---|---|---|
| SURVEY SITE: | Location/Nickname for Site | Surveyors |
| COUNTY: | Provincial County of Site | PEI GOV DATA |
| PID: | Parcel Identification Number of Site | PEI GOV DATA |
| LAT: | Latitude of Approximate Site Center | Variable |
| LONG: | Longitude of Approximate Site Center | Variable |
| WATERSHED: | Natural Watershed of Site | PEI GOV DATA |
| REPORTED BY: | Group that reported site location | Variable |

| STEWARD | Property Steward/Owner |
|---|---|
| PRIVATE | Privately Owned Land |
| PEIGOV | Provincially Owned Land |
| NCC | Nature Conservancy of Canada |
| INT | Island Nature Trust |
| PARKS | PEI National Parks |
| MWOODS | Macphail Woods Ecological Forestry Project |
| OTHER | Examples: Along Confederation Trail, Scotchfort Reserve |

| DATA SOURCE | Type of Location Information |
|---|---|
| REPORTED | Externally Reported at Start of Project |
| NEW | Newly Reported by other ORGs After Start of Project |
| HYPOTHETICAL | Site chosen through GIS data analysis of potential location |
| DISCOVERED | Non Project Related Sites with suitable habitat or black ash found |
| OTHER | Sites where black ash originate from a non-wild source |

| REPORTED BY | Reporter of Original Location Information |
|---|---|
| MW | Macphail Woods Ecological Forestry Project |
| ACCDC | Atlantic Canada Conservation Data Centre |
| NAME | Individual Reporter's Name |
| RUMOUR | Oral hearsay without definite coordinates |
| OTHER | Sites where black ash originate from a non-wild source |
| BLANK | Unknown Reporter |

# Ecological Assessment: Ecological Definitions

## ECOLOGY

| HABITAT | Based on II-Plant Community Analysis (*Sobey, 1995*) |
|---|---|
| WOODED RIPARIAN | Area along River with over 50% Canopy Closure |
| OPEN RIPARIAN | Area along River with under 50% Canopy Closure |
| SWAMPY WOODS | Wet Forested areas with over 50% Deciduous Canopy and/or Cedar Swamps |
| BOGGY WOODS | Wet Forested Areas with over 50% Coniferous Canopy |
| PEAT BOG | Generally wet open areas dominated by Sphagnum mosses |
| ALDERS | Areas with Alder Swales |
| OPEN MARSH | Open wet areas dominated by herbs and/or shrubs |
| Ditch | Wet areas along roads or the Confederation Trail |
| Other | Generally heavily disturbed or cultivated sites (Ex: MW Arboretum, Scotchfort Plantings) |
| Unknown | Sites recently confirmed by other organizations |

| SOIL TYPE | REFERENCE |
|---|---|
| Loamy | Fluffy soils of relatively even clay and sand |
| Clay | Soils of primarily smaller grain-size |
| Sand | Soils of primarily larger grain-size |
| Muck | Water-logged sticky soils with high organic matter content |

| LIGHT LEVEL | REFERENCE |
|---|---|
| SHADY | Areas of good canopy closure dominated by conifers |
| DAPPLED | Areas of good canopy closure dominated by deciduous trees |
| PATCHY | Areas of moderate canopy closure or many gaps in a denser canopy |
| FULL SUN | Areas of low or no canopy closure |
| UNKNOWN | Sites recently confirmed by other organizations |

| OTHER ECOLOGICAL INFORMATION | REFERENCE |
|---|---|
| DRAINAGE | Based on Provincial data |
| STANDING WATER | Standing water present during fieldwork (Y/N) |
| INVASIVES | Invasive species present (Confirmed/Unconfirmed) |
| BEAVERS | Current or past signs of beaver habitation (Confirmed/Unconfirmed) |
| WATERCOURSE | Site within riparian zone of watercourse (Y/N) |
| SEASONAL WATERCOURSE | Site of a seasonal watercourse (Y/N) |
| VERNAL POOLS | Site with Vernal pools (Y/N) |

# Ecological Assessment: Tree Data Definitions

## TREE DATA

| BA DATA | REFERENCE |
|---|---|
| CONFIRMED | Black ash confirmed by survey team or reliable source/photo evidence |
| NUMBER FOUND | Number of black ash confirmed through fieldwork |
| SEEDING | Trees in flower and/or seed production confirmed through fieldwork |

| BA QUALITY | Qualitative assessment average black ash specimen health on site |
|---|---|
| THRIVING | Black ash of high-quality with little damage, disease die-back, and vigorous growth |
| SUSTAINING | Black ash of medium quality with slight damage, disease, die-back and moderate growth |
| RECOVERING | Black ash of poor quality with medium damage, disease, die-back and some growth |
| STRUGGLING | Black ash of poor quality with medium-heavy damage, disease, die-back and little growth |

| CANOPY | REFERENCE |
|---|---|
| CANOPY CLOSURE | Qualitative percentage of canopy closure |
| CANOPY # | Top four dominant canopy species |
| CANOPY # % | Percentage of canopy of each dominant species |

# BLACK ASH ON PEI


Swamp Red Currant - *Ribes triste* - *S3S4*

## OBSERVATIONS FROM THE FIELD

Although the project is still ongoing with many more sites to survey and black ash to assess, the field team has developed extensive expertise in traversing these swampy habitats and finding black ash trees. These experiential lessons from the field can inform the project moving forward. Some of the field conclusions are even supported by the preliminary data analysis that follows.

## ECOLOGICAL ROLE

Black ash trees have a high tolerance for water-logged soils and it is this adaptation that allows them to out-compete other species in these settings. The eastern hemlock is a nice comparison, it has the ability to thrive in heavily-shaded areas, where other species often struggle.

Black ash can survive in water-logged soils with little oxygen, a place where many other native species cannot.

They also tolerate a wide-range of light conditions, one of the reasons they can be found in so many different wetland habitats.

## PREFERRED HABITAT

Black ash on PEI tend to be found predominantly in swampy woods, wetland forests with a predominantly deciduous canopy, often amongst abundant red maple. The most populated and healthy black ash sites seemed to grow in areas with less acidic soils. No soil testing was done to date, however peat bogs and predominantly coniferous sites tended to have much lower populations and trees struggling to survive. Open marshes also tended to have less trees of poorer health. The flexibility in habitat of the black ash tree is likely tied to their intermittent seed production, the challenges of their seed's dispersal as well as the dynamic shifting ecology of wetlands.

*Woolly Liverwort - Trichocolea tomentella - SU*

**FOREST STRUCTURE**

Black ash were often found to be a tree of the lower canopy, rarely reaching the top layer, growing best in small forest patches or under dappled light. Although trees were found in more open marsh-like conditions, these were often in poor health and low population.

Black ash were also found growing along rivers, most often in poorly drained alluvial soils that are seasonally flooded. However, several specimens were found growing at higher elevations along the river's steep banks.

**COMPANION SPECIES**

When looking for black ash in swampy forest habitats, several species were found to be very indicative of black ash sites. The following species began to be thought of as a compass for locating black ash trees. As they became more dominant and as more of the species occurred, the likelihood of locating black ash was higher. There are many more indicative species to be sure, however these nine were the most useful, while still being easy to identify in the field.

1) White Elm - *Ulmus americana - S3*
2) Eastern white cedar - *Thuja occidentalis - S3S4*
3) White ash - *Fraxinus americana - S2S3*
4) Alder-leaved buckthorn - *Endotropis alnifolia - S3S4*
5) Mountain-fly honeysuckle - *Lonicera villosa - S4*
6) Swamp Red Currant - *Ribes triste - S3S4*
7) Western Poison Ivy - *Toxicodendron radicans var. rydbergii - S4*
8) Shining Rose - *Rosa nitida - S4*
9) Woolly Liverwort - *Trichocolea tomentella - SU*

# A Short History of PEI's Black Ash


Swampy Forest Floor

Black ash have a long history in the maritime region and are generally found in scattered pockets amongst wetland habitats. They are a tolerant species able to grow in a variety of conditions and locations, from shady river valleys to dappled swampy forests to open sunny marshes.

Slow-growing with relatively even growth rings, black ash has long been valued as a craft tree by the Mi'kmaq. Over the last several decades, black ash have been in decline due to "die-back", the causes of which are still under investigation. There is also the eastern migration of the Emerald Ash-boring beetle which has yet to be confirmed on PEI.

Up until the mid-1900's, many wetlands were drained for agriculture while large portions of Island woodlands were heavily harvested. This led to a loss of biodiversity and habitat as well as fragmentation of our forests. Without forest cover, many of our wetlands and riparian zones have undergone drastic ecological shifts further reducing the proportion and quality of these habitats across the Province.

Since then, there has been much greater efforts to replant forests and protect our riparian zones. Islanders views on wetlands have also changed. Where once they were considered wasted space, they are now valued as providing crucial habitat and ecological services (they play an important role in our ground water cycle). This has shifted our stewardship of habitats where black ash are found. These areas are often water-logged with swampy and uneven terrain or steep riparian ravines. The tendency of black ash to grow in areas of difficult access with lower-value timber, has helped to conserve the provincial population in the second half of the 20th century. Unlike upland hardwoods habitats, black ash areas are not as easily profitable for low-value extraction.


Black Ash - *Fraxinus nigra* - S2

# Black Ash Site Selection

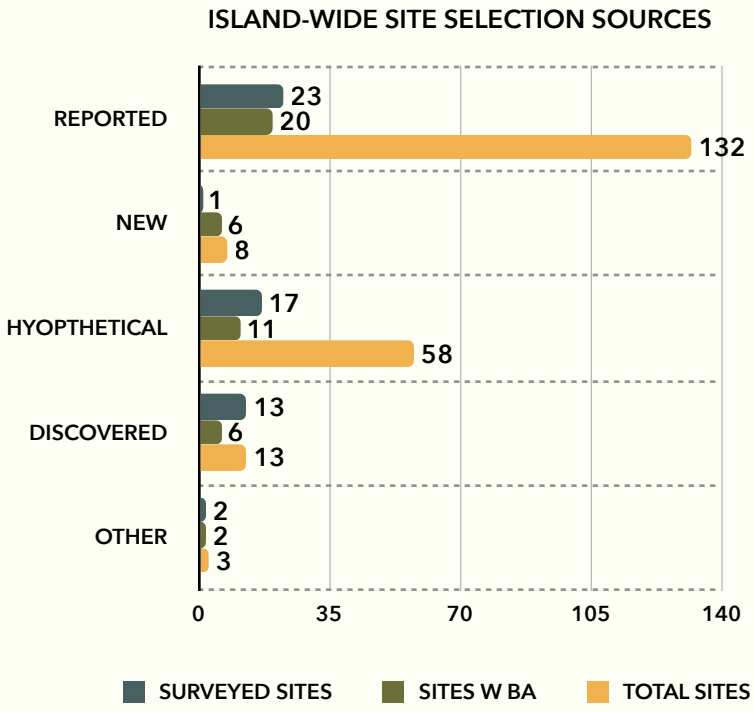

Alder-leaved Buckthorn - *Endotropis alnifolia - S3S4*

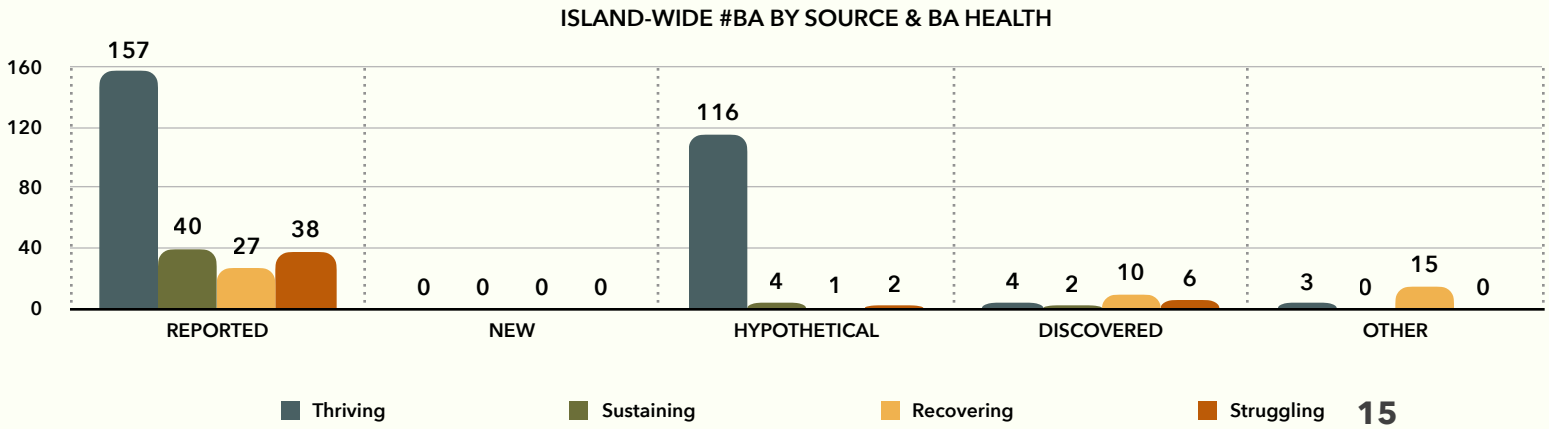
The Black Ash Project began with a hefty list of historic records as well as some oral rumours of black ash locations. The uncertainty error of these records varied wildly, with some records exceeding 2000m of possible location error. These records have since been pruned, merging very close locations and putting aside others with unhelpful uncertainty values.

A number of new sites have been added over the course of the project, often due to new black ash reported by local and regional organization such as the ACCDC. Other sites were visited during fieldwork for other projects in which either black ash themselves or suitable habitat were discovered.

The 2022 field season saw an attempt at using GIS software to hypothesize locations with habitat where new populations might be found. A number of new potential sites were added, primarily in Queens and Kings county.

The historically reported sources yielded the greatest number of confirmed black ash, however the hypothetical habitat methodology has provided excellent results as well.



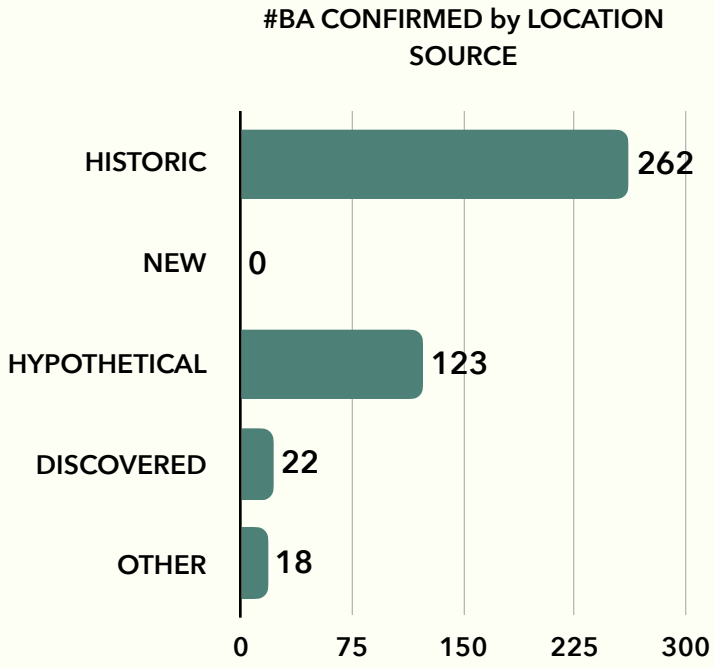
# Finding Black Ash

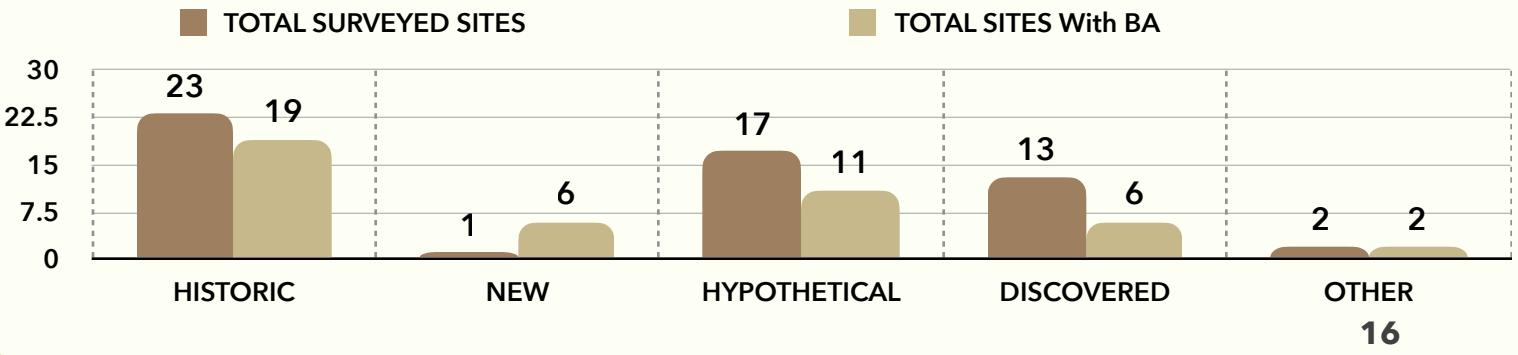
Finding Black Ash along the Pisquid River

As mentioned, the majority of potential sites were sources from historical records primarily from the Provincial Government and the ACCDC, these also included some rumoured locations with no coordinates . These records have yielded good results.

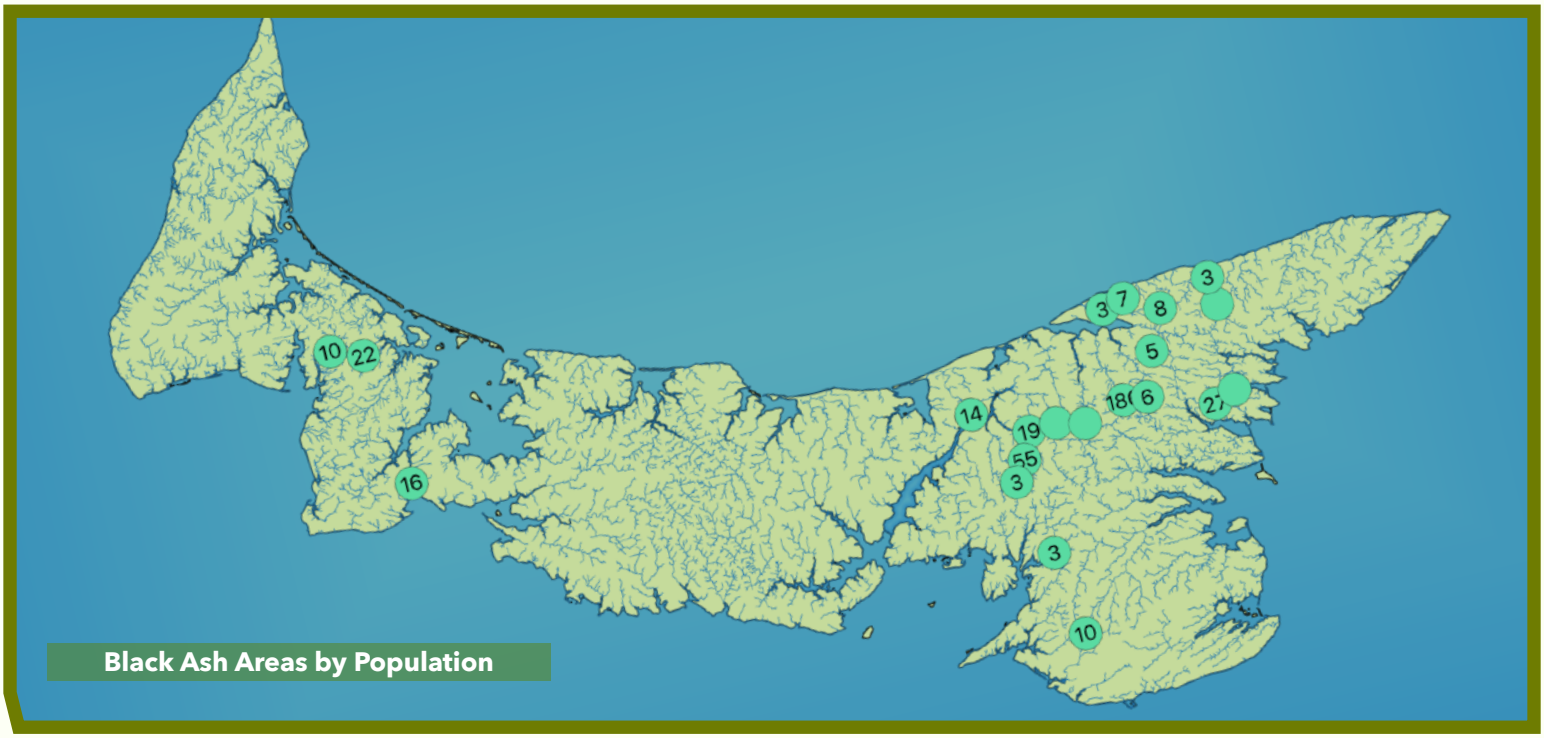
After the 2021 field season, data was analyzed for the purposes of estimating potential new black ash sites in Kings and Queens counties. In 2022, seventeen of these sites were surveyed, with over 123 black ash found over 11 sites. These results indicate that black ash are present across more sites in PEI than previously thought.

There were a number of sites visited by Macphail Woods staff for other work in which black ash and/ or suitable habitat were discovered. Again, this suggests that there are more isolated populations of this species than previously recorded.



# Provincial Project Data

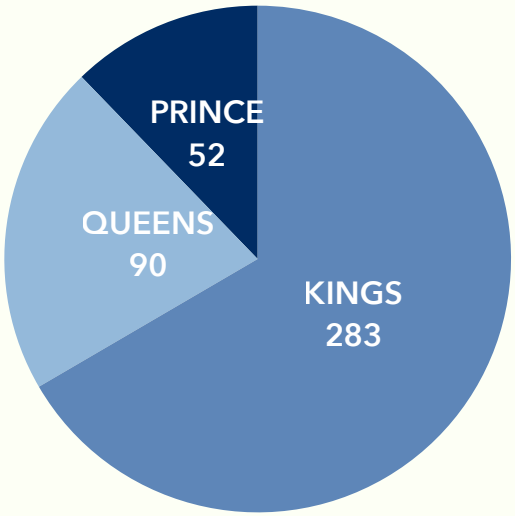



The historical records of black ash on PEI are predominantly found in Prince county, with far fewer sites listed in Kings or Queens county. Fieldwork in 2022 visited a number of hypothetical sites, primarily in Kings and Queens counties. Eleven out of Seventeen of these sites had black ash present with one site along the Pisquid River being home to over 42 black ash trees. This would suggest that, although still rare, black ash specimens and locations have been under-identified historically with other populations yet to be found. This is presumably true for Prince county as well, although none of these hypothetical sites have been determined or visited yet in this area.

As of March 2023, more black ash has been found in Kings county, which also corresponds to the most surveyed county.

The largest populations of black ash have been found in the Martinvale area in King county, the Dromore area in Queens county, and the Ellerslie bog in Prince county.

**BLACK ASH BY COUNTY**

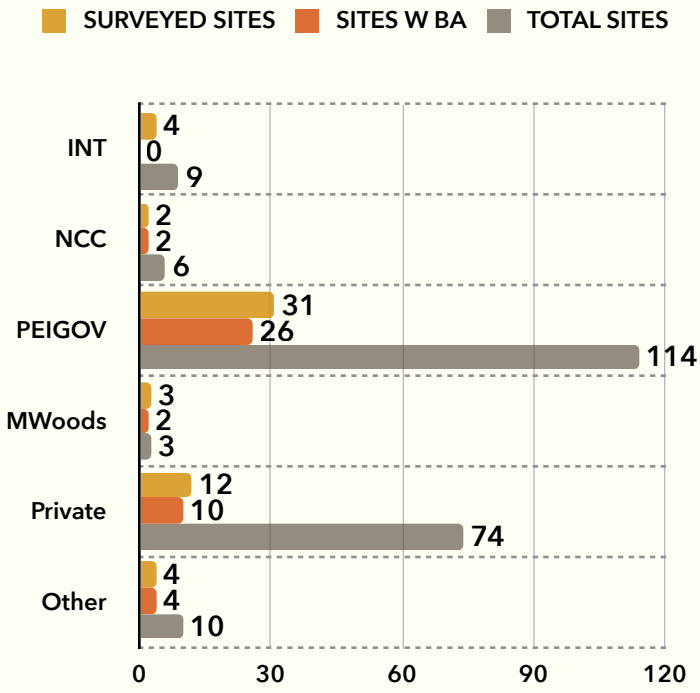


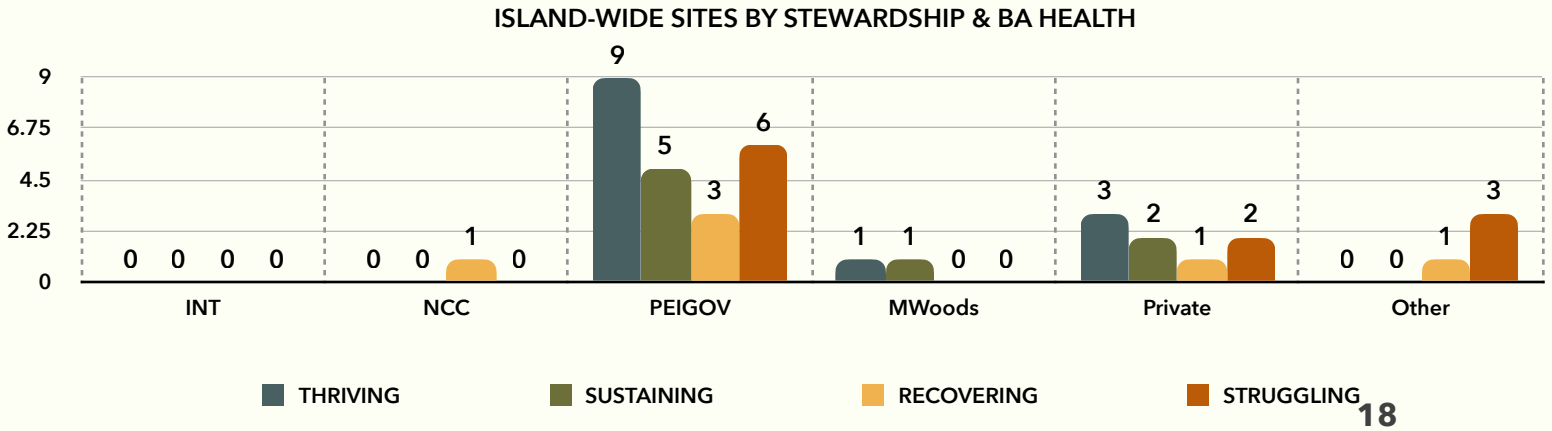

| County | # Sites Surveyed | # Sites Confirmed | Total # Black Ash | # Black Ash at Most Populated Site |
|---|---|---|---|---|
| Prince | 12 | 9 | 52 | 19 |
| Queens | 17 | 10 | 90 | 42 |
| Kings | 27 | 19 | 283 | 124 |
| **Totals** | 56 | 38 | 425 | |

# Provincial Sites: Stewardship


Most of the historically recorded sites are stewarded by the Provincial government or by private citizens. Although public land sites have yielded the greatest number of confirmed trees, they have also been the most surveyed due to accessibility.

While few recorded trees have been found on land stewarded by ecological groups such as the INT or NCC, fieldwork on these properties has been minor. Both groups have been contacted and their properties have been marked for virtual assessment of black ash habitability for 2023 field season work.



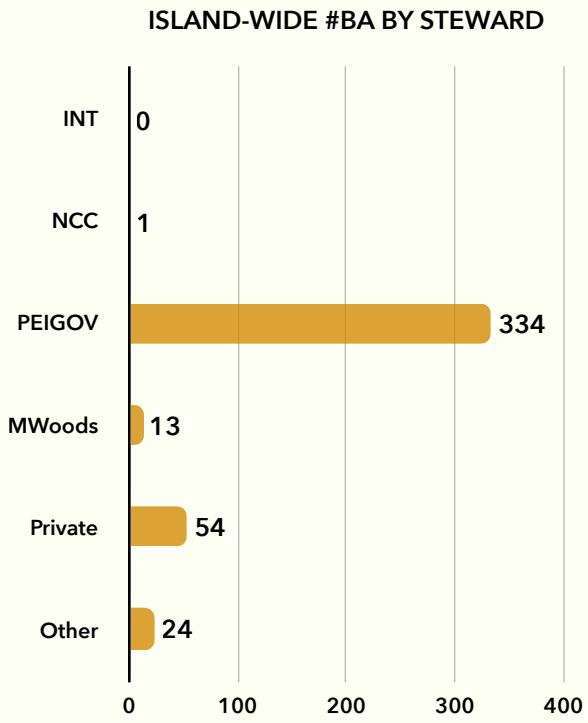
# Provincial Black Ash: Stewardship

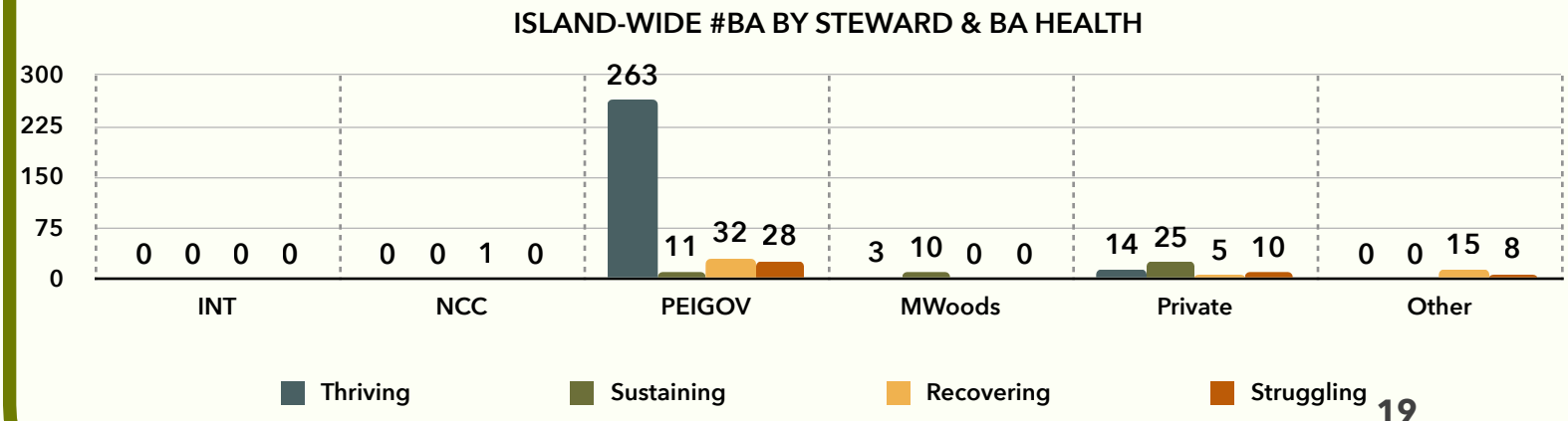
Black ash at Nature Conservancy of Canada Site

When looking at the number of confirmed black ash by stewardship, it is apparent that most of the population is on public land. That being said, public land has been surveyed more than twice as much as private land, which might account for such a large discrepancy.

By comparing the health of each site with the number of black ash found by the land steward, government stewarded trees are proportionately in better health compared to those of other stewards. This result is heavily influenced by three high-population sites with thriving trees on public land.

While most sites visited had been ecologically disturbed at least once in the past 75 years. Private land sites tended to be smaller in area with more nearby disturbances affecting a number of ecosystem processes from soil drainage to light conditions.



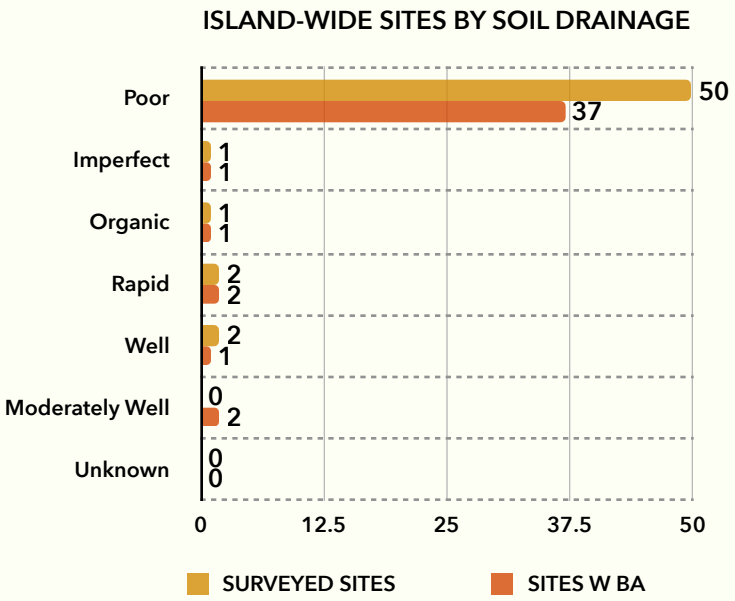



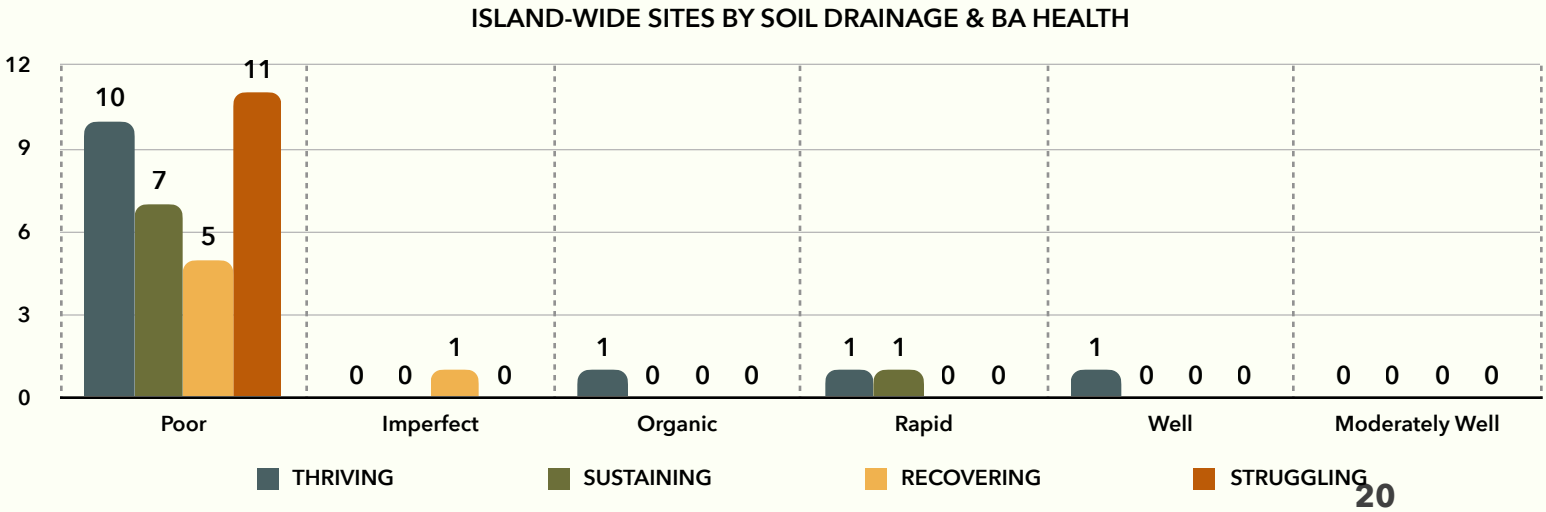
# Provincial Sites: Drainage

Green frog in standing water

Black ash are known to be trees of wetlands and riparian zones and the data collected during fieldwork reflects this. Although most sites with black ash were located on poorly drained soils, a healthy population of 99 trees were found at one site with "Organic" classified soils. There were also a small number of trees growing in rapid and well drained soils, these were generally found along riparian zones. One of the well drained sites is located at Macphail Woods with three black ash planted in the Arboretum.

Although black ash are found more often and more numerously in poorly drained soils, they can still grow well in better drainage given the right conditions.



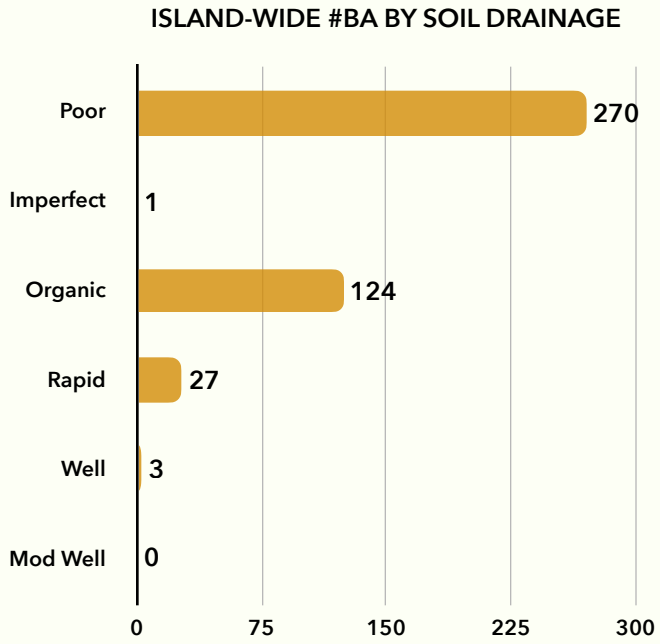



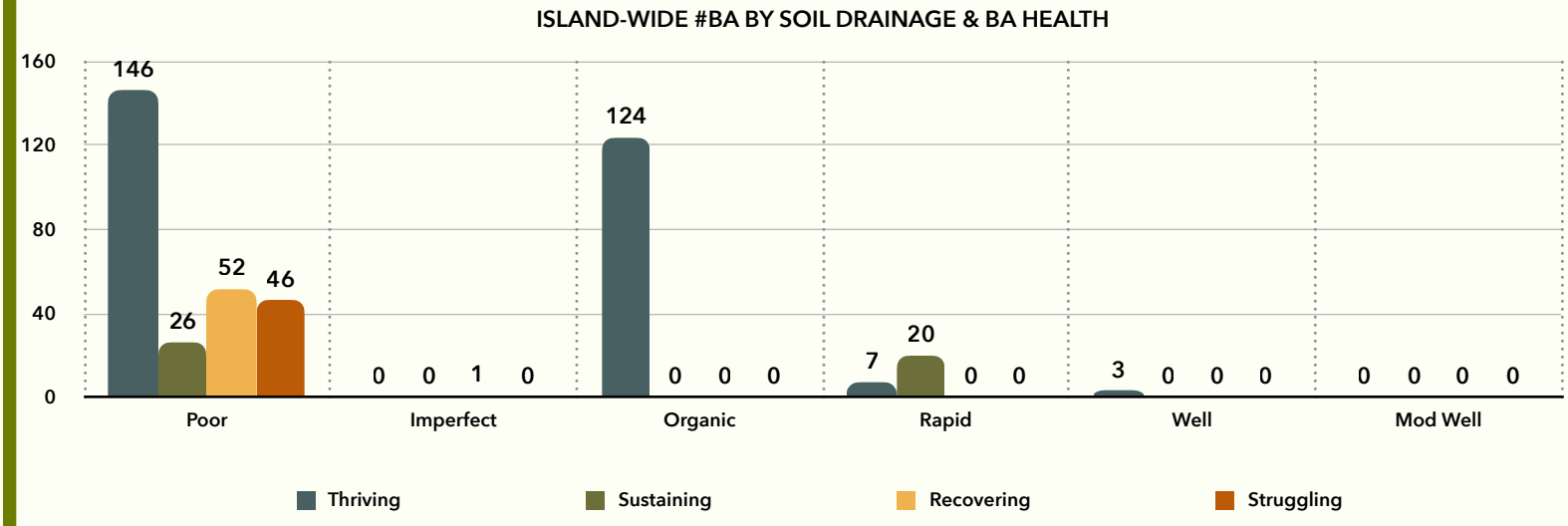
# Provincial Black Ash: Drainage


Round-Leaved Sundew -*Drosera rotundifolia* - S4

Like the breakdown of sites, looking at the number of trees found by drainage type yields a similar conclusion. The greater number of trees in all categories of health are found on poorly drained soils. There are a limited number of trees found in other soils across a much smaller sampling of sites. It is hard to conclude whether there might be many more undiscovered sites with higher drainage along wooded riparian zones.

It is also worth noting, that as many sites with poor drainage have as many *struggling* black ash as *thriving* black ash. However, the *struggling* sites have much lower populations of trees. This would suggest other ecological variables are dictating this contrast in both population and tree health.

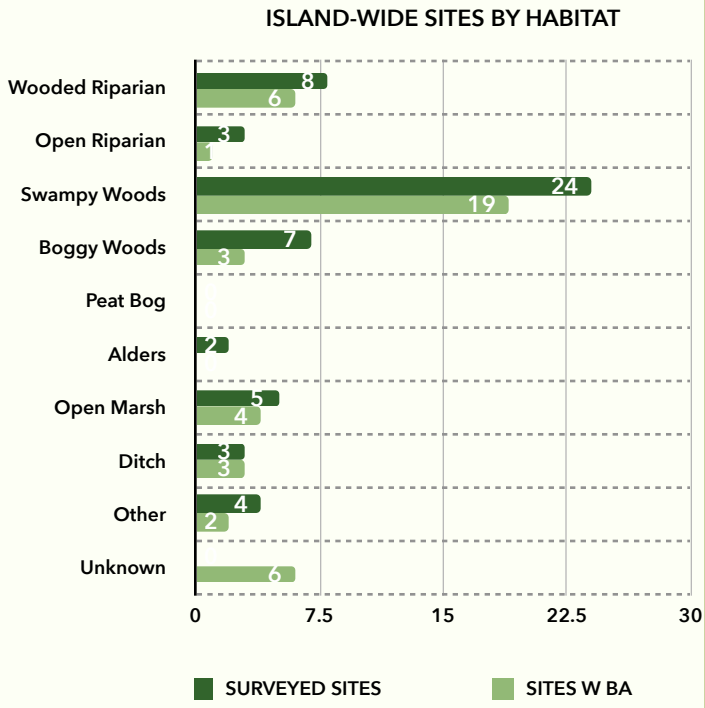


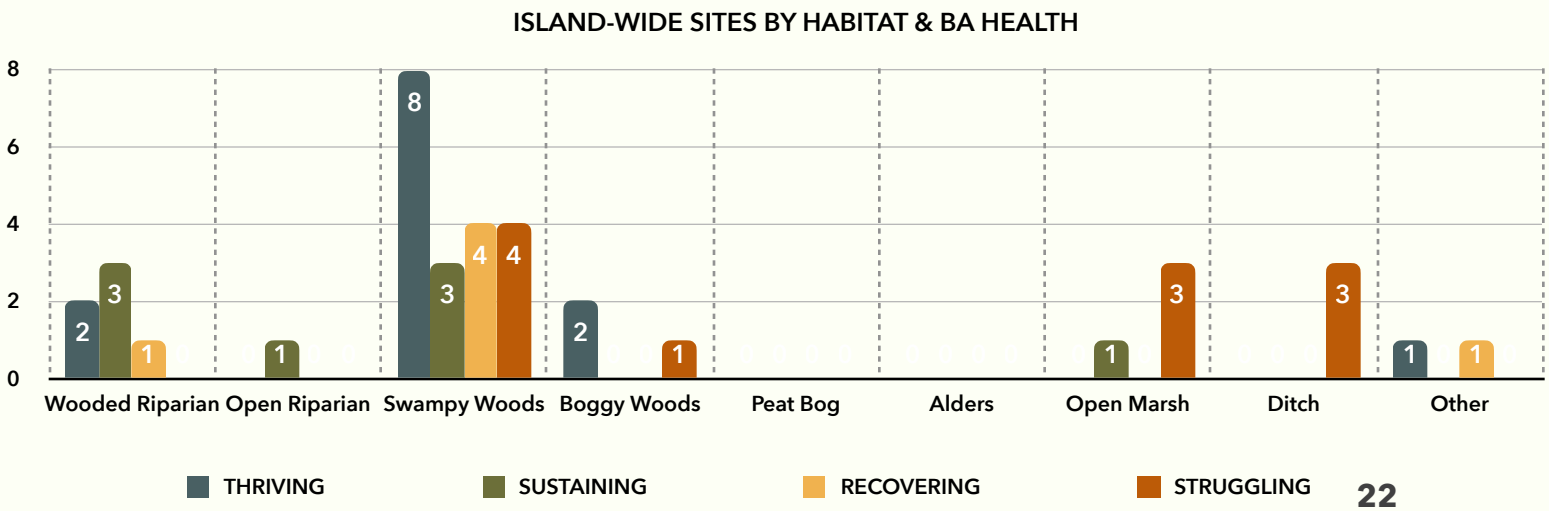



# Provincial Sites: Habitat

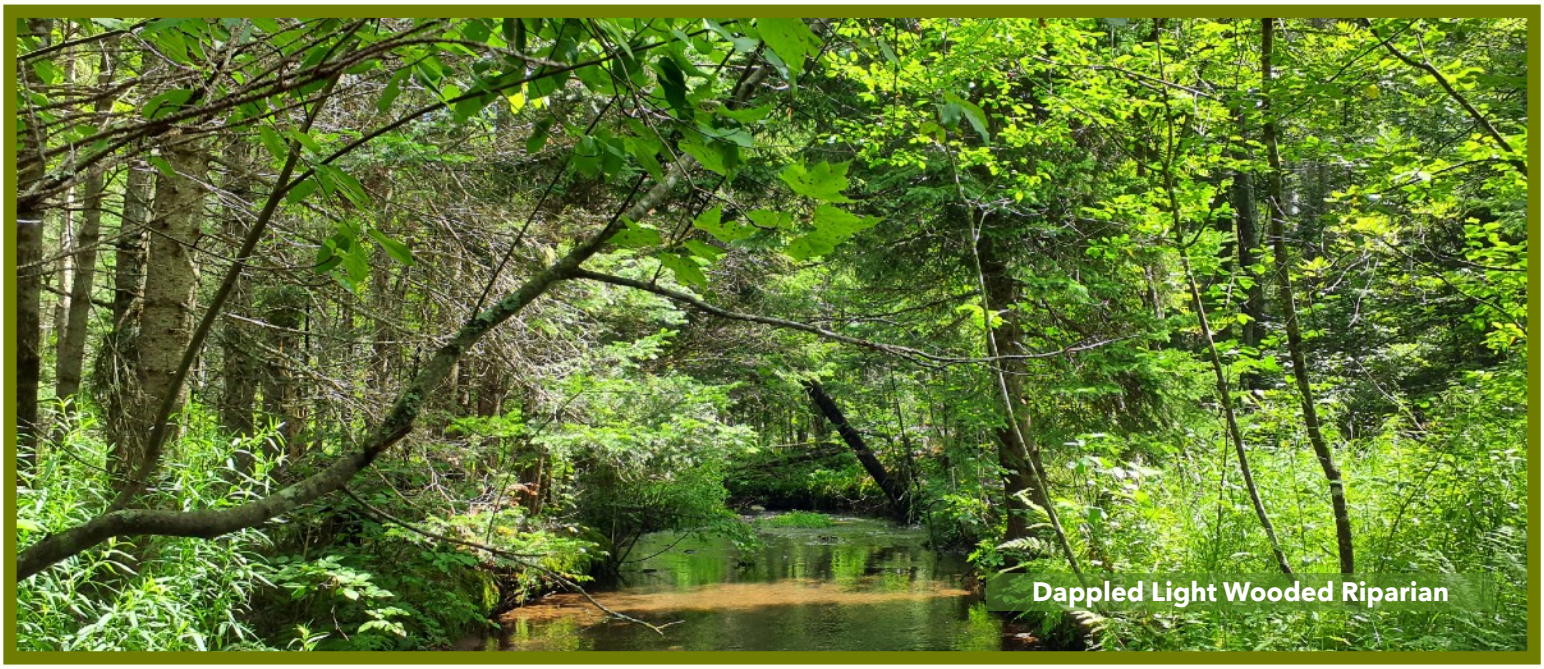

Black ash on PEI have been found in greater numbers growing in *swampy woods*. These habitats also have the greatest proportion of *thriving* sites. Wooded riparian zones represent the second largest subset of black ash sites by habitat. While a small number of sites were found in more open habitats like ditches and marshes, these were most often determined to be *struggling* populations.

The field data collected to date would suggest that Island black ash prefer at least partially forested habitats with high moisture levels and some shade from the sun. These types of habitats have yielded the largest and healthiest populations as of yet.



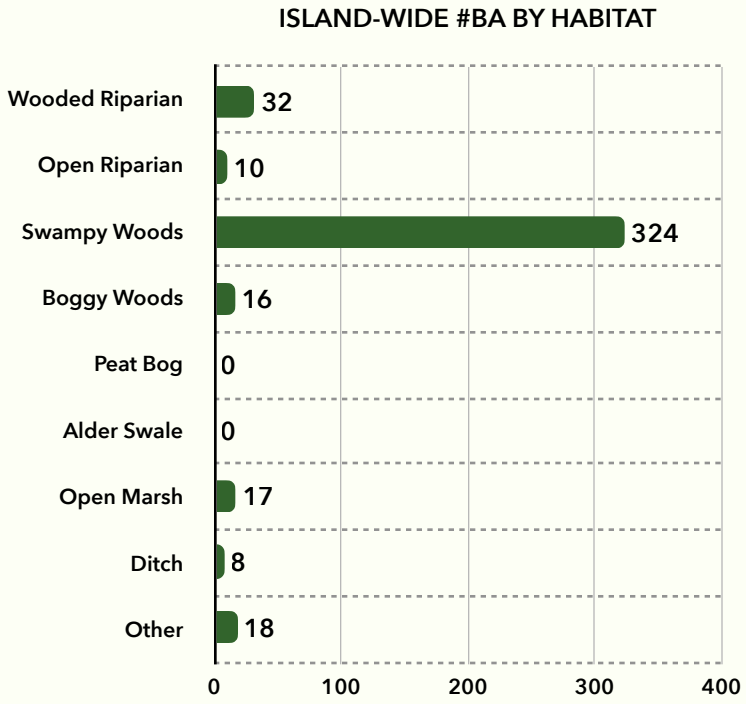



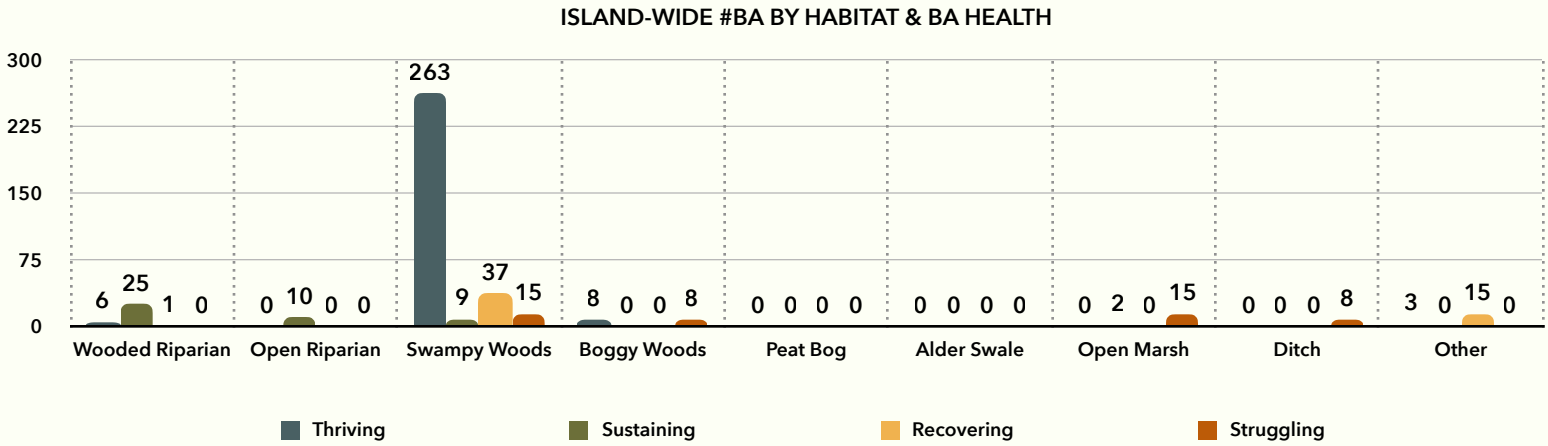
# Provincial Black Ash: Habitat


Dappled Light Wooded Riparian

Similarly to the site breakdown, both the *swampy woods* and *wooded riparian zone* habitats have the greatest number of black ash specimens by far. Not only were many black ash found in *swampy woods* but these were predominantly *thriving* as well. Again, this suggests that black ash prosper in sheltered and moist growing-conditions without too much exposure to light. The lack of black ash in typically shadier *boggy woods* supports this conclusion.

It should be mentioned that historic land-use certainly plays are large role in influencing these findings. *Swampy woods* were not suitable for farming and would have seen less historic disturbances which can quickly extirpate black ash locally.



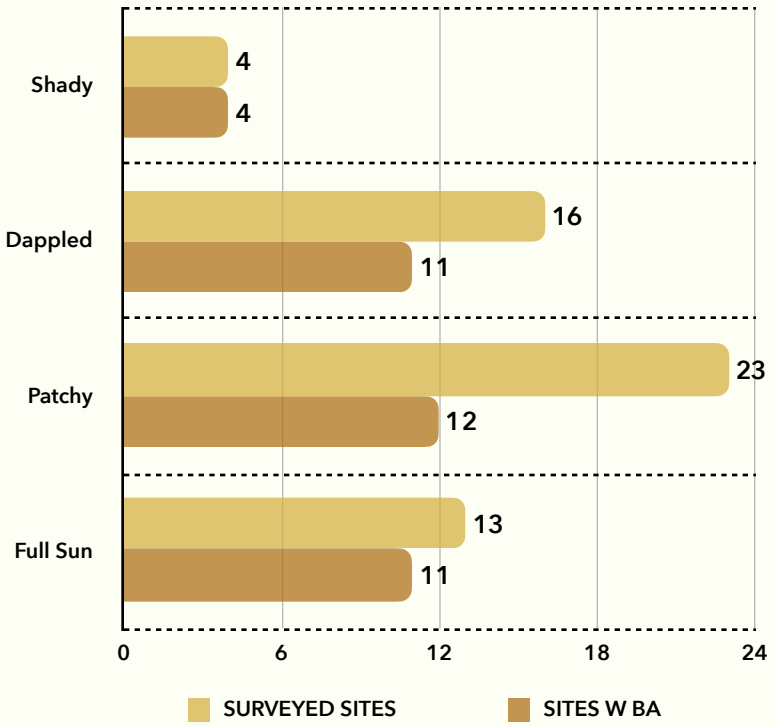
# Provincial Sites: Light Conditions


Black ash on PEI were found growing in a variety of different light conditions during fieldwork. The greatest number of confirmed sites were found growing in *patchy* conditions, although almost as many sites were found in *dappled* and *full sun* conditions.

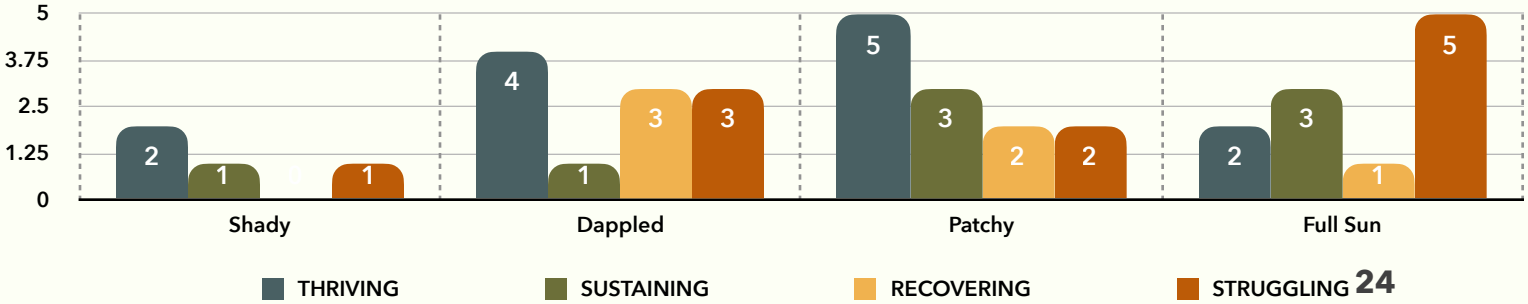
Looking at tree health, the *full sun* category had a higher proportion of *struggling* specimens. Both the *dappled* and *patchy* trees shared similar proportions between health categories.

While not yet conclusive, the field data suggests that black ash favour partially-shaded conditions, favouring small sunny patches or the dappled effects of a predominantly deciduous canopy. While sites under *shady* conditions are not numerous, it should be noted that black ash appears to be able to tolerate heavier shade in some settings.

**ISLAND-WIDE SITES BY LIGHT CONDITIONS**




**ISLAND-WIDE SITES BY LIGHT CONDITIONS & BA HEALTH**

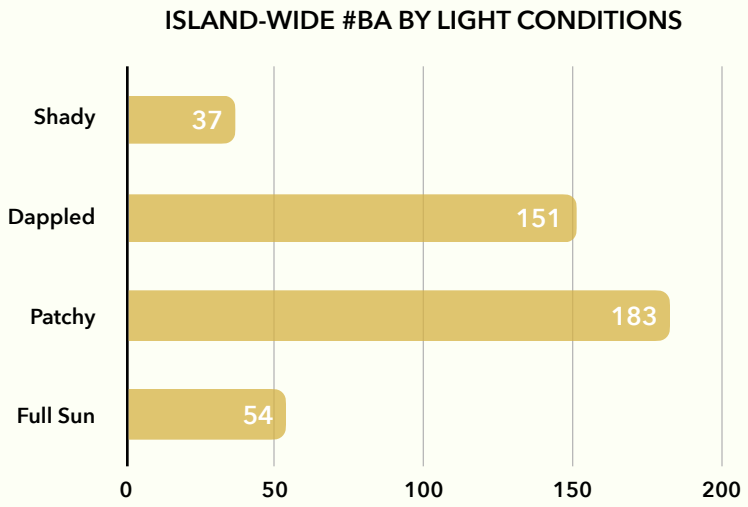


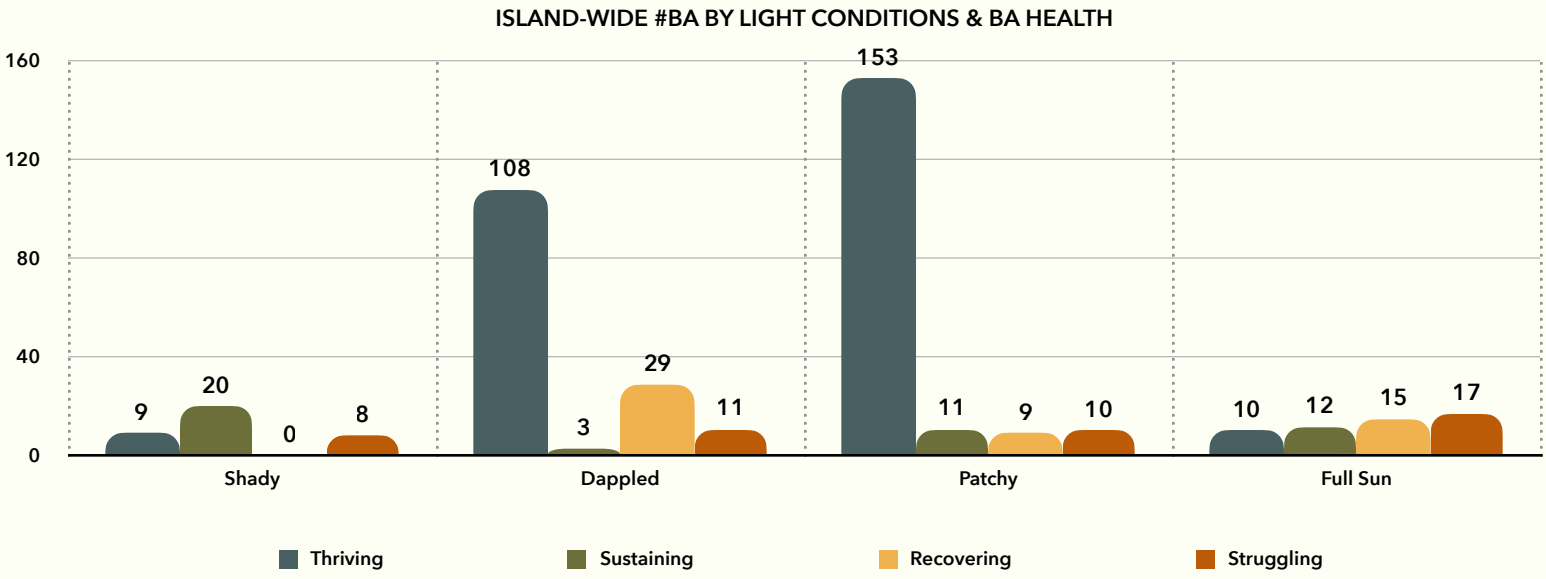
# Provincial Black Ash: Light Conditions

Patchy Canopy in Swampy Woods

A much greater number of trees were found growing in *dappled* and *patchy* conditions. Although there is almost an equal number of *full sun* sites, their populations and general tree health are much lower. This further suggests the propensity for black ash to thrive in partially-shaded conditions.

The high proportional number of *thriving* trees found in partially-shaded sites seems to point at a preference for sites with some shade and protection for optimal health.



# BLACK ASH BIODIVERSITY

White Pincushion Moss (*Leucobryum Glaucum*) - Status Unknown

As demonstrated in the Provincial site analysis, Island black ash are found growing in a variety of wetland habitats, many of which show little evidence of recent farming. This Island-wide and diverse distribution results in black ash growing amongst many unique, interesting and rare native species.

Christmas fern - *Polystichum acrostichoides* - S3S4

Many of the sites visited were swampy woodlands populated by typical water-tolerant native trees such as eastern larch, black spruce and red maple. Other wooded sites have a much less common array of tree species such as American elm, white ash and eastern white cedar.

The understory of these sites is often densely vegetated with ferns, wetland wildflowers, shrubs and an incredible diversity of non-vascular species. Some of the shrubs found include alder-leaved buckthorn, mountain-fly honeysuckle, poison ivy, red-osier dogwood, shining rose, alders, witch-hazel, hobblebush and both native hollies.

Woolly Liverwort (*Trichocolea tomentella*) - SU

The ferns & non-vascular community are of particularly interest across these sites. Ferns such as royal fern, Christmas fern and many others have been located during fieldwork. There has also been a large number of lichens, mosses and liverworts found, including many rare and unconfirmed species.

# Data Collection


Herb Robert - *Geranium robertianum* - S4

Biodiversity data for each site was collected during fieldwork between December 2022 and March 2023.

**A number of field tools were used to aid in species identification.**

1) Field guides
2) 2 botanical loupes (10x & 20x magnification)
3) A portable digital microscope
4) A field tablet for photography
5) GPS for recording species location

**Species identification was confirmed in one of three ways:**

1) Identification by survey team in the field.
2) Identification through consultation with staff of the ACCDC.
3) Identification through crowd-sourcing help on the website/app, INaturalist.


Halberd-leaved Tearthumb - *Persicaria arifolia* - S3


Showy Lady's-Slipper - *Cypripedium reginae* - S2S3

**OBSERVER BIAS**

The field team acknowledges a number of biases in the collected data. The lead botanist's background is predominantly in dryer upland habitats. Sites visited at later dates generally have larger and more comprehensive species lists. Seasonal surveying also led to a number of missed species with some sites surveyed outside the growing season. Difficult terrain also led to limitation in species surveying. At some sites, black ash were found late in the day leaving little time for data collection.

# Data Collection: Provincial Conservation Ranks


Spotted Joe Pye Weed - *Eutrochium maculatum - S5*

The **Atlantic Canada Conservation Data Centre (AC CDC)** in Sackville, N.B. continues to be a great asset throughout the region for determining whether or not a plant is native and its rarity. They have a ranking system on their excellent web site (accdc.com) for plants found in each individual province (S1 to S5).

The **AC CDC** rankings for our Provincial plants are:

**S1 - Critically Imperiled:**
Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.

**S2 - Imperiled:**
Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province.

**S3 - Vulnerable:**
Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

**S4 - Apparently Secure:**
Uncommon but not rare; some cause for long-term concern due to declines or other factors.

**S5 - Secure:**
Common, widespread, and abundant in the province.

**SU/Unknown - Unrankable -**
Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

**Website**: http://www.accdc.com/index.html

# Black Ash Flora Data


Unknown Spindle Fungus

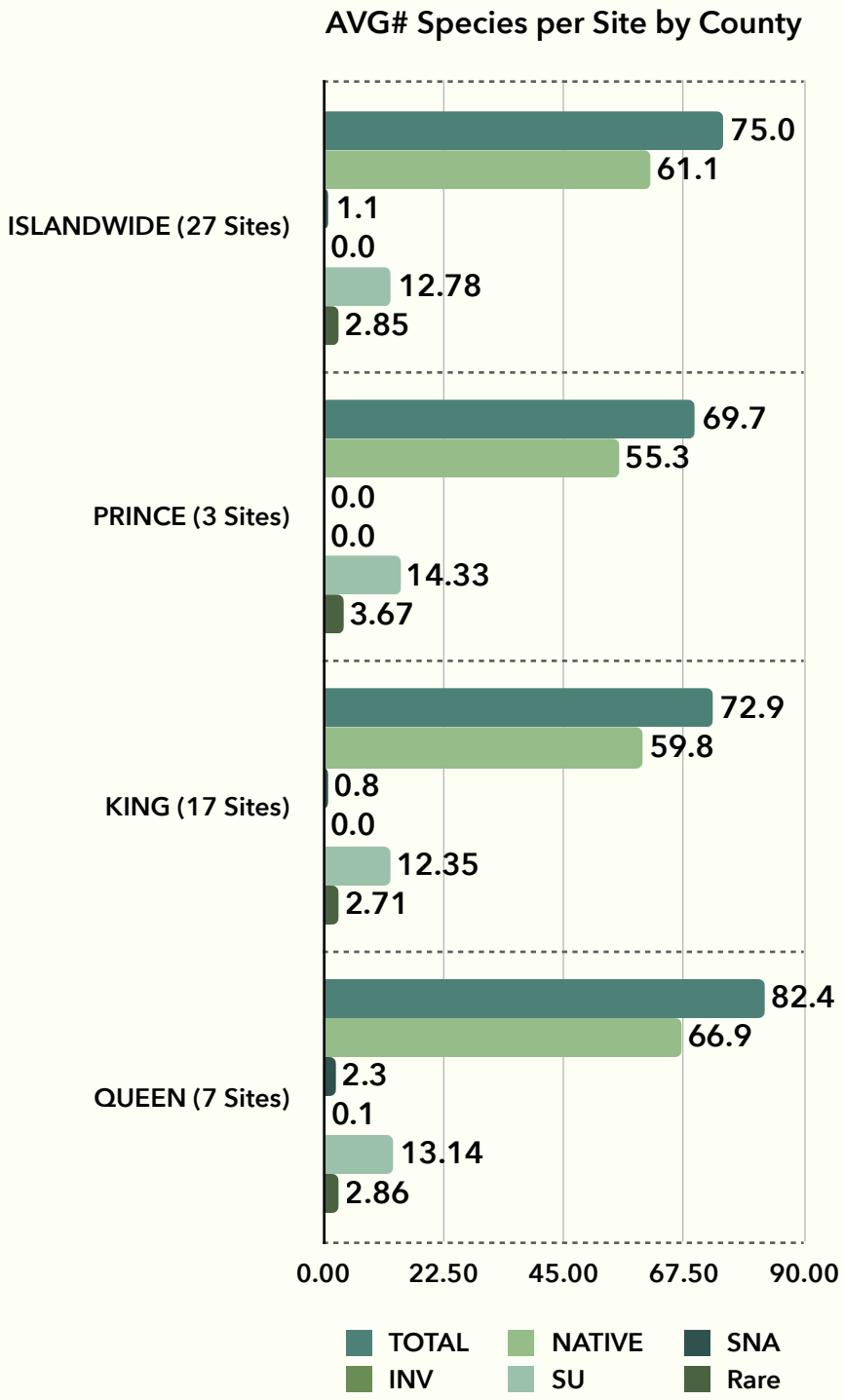
Although biodiversity data was collected for all surveyed sites, a number of sites were omitted from the biodiversity analysis for the following reasons.

1) Site was surveyed outside of growing season leading to a largely incomplete species survey.
2) Site lacked black ash trees. These sites will be used in future analyses to compare black ash site diversity to non-black ash site diversity across similar growing conditions.
3) Sites from early in the project's history in which too many of the site specimens were identified to family, genus or not at all.

All species occurrences at each site were tallied by multiple categories and then averaged by the number of sites.

Species were grouped into a variety of sub-categories to better analyze the findings. Species were broadly grouped by Provincial conservation status , growth-form and favoured growing conditions.

The graph to the right, shows the average species number breakdown Island-wide as compared to each individual county. The species averages are grouped into broad categories describing their provincial conservation status.



# Black Ash Flora: SRank


One-flowered Wintergreen - *Moneses uniflora* - S3

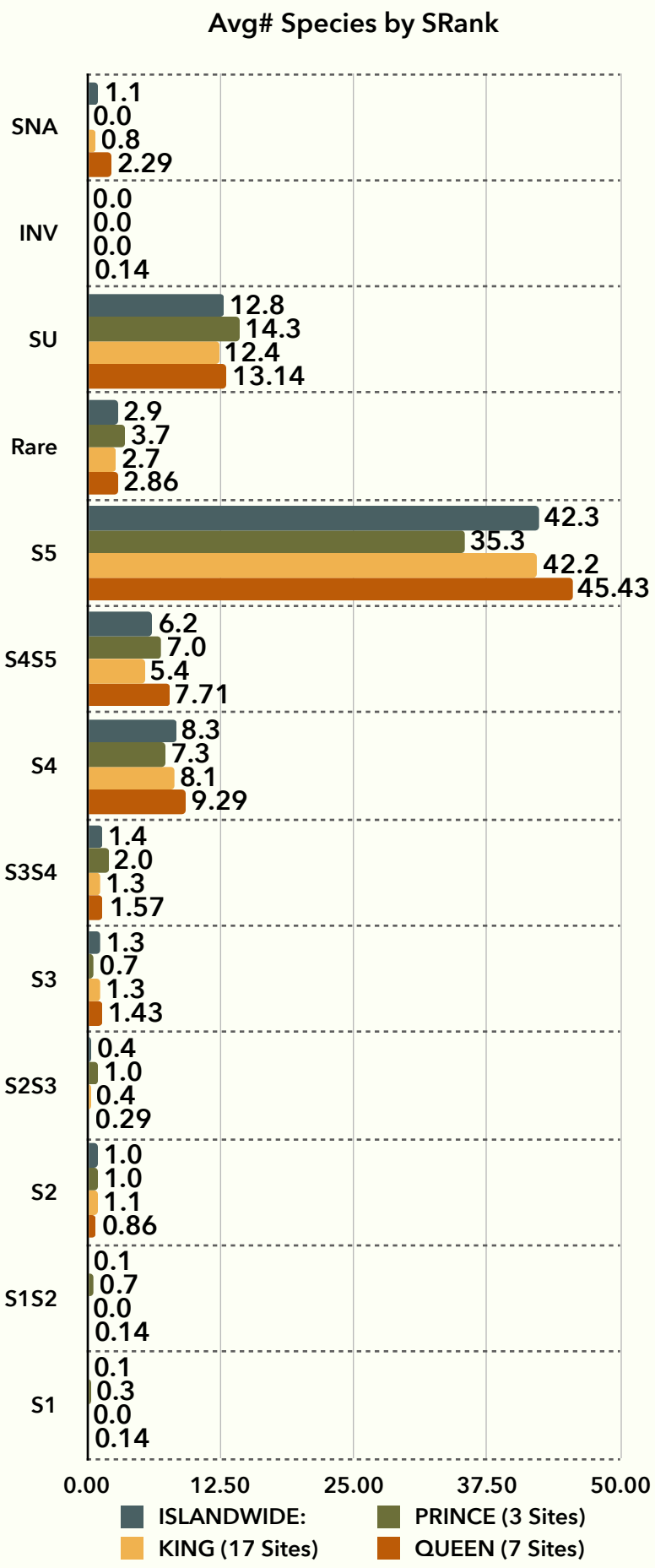
The graph to the right shows the average number of species found per site by their Provincial Conservation Status Rankings (SRANK).

The graph shows the data by Provincial county as well as island-wide.

When examining the county by county data, it is worth noting the number of sites included in the analysis. Kings county had 17 sites surveyed with black ash present and with adequate biodiversity surveys completed. This results in a much better data analysis, with a variety of conditions represented as well as sites with black ash of varying health and population.

Prince county, by contrast, only includes three sites in this analysis due to the low number of surveys enacted during the growing season. In addition, all three of these sites are in close proximity and in the same watershed. The narrow data-set creates many issues when looking at Prince county alone.

Queens county sites generally had higher species counts although this is effected, in small part, to higher numbers of non-native and invasive species present. Only 7 sites from Queens county were included in this analysis, giving extremely high or low diversity sites more weight amongst the averaging process.



# Black Ash Flora: Flora Type

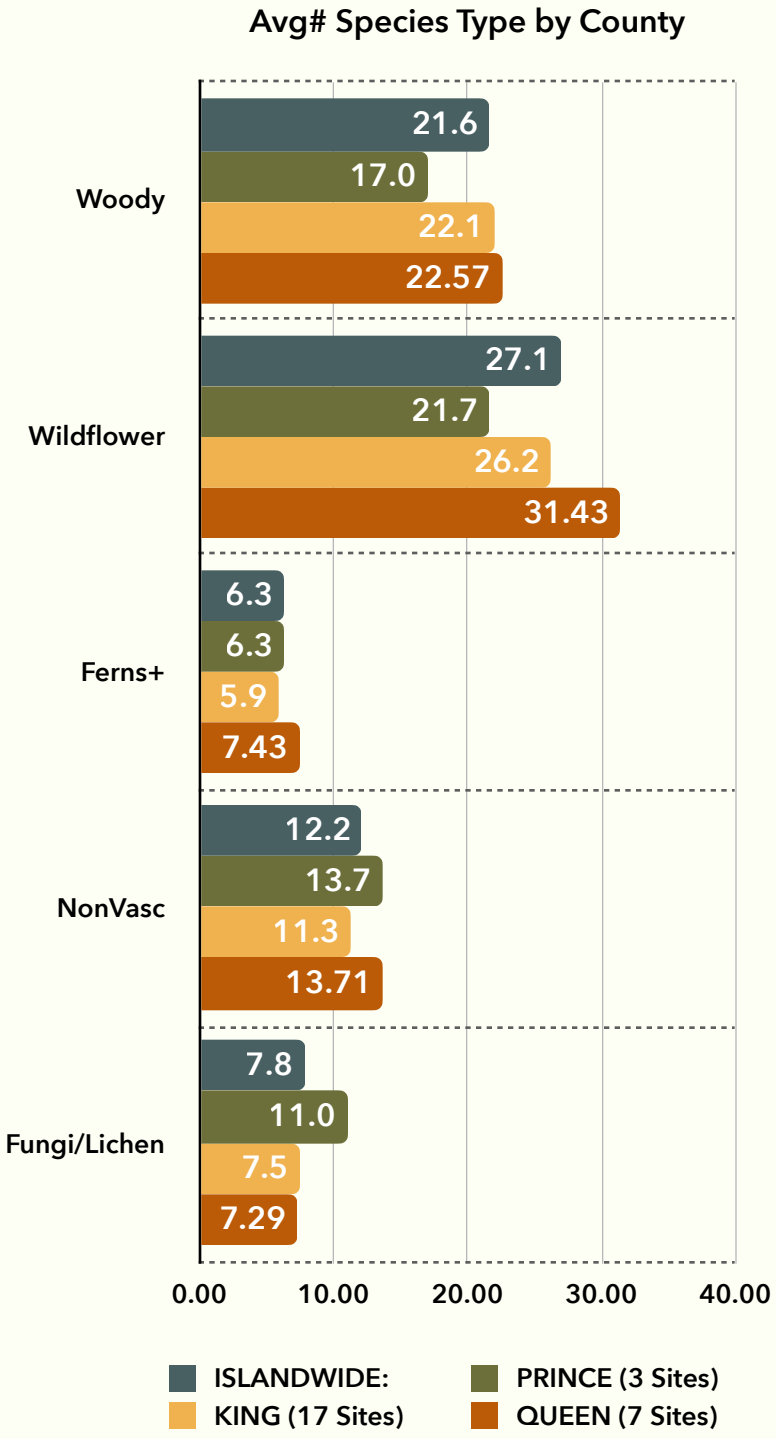

As mentioned, the biodiversity analysis also categorized species by their growth-form. The list of flora and fungi were broken down into 5 categories representing similar lifestyles and/or challenges. These categories also begin to highlight the diversity found across the structural layers of the forest, from ground cover to the canopy as well epiphytic species.

The graph to the right shows the average number of species by growth-form as well as by Provincial county.

Queens county has the highest average species count across 7 sites in most categories, except for the fungi/lichen category. Prince County, with its low site sample size, all located in Ellerslie bog, comes out on top due to a number of rare lichens found when doing fieldwork with James Churchill from the ACCDC.

Kings county has the second highest average species count in all categories across 17 sites. Even with a larger data-set, which should moderate sites of extremely high diversity, Kings county black ash sites are still among the most diverse by average number of species.

The 2023-24 stage of the project will aim to increase the number of sites surveyed across Queens and Prince Counties to improve some of the limitations in the current dataset.



# Black Ash Flora: Habitat

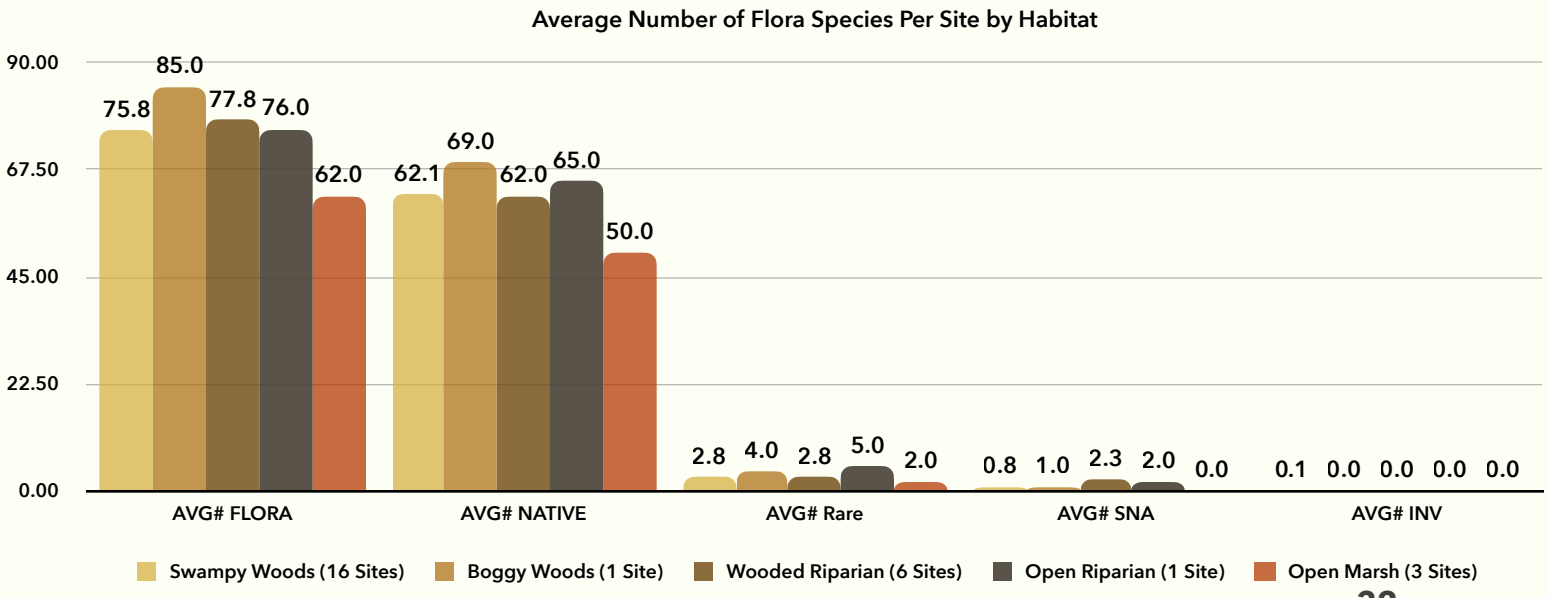
Black ash growing along Wooded Riparian

Biodiversity survey data was also averaged by each of the habitat categories established during the site assessment. As the predominance of the black ash found were growing in *Swampy Woods,* this habitat has a much larger set of data for analysis compared to other types. *Wooded Riparians* and *Open Marshes* are the only other habitats which have more than one site included in the biodiversity analysis.

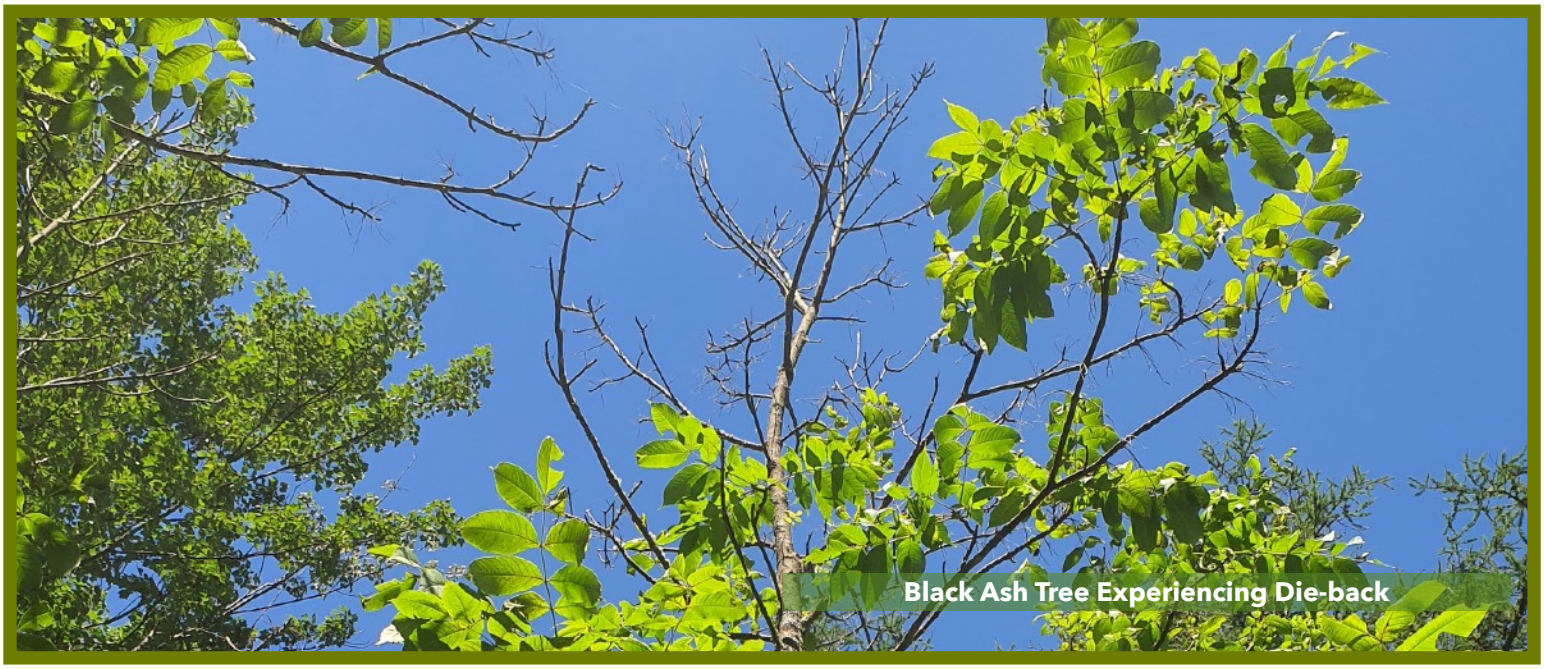
The diversity data by habitat is further analyzed across broad conservation status categories.

These limitations have created a number of presumed anomalies. For example, the *Boggy Woods* habitat have the highest average number of species across most of the categories despite being described as "species poor" in other work, including the 1996 inventory by the Province (Sobey, 1996).

As the project matures, these discrepancies will become less-pronounced once more field data is collected across a great array of locations and categories.



# Black Ash Flora: Black Ash Health

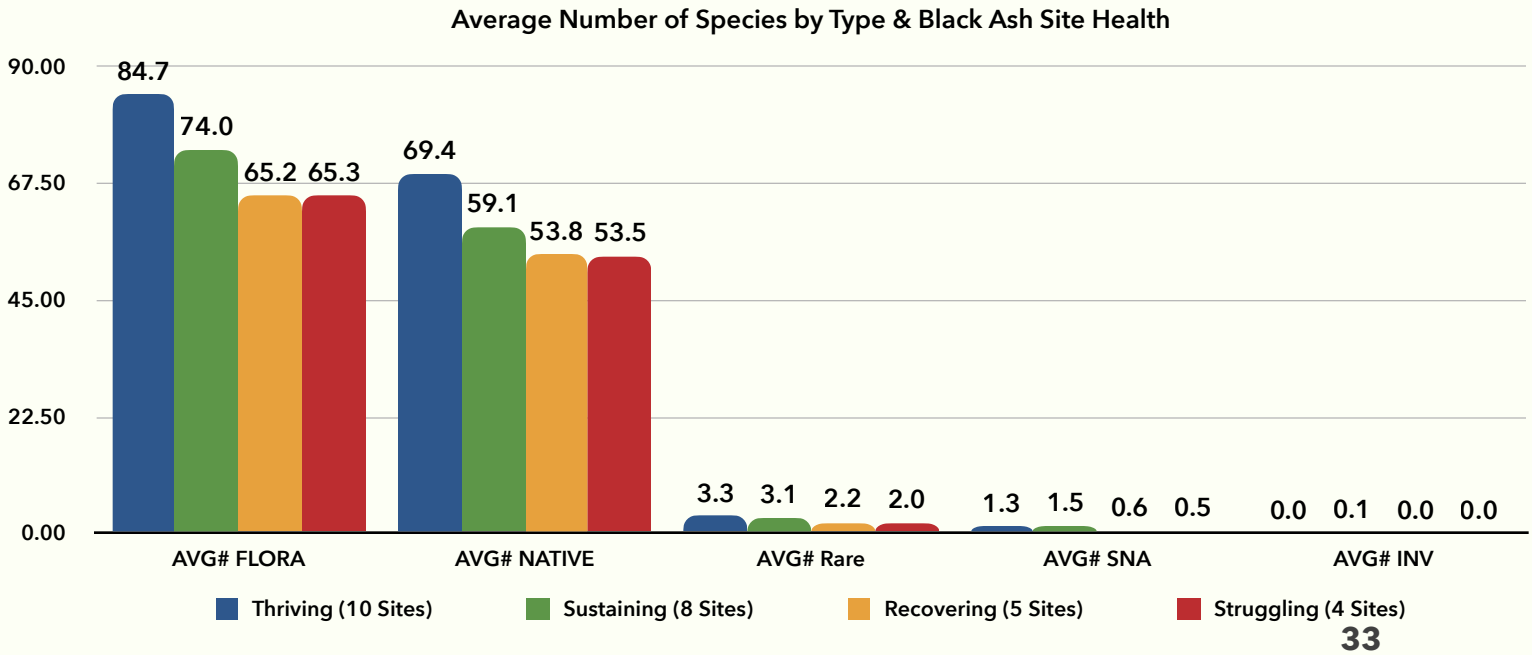


Black Ash Tree Experiencing Die-back

When examining species diversity in regards to the general health of black ash specimens found on-site, there is a better balance amongst the data set. All four categories concerning black ash health had multiple sites included in this analysis.

As mentioned, the black ash health assessment was a purely qualitative survey with ample room for error.

With these limitations in mind, a trend amongst the data can be seen. Sites which support black ash of greater health are more species rich on average. If this is correct, there could be a number of explanations. This could be the result of past ecological disturbances such as clearcutting or farming which can reduce species richness in an area. It might also be due to the black ash's preference for wetland habitats which are often known for their high species richness.



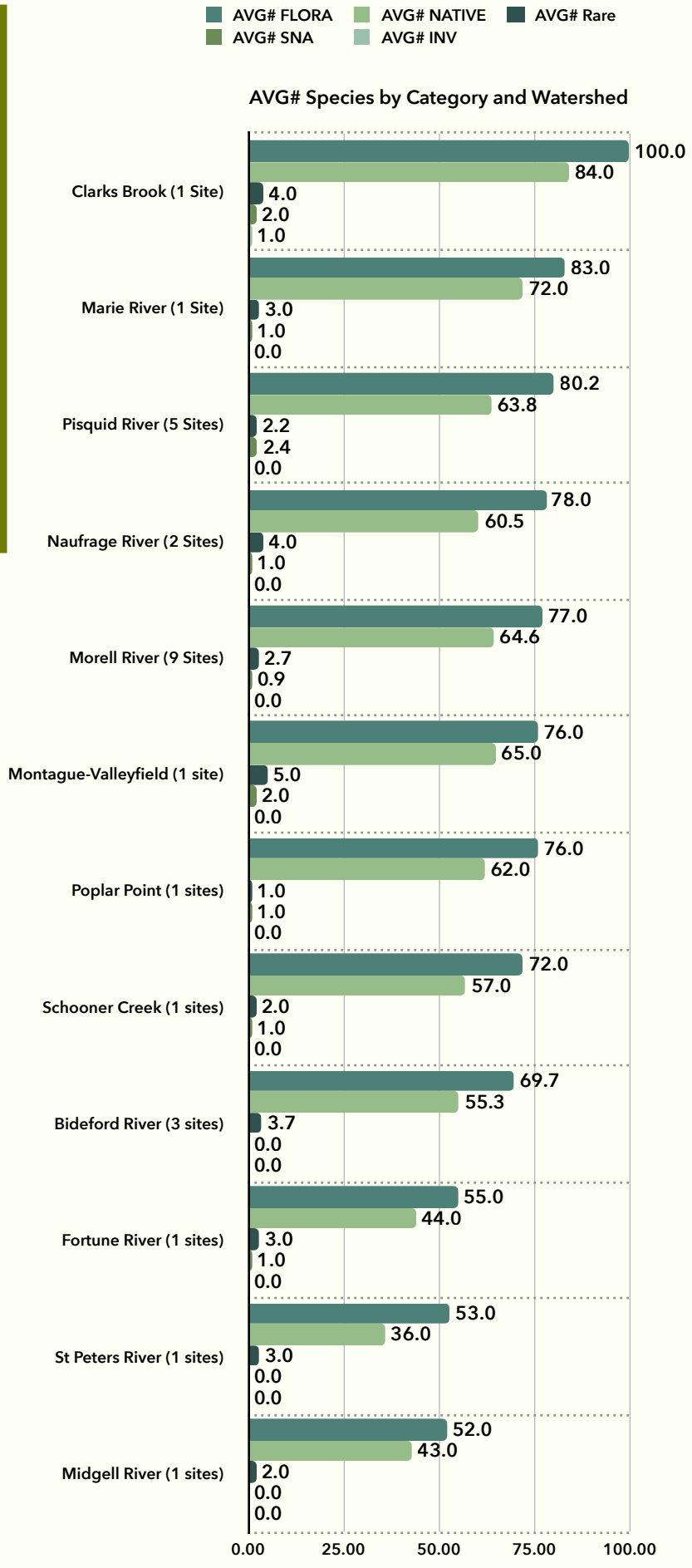
# Black Ash Flora: Watersheds


The average number of species by watershed, shown in the graph to the right, is preliminary data at best. Many of the watersheds had only one site surveyed with black ash present, allowing limited analysis.

The Morrell, Pisquid, Bideford, and Naufrage watersheds were the only ones with more than one site included in the diversity analysis.

As the project continues, this data-set will help to target various watershed groups across the Island for collaboration with this project.

All data concerning black ash and site biodiversity within each watershed will be shared with the watershed group responsible for that area.



# Associated Species


Mountain Fly Honeysuckle - *Lonicera villosa* - S4

## COMPANION SPECIES

By examining the number of occurrences of each species by site where black ash were found, we should be able to determine native companion species that share growing condition preferences with black ash. This information can be used in conjunction with Provincial species and habitat distribution records to find likely sites for new black ash populations. The sites surveyed in the 2022 field season, were hypothosized using this information, also incorporating soil drainage, wetland and forest-age GIS data. When in the field, the survey team used these companion species for locating black ash, especially at new sites or where the historic location data was highly inaccurate.


White Elm - *Ulmus americana* - S3

While the data presented below does begin to reveal ecological community connections amongst native species and black ash, there are still the many gaps and discrepancies in the biodiversity data that need to be taken into account. As the project continues, this data will become more robust. To date, more *swampy woods* habitats have been surveyed with black ash than any other type, leaving a bias in the lists below towards species with those habitat preferences.


Eastern Marsh Fern Thelypteris palustris - S4S5

# Associated Species: Trees


Eastern White Cedar - *Thuja occidentalis* - S3S4

*Swampy woods* are most often mixed woodlands with a tendency towards a slightly more deciduous canopy and wet soils. The species of trees which had higher occurrence rates were all species which could tolerate these conditions. However, many of these species are relatively common native species which can grow in a variety of habitats.

Several species, although with lower occurence rates, were more useful during fieldwork in establishing potential black ash locations. These were white elm, white ash and American mountain ash. Most often, when these species occurred, the field team would also find black ash trees.

This was found to be true for shrubs as well, with many of the species of highest occurrence, being relatively common species with wide-ranging tolerances.

| WOODY PLANTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| CONIFEROUS PLANTS | SCIENTIFIC NAME | SRANK | Total OCC | %OCC | PR | QU | KI |
| Balsam Fir | *Abies balsamea* | S5 | **26** | **96.3%** | 3 | 7 | 16 |
| Black Spruce | *Picea mariana* | S5 | **17** | **63.0%** | 0 | 2 | 15 |
| Tamarack | *Larix laricina* | S5 | **13** | **48.1%** | 0 | 1 | 12 |
| Red Spruce | *Picea rubens* | S5 | **9** | **33.3%** | 2 | 4 | 3 |
| Eastern White Cedar | *Thuja occidentalis* | S3S4 | **4** | **14.8%** | 3 | 1 | 0 |
| Eastern Hemlock | *Tsuga canadensis* | S3 | **4** | **14.8%** | 0 | 3 | 1 |
| White Spruce | *Picea glauca* | S5 | **3** | **11.1%** | 0 | 2 | 1 |
| Eastern White Pine | *Pinus strobus* | S3S4 | **2** | **7.4%** | 0 | 1 | 1 |
| DECIDUOUS TREES | | | | | | | |
| Black Ash | *Fraxinus nigra* | S2 | **27** | **100.0%** | 3 | 7 | 17 |
| Red Maple | *Acer rubrum* | S5 | **27** | **100.0%** | 3 | 7 | 17 |
| Paper Birch | *Betula papyrifera* | S5 | **14** | **51.9%** | 0 | 6 | 8 |
| Yellow Birch | *Betula alleghaniensis* | S5 | **9** | **33.3%** | 2 | 4 | 3 |
| White Elm | *Ulmus americana* | S3 | **9** | **33.3%** | 2 | 2 | 5 |
| American Mountain Ash | *Sorbus americana* | S5 | **7** | **25.9%** | 0 | 2 | 5 |
| Trembling Aspen | *Populus tremuloides* | S5 | **7** | **25.9%** | 0 | 2 | 5 |
| Gray Birch | *Betula populifolia* | S5 | **6** | **22.2%** | 0 | 2 | 4 |
| Striped Maple | *Acer pensylvanicum* | S5 | **5** | **18.5%** | 0 | 4 | 1 |
| White Ash | *Fraxinus americana* | S2S3 | **3** | **11.1%** | 0 | 1 | 2 |
| Pin Cherry | *Prunus pensylvanica* | S5 | **2** | **7.4%** | 0 | 1 | 1 |
| American Beech | *Fagus grandifolia* | S3S4 | **1** | **3.7%** | 0 | 1 | 0 |
| NON-NATIVE TREES | SCIENTIFIC NAME | SRANK | | | | | |
| European Mountain Ash | *Sorbus aucuparia* | SNA | **5** | **18.5%** | 0 | 3 | 2 |
| English Oak | *Quercus robur* | SNA | **1** | **3.7%** | 0 | 0 | 1 |

# Associated Species: Shrubs & Berries

There were several less widespread species which were very useful when on-site to pinpoint the location of black ash populations. These included alder-leaved buckthorn, shining rose, mountain fly honeysuckle, western poison ivy and swamp red currant. While not the species with the most occurrences, their presence was almost always in conjunction with areas of black ash.

| WOODY PLANTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SHRUBS** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Speckled Alder | *Alnus incana* | *S5* | **26** | **96.3%** | 3 | 7 | 16 |
| Canada Yew | *Taxus canadensis* | *S4* | **24** | **88.9%** | 3 | 7 | 14 |
| Red Osier Dogwood | *Cornus sericea* | *S5* | **21** | **77.8%** | 3 | 5 | 13 |
| alder-leaved buckthorn | *Endotropis alnifolia* | *S3S4* | **17** | **63.0%** | 3 | 2 | 12 |
| Shining Rose | *Rosa nitida* | *S4* | **17** | **63.0%** | 3 | 2 | 12 |
| Beaked Hazel | *Corylus cornuta* | *S5* | **16** | **59.3%** | 0 | 7 | 9 |
| Northern Wild Raisin | *Viburnum cassinoides* | *S5* | **16** | **59.3%** | 0 | 4 | 12 |
| Late Lowbush Blueberry | *Vaccinium angustifolium* | *S5* | **15** | **55.6%** | 3 | 2 | 10 |
| Sheep Laurel | *Kalmia angustifolia* | *S5* | **14** | **51.9%** | 0 | 3 | 11 |
| Mountain Holly | *Ilex mucronata* | *S5* | **13** | **48.1%** | 0 | 2 | 11 |
| Common Winterberry | *Ilex verticillata* | *S5* | **12** | **44.4%** | 3 | 3 | 6 |
| Mountain Fly Honeysuckle | *Lonicera villosa* | *S4* | **11** | **40.7%** | 0 | 2 | 9 |
| Willow | *Salix spp.* | *S5* | **11** | **40.7%** | 0 | 4 | 7 |
| Chokecherry | *Prunus virginiana* | *S5* | **10** | **37.0%** | 2 | 2 | 6 |
| Mountain Maple | *Acer spicatum* | *S5* | **10** | **37.0%** | 0 | 5 | 5 |
| Canada Fly Honeysuckle | *Lonicera canadensis* | *S5* | **9** | **33.3%** | 0 | 3 | 6 |
| Common Labrador Tea | *Rhododendron groenlandicum* | *S5* | **8** | **29.6%** | 0 | 1 | 7 |
| Common Elderberry | *Sambucus canadensis* | *S4S5* | **8** | **29.6%** | 0 | 3 | 5 |
| Western Poison Ivy | *Toxicodendron radicans var. rydbergii* | *S4* | **6** | **22.2%** | 3 | 1 | 2 |
| Serviceberry | *Amelanchier spp.* | *SU* | **6** | **22.2%** | 0 | 2 | 4 |
| Highbush Cranberry | *Viburnum opulus* | *S3* | **5** | **18.5%** | 0 | 1 | 4 |
| Green Alder | *Alnus alnobetula* | *S4S5* | **3** | **11.1%** | 0 | 0 | 3 |
| Velvet-leaved Blueberry | *Vaccinium myrtilloides* | *S4S5* | **3** | **11.1%** | 0 | 2 | 1 |
| White Meadowsweet | *Spiraea alba* | *S5* | **3** | **11.1%** | 0 | 1 | 2 |
| Bog Birch | *Betula pumila* | *S3* | **2** | **7.4%** | 0 | 0 | 2 |
| Alternate-leaved Dogwood | *Cornus alternifolia* | *S4* | **2** | **7.4%** | 0 | 0 | 2 |
| Sweet-fern | *Comptonia peregrina* | *S4* | **2** | **7.4%** | 0 | 0 | 2 |
| Sweet Gale | *Myrica gale* | *S5* | **2** | **7.4%** | 0 | 1 | 1 |
| Spreading Dogbane | *Apocynum androsaemifolium* | *S4* | **1** | **3.7%** | 0 | 0 | 1 |
| Leatherleaf | *Chamaedaphne calyculata* | *S4* | **1** | **3.7%** | 0 | 1 | 0 |
| Rhodora | *Rhododendron canadense* | *S5* | **1** | **3.7%** | 0 | 0 | 1 |
| American Witch-Hazel | *Hamamelis virginiana* | *S1* | **1** | **3.7%** | 0 | 1 | 0 |
| Virginia Clematis | *Clematis virginiana* | *S4* | **1** | **3.7%** | 0 | 0 | 1 |
| Steeplebush | *Spiraea tomentosa* | *S4* | **1** | **3.7%** | 0 | 1 | 0 |
| Hobblebush | *Viburnum lantanoides* | *S1S2* | **1** | **3.7%** | 0 | 1 | 0 |
| **BERRIES** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Dwarf Red Raspberry | *Rubus pubescens* | *S5* | **24** | **88.9%** | 3 | 6 | 15 |
| Red Raspberry | *Rubus idaeus* | *S5* | **16** | **59.3%** | 0 | 4 | 12 |
| Wild Strawberry | *Fragaria virginiana* | *S5* | **14** | **51.9%** | 0 | 4 | 10 |
| Bristly Dewberry | *Rubus hispidus* | *S4* | **11** | **40.7%** | 1 | 3 | 7 |
| Bristly Black Currant | *Ribes lacustre* | *S5* | **10** | **37.0%** | 3 | 1 | 6 |
| Swamp Red Currant | *Ribes triste* | *S3S4* | **5** | **18.5%** | 0 | 1 | 4 |
| Smooth Gooseberry | *Ribes hirtellum* | *S5* | **4** | **14.8%** | 0 | 0 | 4 |
| Skunk Currant | *Ribes glandulosum* | *S5* | **3** | **11.1%** | 0 | 2 | 1 |
| Smooth Blackberry | *Rubus canadensis* | *S5* | **1** | **3.7%** | 0 | 1 | 0 |

# Associated Species: Shade-Tolerant Wildflowers

Again, the most commonly occurring shade-tolerant wildflowers were often species with a wide-spread, both geographically and ecologically. There were no particular species amongst this category that were found to be particularly indicative of black ash populations or habitat. That being said, when looking at the species-spread of this category holistically, one can see a preference for shade-tolerant species which can also thrive in moist-to-wet soils. Species such as creeping snowberry, goldthread, the enchanter's nightshades, Jack-in-the-pulpit, and the agrimonies.

| NON-WOODY PLANTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| FORESTED HABITATS | SCIENTIFIC NAME | SRANK | Total OCC | %OCC | PR | QU | KI |
| Bunchberry | *Cornus canadensis* | S5 | 25 | 92.6% | 3 | 5 | 17 |
| Northern Starflower | *Lysimachia borealis* | S5 | 19 | 70.4% | 3 | 5 | 11 |
| Wild Lily-of-The-Valley | *Maianthemum canadense* | S5 | 17 | 63.0% | 3 | 4 | 10 |
| Wild Sarsaparilla | *Aralia nudicaulis* | S5 | 16 | 59.3% | 0 | 5 | 11 |
| Creeping Snowberry | *Gaultheria hispidula* | S5 | 15 | 55.6% | 0 | 2 | 13 |
| Creeping Buttercup | *Ranunculus repens* | SNA | 15 | 55.6% | 0 | 7 | 8 |
| Twinflower | *Linnaea borealis* | S5 | 13 | 48.1% | 0 | 3 | 10 |
| Hairy Flat-top White Aster | *Doellingeria umbellata* | S5 | 12 | 44.4% | 3 | 2 | 7 |
| Goldthread | *Coptis trifolia* | S5 | 11 | 40.7% | 3 | 1 | 7 |
| Aster spp. | *Symphyotrichum spp.* | SU | 10 | 37.0% | 1 | 2 | 7 |
| Small Enchanter's Nightshade | *Circaea alpina* | S5 | 9 | 33.3% | 0 | 5 | 4 |
| Whorled Wood Aster | *Oclemena acuminata* | S5 | 7 | 25.9% | 0 | 2 | 5 |
| Calico Aster | *Symphyotrichum lateriflorum* | S5 | 7 | 25.9% | 0 | 2 | 5 |
| Yellow Bluebead Lily | *Clintonia borealis* | S5 | 7 | 25.9% | 0 | 3 | 4 |
| Helleborine | *Epipactis helleborine* | SNA | 6 | 22.2% | 0 | 2 | 4 |
| Violet Spp. | *Viola spp.* | SU | 6 | 22.2% | 1 | 0 | 5 |
| Three-leaved Rattlesnakeroot | *Nabalus trifoliolatus* | S5 | 5 | 18.5% | 0 | 1 | 4 |
| Eastern Teaberry | *Gaultheria procumbens* | S4S5 | 5 | 18.5% | 0 | 3 | 2 |
| One-sided Wintergreen | *Orthilia secunda* | S4S5 | 5 | 18.5% | 1 | 2 | 2 |
| Round-leaved Pyrola | *Pyrola americana* | S4 | 4 | 14.8% | 0 | 0 | 4 |
| Jack-in-the-pulpit | *Arisaema triphyllum* | S4 | 3 | 11.1% | 0 | 1 | 2 |
| Painted Trillium | *Trillidium undulatum* | S5 | 3 | 11.1% | 0 | 1 | 2 |
| Pink Lady's-Slipper | *Cypripedium acaule* | S5 | 3 | 11.1% | 1 | 0 | 2 |
| Woodland Agrimony | *Agrimonia striata* | S4 | 3 | 11.1% | 0 | 0 | 3 |
| Trailing Arbutus | *Epigaea repens* | S4 | 2 | 7.4% | 0 | 1 | 1 |
| Convulsion-Root | *Monotropa uniflora* | S5 | 2 | 7.4% | 0 | 1 | 1 |
| Common Hemp-nettle | *Galeopsis tetrahit* | SNA | 2 | 7.4% | 0 | 2 | 0 |
| Cucumber Root | *Medeola virginiana* | S3S4 | 2 | 7.4% | 0 | 1 | 1 |
| Nodding Trillium | *Trillium cernuum* | S4 | 2 | 7.4% | 0 | 0 | 2 |
| Common Speedwell | *Veronica officinalis* | SNA | 2 | 7.4% | 0 | 2 | 0 |
| Hooked Agrimony | *Agrimonia gryposepala* | S3 | 2 | 7.4% | 0 | 0 | 2 |
| Bittersweet Nightshade | *Solanum dulcamara* | INV | 2 | 7.4% | 0 | 2 | 0 |
| Large False Solomon's Seal | *Maianthemum racemosum* | S4 | 1 | 3.7% | 0 | 1 | 0 |
| Zigzag Goldenrod | *Solidago flexicaulis* | S3 | 1 | 3.7% | 0 | 0 | 1 |
| Pinesap | *Hypopitys monotropa* | S3 | 1 | 3.7% | 0 | 1 | 0 |
| One-flowered Wintergreen | *Moneses uniflora* | S3 | 1 | 3.7% | 0 | 0 | 1 |
| Shinleaf | *Pyrola elliptica* | S5 | 1 | 3.7% | 0 | 0 | 1 |
| Fireweed | *Chamaenerion angustifolium* | S5 | 1 | 3.7% | 0 | 0 | 1 |
| Broad-leaved Enchanter's Nightshade | *Circaea canadensis* | S2S3 | 1 | 3.7% | 0 | 0 | 1 |
| Common Wood Sorrel | *Oxalis montana* | S4 | 1 | 3.7% | 0 | 1 | 0 |
| European Wood Sorrel | *Oxalis stricta* | S5 | 1 | 3.7% | 0 | 1 | 0 |
| Red Baneberry | *Actaea rubra* | S4 | 1 | 3.7% | 0 | 1 | 0 |

# Associated Species: Wetland Wildflowers


Purple-stemmed Angelica - Angelica atropurpurea - S3

Wildflowers which thrive in wet conditions are found abundantly growing alongside black ash trees. This category of wildflowers is integral in understanding black ash habitats, growing conditions and companion species. That being said, the field-team began this project with limited knowledge and experience with these species in the wild. There are a number of family/genus groups which are reported without specificity to species level. Refining these observations into more specific data is a concentrated goal of biodiversity surveys into the future. The key genus groups which have abundant occurrences include the sedges, grasses, rushes, avens, willowherbs, bedstraws, and violets.

As with the shade-tolerant category of wildflowers, there were no specific species in the list below which were specifically indicative during field work of black ash populations. That being said, looking at the community of species holistically did assist in locating black ash specimens when surveying sites.

| NON-WOODY PLANTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WETLAND HABITATS | FAMILY | SCIENTIFIC NAME | SRANK | | | | | |
| Sedge Spp. | *Cyperaceae* | *Carex spp.* | *SU* | **24** | **88.9%** | *3* | *6* | *15* |
| Common Marsh Bedstraw | *Rubiaceae* | *Galium palustre* | *S5* | **23** | **85.2%** | *3* | *5* | *15* |
| Avens Spp. | *Rosaceae* | *Geum spp* | *SU* | **21** | **77.8%** | *2* | *6* | *13* |
| Rush | *Juncaceae* | *Rush spp.* | *SU* | **20** | **74.1%** | *3* | *4* | *13* |
| Purple-stemmed Aster | *Asteraceae* | *Symphyotrichum puniceum* | *S5* | **15** | **55.6%** | *2* | *4* | *9* |
| Spotted Jewelweed | *Balsaminaceae* | *Impatiens capensis* | *S5* | **15** | **55.6%** | *2* | *4* | *9* |
| Willherb spp. | *Onagraceae* | *Epilobium spp.* | *SU* | **15** | **55.6%** | *3* | *2* | *10* |
| Yellow Marsh Marigold | *Ranunculaceae* | *Caltha palustris* | *S4S5* | **15** | **55.6%** | *3* | *3* | *9* |
| ree-leaved False Soloman's Si | *Asparagaceae* | *Maianthemum trifolium* | *S4* | **12** | **44.4%** | *1* | *0* | *11* |
| Tall Meadow-Rue | *Ranunculaceae* | *Thalictrum pubescens* | *S5* | **12** | **44.4%** | *2* | *3* | *7* |
| Bedstraw spp. | *Rubiaceae* | *Galium spp.* | *SU* | **12** | **44.4%** | *2* | *3* | *7* |
| Violet Spp. | *Violaceae* | *Viola spp.* | *SU* | **12** | **44.4%** | *2* | *2* | *8* |
| Spotted Joe Pye Weed | *Asteraceae* | *Eutrochium maculatum* | *S5* | **10** | **37.0%** | *3* | *1* | *6* |
| Small Forget-Me-Not | *Boraginaceae* | *Myosotis laxa* | *S4* | **10** | **37.0%** | *0* | *5* | *5* |
| Naked Bishop's-Cap | *Saxifragaceae* | *Mitella nuda* | *S4* | **10** | **37.0%** | *1* | *2* | *7* |
| White Turtlehead | *Plantaginaceae* | *Chelone glabra* | *S5* | **9** | **33.3%** | *3* | *2* | *4* |
| Wild Calla | *Araceae* | *Calla palustris* | *S4* | **8** | **29.6%** | *1* | *2* | *5* |
| American Golden Saxifrage | *Saxifragaceae* | *Chrysosplenium americanum* | *S4* | **8** | **29.6%** | *0* | *3* | *5* |
| Common Water Parsnip | *Apiaceae* | *Sium suave* | *S5* | **7** | **25.9%** | *2* | *1* | *4* |
| Small Purple Fringed Orchid | *Orchidaceae* | *Platanthera psycodes* | *S4* | **7** | **25.9%** | *0* | *1* | *6* |

# Associated Species: Wetland Wildflowers

| NON-WOODY PLANTS WETLAND HABITATS | FAMILY | SCIENTIFIC NAME | SRANK | | | | | |
|---|---|---|---|---|---|---|---|---|
| Harlequin Blue Flag | *Iridaceae* | *Iris versicolor* | *S5* | **6** | **22.2%** | *1* | *1* | *4* |
| Northern Bog Goldenrod | *Asteraceae* | *Solidago uliginosa* | *S4* | **5** | **18.5%** | *0* | *1* | *4* |
| American Speedwell | *Plantaginaceae* | *Veronica americana* | *S4* | **5** | **18.5%** | *0* | *4* | *1* |
| Cyperuslike Sedge | *Cyperaceae* | *Carex pseudocyperus* | *S5* | **4** | **14.8%** | *0* | *0* | *4* |
| Common Woolly Bulrush | *Cyperaceae* | *Scirpus cyperinus* | *S5* | **4** | **14.8%** | *0* | *2* | *2* |
| Marsh Skullcap | *Lamiaceae* | *Scutellaria galericulata* | *S4S5* | **4** | **14.8%** | *0* | *4* | *0* |
| Northern Willowherb | *Onagraceae* | *Epilobium ciliatum* | *S5* | **4** | **14.8%** | *0* | *1* | *3* |
| Bog Willowherb | *Onagraceae* | *Epilobium leptophyllum* | *S4S5* | **4** | **14.8%** | *0* | *2* | *2* |
| Club Spur Orchid | *Orchidaceae* | *Platanthera clavellata* | *S3S4* | **4** | **14.8%** | *0* | *1* | *3* |
| Marsh Cinquefoil | *Rosaceae* | *Comarum palustre* | *S4* | **4** | **14.8%** | *0* | *0* | *4* |
| Three-flowered Bedstraw | *Rubiaceae* | *Galium triflorum* | *S5* | **4** | **14.8%** | *0* | *0* | *4* |
| Purple-stemmed Angelica | *Apiaceae* | *Angelica atropurpurea* | *S3* | **3** | **11.1%** | *0* | *0* | *3* |
| Round-leaved Sundew | *Droseraceae* | *Drosera rotundifolia* | *S4* | **3** | **11.1%** | *0* | *2* | *1* |
| Small Cranberry | *Ericaceae* | *Vaccinium oxycoccos* | *S4* | **3** | **11.1%** | *0* | *1* | *2* |
| Fraser's St. John's-wort | *Hypericaceae* | *Hypericum fraseri* | *S5* | **3** | **11.1%** | *0* | *1* | *2* |
| Northern Water Horehound | *Lamiaceae* | *Lycopus uniflorus* | *S5* | **3** | **11.1%** | *0* | *2* | *1* |
| Canadian Mint | *Lamiaceae* | *Mentha canadensis* | *S4S5* | **3** | **11.1%** | *0* | *2* | *1* |
| Mad-dog Skullcap | *Lamiaceae* | *Scutellaria lateriflora* | *S5* | **3** | **11.1%** | *1* | *2* | *0* |
| Bog Buckbean | *Menyanthaceae* | *Menyanthes trifoliata* | *S4* | **3** | **11.1%** | *0* | *0* | *3* |
| Arrow-leaved Smartweed | *Polygonaceae* | *Persicaria sagittata* | *S5* | **3** | **11.1%** | *0* | *2* | *1* |
| Greater Water Dock | *Polygonaceae* | *Rumex britannica* | *S5* | **3** | **11.1%** | *0* | *0* | *3* |
| Bulbous Water-hemlock | *Apiaceae* | *Cicuta bulbifera* | *S4S5* | **2** | **7.4%** | *0* | *1* | *1* |
| Pennsylvania Bittercress | *Brassicaceae* | *Cardamine pensylvanica* | *S4S5* | **2** | **7.4%** | *0* | *0* | *2* |
| Bladder Sedge | *Cyperaceae* | *Carex intumescens* | *S4S5* | **2** | **7.4%** | *0* | *1* | *1* |
| Small-fruited Bulrush | *Cyperaceae* | *Scirpus microcarpus* | *S4S5* | **2** | **7.4%** | *2* | *0* | *0* |
| American Water Horehound | *Lamiaceae* | *Lycopus americanus* | *S4S5* | **2** | **7.4%** | *1* | *1* | *0* |
| Pale Smartweed | *Polygonaceae* | *Persicaria lapathifolia* | *S4S5* | **2** | **7.4%** | *0* | *1* | *1* |
| Gmelin's Water Buttercup | *Ranunculaceae* | *Ranunculus gmelinii* | *S4* | **2** | **7.4%** | *0* | *1* | *1* |
| Rough Avens | *Rosaceae* | *Geum laciniatum* | *S4* | **2** | **7.4%** | *0* | *2* | *0* |
| Water Avens | *Rosaceae* | *Geum rivale* | *S4* | **2** | **7.4%** | *0* | *0* | *2* |
| Rough Bedstraw | *Rubiaceae* | *Galium asprellum* | *S4S5* | **2** | **7.4%** | *0* | *1* | *1* |
| Stinging Nettle | *Urticaceae* | *Urtica dioica ssp. gracilis* | *S4* | **2** | **7.4%** | *0* | *1* | *1* |
| Broad-leaved Arrowhead | *Alismataceae* | *Sagittaria latifolia* | *S4* | **1** | **3.7%** | *0* | *0* | *1* |
| Swamp Milkweed | *Apocynaceae* | *Asclepias incarnata* | *S2* | **1** | **3.7%** | *0* | *0* | *1* |
| Purple-stemmed Beggarticks | *Asteraceae* | *Bidens connata* | *S4* | **1** | **3.7%** | *0* | *1* | *0* |
| Boreal Stitchwort | *Caryophyllaceae* | *Stellaria borealis* | *S3* | **1** | **3.7%** | *0* | *0* | *1* |
| Fringed Sedge | *Cyperaceae* | *Carex crinita* | *S4* | **1** | **3.7%** | *0* | *1* | *0* |
| Three-Way Sedge | *Cyperaceae* | *Dulichium arundinaceum* | *S3* | **1** | **3.7%** | *0* | *1* | *0* |
| Rough Cottongrass | *Cyperaceae* | *Eriophorum tenellum* | *S4* | **1** | **3.7%** | *0* | *0* | *1* |
| Showy Lady's-Slipper | *Orchidaceae* | *Cypripedium reginae* | *S2S3* | **1** | **3.7%** | *0* | *1* | *0* |
| Square-stemmed Monkeyflowe | *Phrymaceae* | *Mimulus ringens* | *S3S4* | **1** | **3.7%** | *0* | *1* | *0* |
| Halberd-leaved Tearthumb | *Polygonaceae* | *Persicaria arifolia* | *S3* | **1** | **3.7%** | *0* | *1* | *0* |
| False Waterpepper | *Polygonaceae* | *Persicaria hydropiperoides* | *SNA* | **1** | **3.7%** | *0* | *1* | *0* |
| White Water Buttercup | *Ranunculaceae* | *Ranunculus trichophyllus* | *S4* | **1** | **3.7%** | *0* | *0* | *1* |
| Three-petaled Bedstraw | *Rubiaceae* | *Galium trifidum* | *S4S5* | **1** | **3.7%** | *0* | *1* | *0* |
| Dwarf Clearweed | *Urticaceae* | *Pilea pumila* | *S4* | **1** | **3.7%** | *0* | *1* | *0* |
| Marsh Blue Violet | *Violaceae* | *Viola cucullata* | *S5* | **1** | **3.7%** | *0* | *0* | *1* |
| Small White Violet | *Violaceae* | *Viola macloskeyi* | *S5* | **1** | **3.7%** | *0* | *0* | *1* |

# Associated Species: More Wildflowers


Turion Duckweed - *Lemna turionifera* - S4S5

Similarly to the other wildflower categories, the groups below present no specific species which easily help locate black ash. The grasses, some of which prefer wetter sites, might be more indicative of black ash habitat with more species-specific field data.

The aquatic species might be another category with potential for locating black ash, although this will only become apparent with more biodiversity surveys in under-represented locations and habitats.

| NON-WOODY PLANTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **OPEN HABITATS** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Grass Spp. | *Grass Spp.* | **SU** | **18** | *66.7%* | *3* | *5* | 10 |
| Rough-stemmed Goldenrod | *Solidago rugosa* | **S5** | **13** | *48.1%* | *0* | *4* | 9 |
| Canada Goldenrod | *Solidago canadensis* | **S5** | **9** | *33.3%* | *0* | *5* | 4 |
| Tall Blue Lettuce | *Lactuca biennis* | **S5** | **6** | *22.2%* | *0* | *1* | 5 |
| Hawkweed spp. | *Hieracium spp.* | **SU** | **3** | *11.1%* | *0* | *0* | 3 |
| Rough Cinquefoil | *Potentilla norvegica* | **S4S5** | **3** | *11.1%* | *0* | *2* | 1 |
| Common Self-heal | *Prunella vulgaris* | **S5** | **2** | *7.4%* | *0* | *0* | 2 |
| Grass-leaved Goldenrod | *Euthamia graminifolia* | **S5** | **1** | *3.7%* | *0* | *1* | 0 |
| Rough Hawkweed | *Hieracium scabrum* | **S4** | **1** | *3.7%* | *0* | *0* | 1 |
| White Goldenrod | *Solidago bicolor* | **S4** | **1** | *3.7%* | *0* | *1* | 0 |
| Aster spp. | *Symphyotrichum spp.* | **SU** | **1** | *3.7%* | *0* | *0* | 1 |
| New York Aster | *Symphyotrichum novi-belgi* | **S5** | **1** | *3.7%* | *0* | *0* | 1 |
| Common Dandelion | *Taraxacum officinale* | **SNA** | **1** | *3.7%* | *0* | *0* | 1 |
| Coltsfoot | *Tussilago farfara* | **SNA** | **1** | *3.7%* | *0* | *0* | 1 |
| Curled Dock | *Rumex crispus* | **SNA** | **1** | *3.7%* | *0* | *1* | 0 |
| **COASTAL HABITATS** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Mountain Cranberry | *Vaccinium vitis-idaea* | **S3** | **1** | *3.7%* | *0* | *0* | *1* |
| **AQUATIC** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Broad-leaved Cattail | *Typha latifolia* | **S5** | **9** | *33.3%* | *0* | *1* | *8* |
| Turion Duckweed | *Lemna turionifera* | **S4S5** | **5** | *18.5%* | *0* | *2* | *3* |
| Green-fruited Burreed | *Sparganium emersum* | **S4S5** | **2** | *7.4%* | *0* | *2* | *0* |
| Floating-leaved Pondweed | *Potamogeton natans* | **S4** | **1** | *3.7%* | *0* | *1* | *0* |
| Clasping-leaved Pondweed | *Potamogeton perfoliatus* | **S4** | **1** | *3.7%* | *0* | *0* | *1* |

# Associated Species: Ferns & Friends


Royal Fern - *Osmunda regalis* - S4

Ferns, as a group, are well-disposed towards habitats in which black ash occur. This whole group tends towards partially-shaded wet habitats, such as wooded riparian areas and swampy woods. Many species are well-represented at black ash sites, often species that are common in varying habitats across the province.

That being said, this group was still used in fieldwork to help find black ash. When considered as a whole, patterns of abundance and species diversity helped to indicate areas with excellent conditions for black ash trees. For instance, spinulose wood fern generally becomes the most abundant species of the *Dryopteridaceae* when in areas with black ash.

| FERNS & MORE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **FERNS** | **FAMILY** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Cinnamon Fern | *Osmundaceae* | *Osmundastrum cinnamomeum* | *S5* | **26** | **96.3%** | *3* | *6* | *17* |
| Sensitive Fern | *Onocleaceae* | *Onoclea sensibilis* | *S5* | **24** | **88.9%** | *3* | *7* | *14* |
| Crested Wood Fern | *Dryopteridaceae* | *Dryopteris cristata* | *S5* | **15** | **55.6%** | *3* | *3* | *9* |
| Common Lady Fern | *Athyriaceae* | *Athyrium filix-femina* | *S5* | **12** | **44.4%** | *0* | *4* | *8* |
| Eastern Marsh Fern | *Thelypteridaceae* | *Thelypteris palustris* | *S4S5* | **12** | **44.4%** | *1* | *1* | *10* |
| Spinulose Wood Fern | *Dryopteridaceae* | *Dryopteris carthusiana* | *S4S5* | **11** | **40.7%** | *2* | *3* | *6* |
| Bracken Fern | *Dennstaedtiaceae* | *Pteridium aquilinum* | *S5* | **8** | **29.6%** | *0* | *2* | *6* |
| Common Oak Fern | *Cystopteridaceae* | *Gymnocarpium dryopteris* | *S5* | **7** | **25.9%** | *0* | *5* | *2* |
| Mountain Wood Fern | *Dryopteridaceae* | *Dryopteris campyloptera* | *S4* | **7** | **25.9%** | *0* | *2* | *5* |
| Evergreen Wood Fern | *Dryopteridaceae* | *Dryopteris intermedia* | *S5* | **5** | **18.5%** | *0* | *4* | *1* |
| Ostrich Fern | *Onocleaceae* | *Matteuccia struthiopteris* | *S4* | **4** | **14.8%** | *0* | *2* | *2* |
| Royal Fern | *Osmundaceae* | *Osmunda regalis* | *S4* | **3** | **11.1%** | *3* | *0* | *0* |
| New York Fern | *Thelypteridaceae* | *Parathelypteris noveboracensis* | *S5* | **3** | **11.1%** | *1* | *1* | *1* |
| Northern Beech Fern | *Thelypteridaceae* | *Phegopteris connectilis* | *S5* | **3** | **11.1%** | *0* | *2* | *1* |
| Christmas Fern | *Dryopteridaceae* | *Polystichum acrostichoides* | *S2S3* | **2** | **7.4%** | *0* | *0* | *2* |
| Interrupted Fern | *Osmundaceae* | *Claytosmunda claytoniana* | *S5* | **2** | **7.4%** | *0* | *1* | *1* |
| **CLUBMOSSES** | **FAMILY** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Northern Bog Clubmoss | *Lycopodiaceae* | *Lycopodiella inundata* | *S3* | **2** | **7.4%** | *0* | *1* | *1* |
| Northern Ground-cedar | *Lycopodiaceae* | *Diphasiastrum complanatum* | *S3* | **1** | **3.7%** | *0* | *1* | *0* |
| **HORSETAILS** | **FAMILY** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Woodland Horsetail | *Equisetaceae* | *Equisetum sylvaticum* | *S5* | **19** | **70.4%** | *3* | *3* | *13* |
| Water Horsetail | *Equisetaceae* | *Equisetum fluviatile* | *S4* | **1** | **3.7%** | *0* | *0* | *1* |

# Associated Species: Mosses & Liverworts

Similarly to the ferns, mosses and liverworts generally share similar growing condition preferences with black ash trees. Many species in this category thrive in partially-shaded to shady sites with ample available moisture. Due to the difficulty in identification of non-vascular species, there are a number of entires only identified to family or genus. For instance, the *Sphagnum* mosses and *Frullania* liverworts.

Areas with black ash tend towards higher abundances and species diversity of non-vascular plants. This, in conjunction with other botanical clues, can help to speed up locating black ash trees when on-site. The mosses and liverworts are excellent indicators of local habitat and growing conditions in the field.

Woolly liverwort, for instance, was only found growing on one site without black ash present. It was another species used in fieldwork to help pinpoint black ash locations.

| MOSSES | FAMILY | SCIENTIFIC NAME | SRANK | Total OCC | %OCC | PR | QU | KI |
|---|---|---|---|---|---|---|---|---|
| Electrified Cat's-tail Moss | Hylocomiaceae | *Rhytidiadelphus triquetrus* | S5 | 22 | 81.5% | 2 | 6 | 14 |
| Delicate Fern Moss | *Thuidiaceae* | *Thuidium delicatulum* | S4S5 | 22 | 81.5% | 3 | 4 | 15 |
| Common Broom Moss | Dicranaceae | *Dicranum scoparium* | S5 | 21 | 77.8% | 2 | 6 | 13 |
| Peatmoss | *Sphagnaceae* | *Sphagnum spp.* | SU | 21 | 77.8% | 2 | 4 | 15 |
| Northern Tree Moss | Climaciaceae | *Climacium dendroides* | S5 | 17 | 63.0% | 0 | 5 | 12 |
| Crisped Pincushion Moss | Orthotrichaceae | *Ulota crispa* | S5 | 17 | 63.0% | 3 | 5 | 9 |
| Red-stemmed Feather Moss | Hylocomiaceae | *Pleurozium schreberi* | S5 | 17 | 63.0% | 1 | 4 | 12 |
| Stairstep Moss | Hylocomiaceae | *Hylocomium splendens* | S5 | 16 | 59.3% | 3 | 4 | 9 |
| Shaggy Peat Moss | Sphagnaceae | *Sphagnum squarrosum* | S5 | 11 | 40.7% | 0 | 4 | 7 |
| Common Haircap Moss | Polytrichaceae | *Polytrichum commune* | S5 | 9 | 33.3% | 1 | 4 | 4 |
| Dotted Leafy Moss | Mniaceae | *Rhizomnium punctatum* | S4 | 8 | 29.6% | 3 | 2 | 3 |
| Green Peat Moss | *Sphagnaceae* | *Sphagnum girgensohnii* | S5 | 8 | 29.6% | 0 | 2 | 6 |
| Smoothcap Moss | Polytrichaceae | *Atrichum spp.* | SU | 7 | 25.9% | 3 | 1 | 3 |
| White Pincushion Moss | Leucobryaceae | *Leucobryum glaucum* | SU | 6 | 22.2% | 1 | 1 | 4 |
| Pellucid Plait Moss | *Hypnaceae* | *Hypnum imponens* | S5 | 6 | 22.2% | 0 | 5 | 1 |
| Knight's Plume Moss | *Hypnaceae* | *Ptilium crista-castrensis* | S5 | 6 | 22.2% | 3 | 1 | 2 |
| Darkgreen Bristle Moss | Orthotrichaceae | *Orthotrichum sordidum* | S5 | 5 | 18.5% | 3 | 1 | 1 |
| Glow Moss | Aulacomniaceae | *Aulacomnium palustre* | S5 | 4 | 14.8% | 0 | 0 | 4 |
| Feathery Neckera Moss | *Neckeraceae* | *Neckera pennata* | S5 | 4 | 14.8% | 0 | 2 | 2 |
| Woodsy Leafy Moss | Mniaceae | *Plagiomnium cuspidatum* | S4S5 | 3 | 11.1% | 0 | 0 | 3 |
| Appalachian Leafy Moss | Mniaceae | *Rhizomnium appalachianum* | S4S5 | 2 | 7.4% | 0 | 0 | 2 |
| Wavy-leaved Broom Moss | Dicranaceae | *Dicranum polysetum* | S5 | 1 | 3.7% | 0 | 0 | 1 |
| **LIVERWORTS** | **FAMILY** | **SCIENTIFIC NAME** | **SRANK** | **Total OCC** | **%OCC** | **PR** | **QU** | **KI** |
| Scalewort | Jubulaceae | *Frullania spp.* | SU | 22 | 81.5% | 3 | 5 | 14 |
| Three-lobed Whipwort | Lepidoziaceae | *Bazzania trilobata* | S5 | 14 | 51.9% | 3 | 3 | 8 |
| Flat-leaved Scalewort | Radulaceae | *Radula complanata* | SU | 12 | 44.4% | 2 | 4 | 6 |
| | Ptilidiaceae | *Ptilidium pulcherrimum* | SU | 11 | 40.7% | 2 | 3 | 6 |
| Woolly Liverwort | Trichocoleaceae | *Trichocolea tomentella* | SU | 8 | 29.6% | 0 | 2 | 6 |
| Wood Rustwort | Cephaloziaceae | *Nowellia curvifolia* | SU | 4 | 14.8% | 0 | 2 | 2 |
| Variable-Leaved Crestwort | Lophocoleaceae | *Lophocolea heterophylla* | SU | 4 | 14.8% | 0 | 2 | 2 |
| Lesser Featherwort | Plagiochilaceae | *Plagiochila porelloides* | SU | 4 | 14.8% | 1 | 2 | 1 |
| Green-tongue Liverwort | Marchantiaceae | *Marchantia polymorpha* | SU | 3 | 11.1% | 0 | 1 | 2 |
| Common Pellia | Pelliaceae | *Pellia epiphylla* | SU | 2 | 7.4% | 0 | 1 | 1 |
| Wall Scalewort | Porellaceae | *Porella platyphylla* | SU | 2 | 7.4% | 0 | 0 | 2 |

# Associated Species: Lichens

Yellow Specklebelly Lichen - Pseudocyphellaria holarctica - S2S3

While no particular group of lichens found during fieldwork have been identified as an ideal indicator species, it is clear that habitats with black ash are often rich in lichen abundance and diversity. These areas often have rare species of lichens, which can vary in size and ease of identification. This makes recording the true diversity and abundance of lichens on these sites both challenging and time-consuming. The data collection for this group has improved significantly since the projects beginning thanks to some help and training from staff at the ACCDC.

The potential for this group to be important in finding new black ash sites, as well as the likely number of rare species growing at these sites bears improvement of data collection and analysis. Many members of this groups prefer shady sites with high humidity, such as the cedar swamps at Ellerslie, a site with a number of rare lichen species found during field work.

| LICHENS | FAMILY | SCIENTIFIC NAME | SRANK | Total OCC | %OCC | PR | QU | KI |
|---|---|---|---|---|---|---|---|---|
| Lungwort Lichen | Lobariaceae | *Lobaria pulmonaria* | S4S5 | 22 | 81.5% | 3 | 4 | 15 |
| Monk's Hood Lichen | Parmeliaceae | *Hypogymnia physodes* | S5 | 21 | 77.8% | 2 | 5 | 14 |
| Cladonia spp. | Cladoniaceae | *Cladonia spp.* | SU | 20 | 74.1% | 3 | 5 | 12 |
| Bottlebrush Shield Lichen | Parmeliaceae | *Parmelia squarrosa* | S5 | 20 | 74.1% | 2 | 4 | 14 |
| Usnea | Parmeliaceae | *Usnea spp* | SU | 18 | 66.7% | 2 | 5 | 11 |
| Varied Rag Lichen | Parmeliaceae | *Platismatia glauca* | S5 | 16 | 59.3% | 2 | 3 | 11 |
| Camouflage Lichen | Parmeliaceae | | SU | 15 | 55.6% | 0 | 5 | 10 |
| Bryoria Lichen | Parmeliaceae | *Bryoria spp.* | SU | 12 | 44.4% | 2 | 3 | 7 |
| Buellia spp. | Physciaceae | *Buellia spp.* | SU | 10 | 37.0% | 2 | 2 | 6 |
| Smooth Lung Lichen | Lobariaceae | *Ricasolia quercizans* | S4S5 | 9 | 33.3% | 3 | 2 | 4 |
| Textured Lungwort Lichen | Lobariaceae | *Lobaria scrobiculata* | S4 | 6 | 22.2% | 3 | 1 | 2 |
| Yellow Specklebelly Lichen | Lobariaceae | *Pseudocyphellaria holarctica* | S2S3 | 4 | 14.8% | 3 | 0 | 1 |
| Powder-headed Tube Lichen | Parmeliaceae | *Hypogymnia tubulosa* | S4S5 | 4 | 14.8% | 2 | 2 | 0 |
| Boreal Oakmoss Lichen | Parmeliaceae | *Evernia mesomorpha* | S5 | 3 | 11.1% | 0 | 0 | 3 |
| Reindeer Lichen | Cladoniaceae | *Cladonia arbuscula* | S5 | 2 | 7.4% | 0 | 0 | 2 |
| Powdered Funnel Lichen | Cladoniaceae | *Cladonia cenotea* | S4S5 | 2 | 7.4% | 0 | 0 | 2 |
| British Soldiers Lichen | Cladoniaceae | *Cladonia cristatella* | S5 | 2 | 7.4% | 0 | 0 | 2 |
| Mealy-rimmed Shingle Lichen | Pannariaceae | *Pannaria conoplea* | S1S2 | 2 | 7.4% | 2 | 0 | 0 |
| Hammered Shield Lichen | Parmeliaceae | *Parmelia sulcata* | S5 | 2 | 7.4% | 0 | 0 | 2 |
| Blue Jellyskin Lichen | Collemataceae | *Leptogium cyanescens* | S5 | 1 | 3.7% | 1 | 0 | 0 |
| a Lichen | Graphidaceae | *Graphis scripta* | S5 | 1 | 3.7% | 0 | 1 | 0 |
| Lecanora spp. | Lecanoraceae | *Lecanora spp.* | S5 | 1 | 3.7% | 0 | 0 | 1 |
| Brown-eyed Shingle Lichen | Pannariaceae | *Pannaria rubiginosa* | S1 | 1 | 3.7% | 1 | 0 | 0 |
| Crumpled Rag Lichen | Parmeliaceae | *Platismatia tuckermanii* | S3S4 | 1 | 3.7% | 0 | 0 | 1 |
| Variable Wrinkle Lichen | Parmeliaceae | *Tuckermannopsis orbata* | S4S5 | 1 | 3.7% | 0 | 0 | 1 |

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