MANAGEMENT PLAN FOR THE DEPARTMENT OF NATURAL RESOURCES & ENERGY DEVELOPMENT

LONEWATER FARM



2024-2025

University of New Brunswick

Faculty of Forestry & Environmental Management

Executive Summary

The Lonewater Farm (LFP) property in Grand Bay-Westfield, New Brunswick, is a historically, ecologically and socially significant area. Following Lonewater Farm's transition from an addictions treatment facility to Crown Land ownership in 2024, the Government of New Brunswick's Department of Natural Resources and Energy Development (ERD-NB), the Town of Grand Bay-Westfield, and the Nature Conservancy of Canada (NCC) reached out in a collaborative effort with the University of New Brunswick (UNB) to create and develop a management plan focused on conservation and recreation. The plan ensures the allocation of the maximum amount of property to Other Effective area-based Conservation Measure (OECM) areas while incorporating social and recreational features.

The Lonewater Farm Management Plan provides a plan for balancing conservation efforts with public use and recreation. This plan is designed to:

- Protect species at risk by conserving critical habitat.
- Enhance public access and recreation through trail management and outdoor education.
- Engage rights-holders, stakeholders and residents, to ensure a collective approach to land use and development.
- Identify ecological threats, such as illegal dumping, invasive species, and the impacts of climate change.

Implementing this management plan will maintain ecosystem health, preserve biodiversity, and enhance community involvement with the property. Having a diverse set of partnerships will help manage the property through a conservation lens. Additionally, increasing education and collaborations with rights-holders and stakeholders will foster gratitude and stewardship of the land.

The Lonewater Farm Management Plan represents a new way of preserving New Brunswick's heritage while offering accessible, low-impact outdoor recreation and learning opportunities for the Town of Grand Bay-Westfield and surrounding communities. Through planned conservation methods and public engagement, this project ensures that Lonewater Farm remains an ecologically valuable and historically significant site for generations.

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Introduction

Management Plan for the Department of Natural Resources and Energy Development: Lonewater Farm

Land Acknowledgement

The lands where UNB and Lonewater Farm stand are the unceded and unsurrendered territories of the Wəlastəkwiyik/Wolastoqiyik. These territories are governed by the "Treaties of Peace and Friendship" which the Wəlastəkwiyik/Wolastoqiyik, Mi'kmaq/Mi'kmaw and Peskotomuhkatiyik/Peskotomuhkati co-developed and signed with the British Crown in the 18th century. These treaties did not involve the giving up of land, water, or resources, but rather acknowledged their titles and established guidelines for what was to be a lasting, ongoing relationship.

It is our duty as students and land managers to support communities in exercising Wolastoqey Aboriginal and Treaty rights ensuring the ability to practice cultural and spiritual traditions and impart these to the younger generation.

Introduction

The Lonewater Farm property (LFP) is a 167-hectare (ha) plot of Crown Land in the Grand Bay-Westfield area, New Brunswick (Figure 1). This historic piece of New Brunswick property sits upon the unceded and unsurrendered territories of the Wəlastəkwiyik/Wolastoqiyik, who have cared for this land since time immemorial. In 1859-1860 David, Marey and Samuel George Eccles immigrated from England and established Lonewater Farm (Loan Water Farm, Westfield, N.B. ND.). Samuel Eccles later took over farming in 1891 after his father David passed away. Samuel married Margaret Cronk, and together they produced honey, eggs, vegetables, fruits and hay. They also built and operated two scows trading their produce and locally made products (Loan Water Farm, Westfield, N.B. ND.). In 1968, Lonewater Farm was purchased by the province and run by former Saint John mayor Maj. Edis Flewwelling. Lonewater Farm was used as a treatment center for male alcoholics (Flewwelling, Edis A., 1998); the property ran as an addiction facility for over 50 years (Bates, 2024). After moving the rehabilitation center to Saint John New Brunswick in 2020, Lonewater Farm was officially handed over to the province of New Brunswick for conservation in 2024 (Bates, 2024).

Currently, the property is under the management of the Department of Natural Resources and Energy Development (ERD-NB) in partnership with the Town of Grand Bay-Westfield and the Nature Conservancy of Canada (NCC).

Approximately 85% of this property is composed of forest, equating to 142 ha. The remainder comprises a 14-ha field where the rehabilitation center was located, and 11 ha of wetland. Given the diverse site conditions of this property, there is a variety of habitat types for an array of species. The property's proximity to the Town of Grand Bay-Westfield as well as its accessibility by main roads provides an excellent opportunity for it to be an area of conservation and a place of education for the public.

This report contains the methodology and results of an inventory assessment conducted on the LFP, completed in the fall season of 2024. In the forested area, several environmental assessments were conducted to gain forest and tree-level data. Hydrological features, wildlife and associated habitat, invasive species, species at risk, and ground vegetation species were evaluated across the whole property. Wildlife habitat inspection and ground vegetation identification were completed in the open field, and the property's wetland boundaries were delineated.

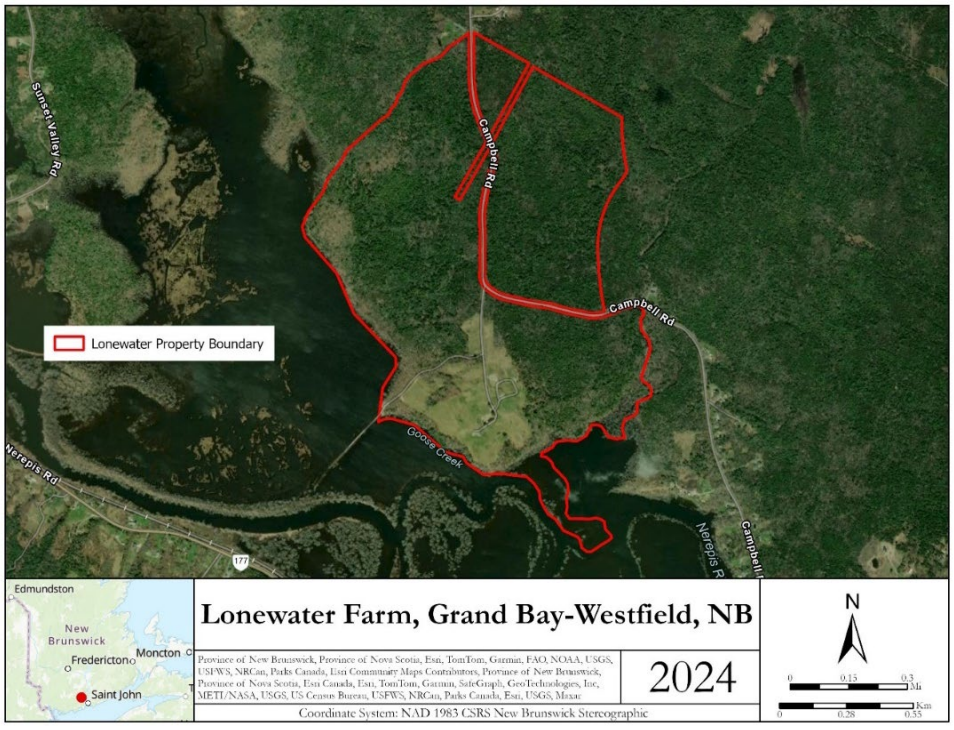

Figure 1. Map of LFP boundary in Grand Bay-Westfield, New Brunswick, created using ArcGIS Pro software from ESRI and data from the GeoNB website.

Goals and Objectives

The main goal of this project is to produce a management plan that conserves the environmental, ecological, and historical values of the LFP, and aligns with the goals and objectives of ERD-NB and associated rights-holders and stakeholders. Goals for each of these values were created, and several objectives were developed to measure the plan's performance in relation to the stated goal (Table 1). ERD-NB, NCC, and the Town of Grand Bay-Westfield envision this property as an area of conservation where any existing rare species and species at risk may expand their populations while also allowing for low-impact public use and education that will not inhibit the area's ecological function. Ecological function is defined as the collection of biotic and abiotic elements and how each affects the ecosystem's physical and chemical conditions (Naeem et al., 1999). A functioning ecological system produces vegetation, supports life, stores carbon and cycles energy throughout the system. The following goals of this management plan are established to support and achieve the values of ERD-NB and the Town of Grand Bay-Westfield.

Table 1. Outlined goals, objectives, measures and timelines for each of the values of ERD-NB stated above for the LFP in Grand Bay-Westfield.

Goal	Objective	Measure	Timeline
Allocate areas of conservation	Maintain critical habitat for wildlife species at risk.	Protect 100% of identified potential species at risk habitat from further anthropogenic disturbance	Winter 2028
	Identify Other Effective area-based Conservation Measures (OECM)	Increase allocated OECM areas to 30% of the property area (46 ha)	Winter 2028
Create restoration plan	Locate areas of illegal dumping during site walks and inventory using GPS points.	Remove 100% of located dumps	Fall 2026
	Identify affected areas of invasive plant species and limit range expansion	Reduce patch sizes of invasive plant species by at least 70% of their currently defined area	Spring 2026
Identify recreational opportunities	Improve the existing trail system to meet Trail Environment Screening Tool (TEST) standards.	Ensure all trails meet TEST standards by spring 2026, Map 100% of existing trails on property	Spring 2026
	Increase learning opportunities and education enrichment for the public	Increase educational visits annually from 0 to 12 (increase by 4 trips per year)	Spring 2028
	Maintain boat landing accessibility and reduce motorized vessels	Decrease motorized vessel usage by 30% by spring 2027	Spring 2027
Rights-holder & Stakeholder Engagement	Build partnerships with local conservation groups	Increase number of partnerships between ERD-NB and conservation groups to 5	Spring 2026
	Incorporate Rights-Holder and Stakeholder survey and interview data to ensure values are considered in management practices	Increase rights-holder and stakeholder engagement by 60% (20% per year)	Spring 2028

Rationalization of Objectives

Goal 1: Conservation

Low genetic diversity in subpopulations of species can be linked to habitat fragmentation caused by anthropogenically introduced invasive species and intensive land use (Schlaepfer et al., 2018). To offset some of these negative effects, suitable habitats must be protected from further disturbance, allowing for strong population regeneration. To maintain critical habitat for species at risk, 100% of all identified potential species at risk habitat on the LFP will be protected from further anthropogenic disturbance by the winter of 2028. Species at risk habitat being assessed are those outlined by the New Brunswick Species at Risk Act (NBSARA) (Government of New Brunswick, n.d.), and the Committee on the Status of Endangered Wildlife in Canada (Government of Canada, n.d.). For the purposes of the LFP, anthropogenic disturbance is defined as any permanent unnatural alteration to the natural landscape. This would include infrastructure such as permanent trails, buildings, lights, or huts, or alterations such as tree removal or excavation.

A goal of conserving 30% of land and water in Canada by the year 2030 was pledged at the 15th Conference of the Parties (COP15) in Montreal on December 9th, 2022 (Power, 2022). It is important to identify Other Effective area-based Conservation Measures (OECMs) because land can be used and conserved simultaneously. This can be more appealing from a landowner management perspective because it meets the requirements of conserved land status in Canada (Government of Canada, 2022). OECMs refer to areas that support biodiversity but are not specifically protected as national areas or parks (Government of Canada, 2022).

In contribution to COP15 target 3, the LFP will ensure 46 ha, or 30%, of land qualifies as OECM area by 2028. This time horizon leaves two years before 2030 to assess the effectiveness of the implemented management plan.

Goal 2: Restoration

Dumping of waste in the environment is illegal, yet a common problem that threatens ecosystems globally. It negatively impacts the environment by contaminating soil, polluting water, impacting vegetation composition, and disrupting natural ecosystem function (Vaverková et al., 2019). Site restoration is used to improve the state of a given area or return it to a previous

state. It is important to ecological health, can help increase biodiversity in the area, and helps to maintain the value of the property. ERD-NB was previously made aware of dumping that was left around the edge of the field on the property that included old farming equipment. This could potentially lead to a variety of pollutants being released into the environment the longer it is left there. All dumping sites found during site walkthroughs and inventory will be mapped and provided to the landowners. On the LFP, 100% of all waste will be removed by the fall season of 2026.

The removal of non-native plant species plays a key role in the restoration of habitats and allows for the regeneration of native species (Hobbs & Harris, 2001). Invasive species such as Glossy Buckthorn (*Rhamnus frangula*), Poison Ivy (*Toxicodendron radicans*), and Purple Loosestrife (*Lythrum salicaria),* are detrimental to New Brunswick ecosystems, often outcompeting native species and disrupting the ecological balance of an area (Environment and Climate Change Canada, 2017). All invasive plant patches identified on the LFP from inventory sampling are documented to provide a recommendation for the reduction of at least 70% of patch sizes from their currently defined areas by spring of 2026. A higher percentage of invasives removed will increase the chance of the native species' ability to recover, returning the property to a more biodiverse state (Hobbs & Huenneke, 1992).

Goal 3: Recreation

The LFP has many trails throughout the property that are used by the locals for non-motorized recreation such as walking and biking. Creating user friendly maps of existing trails can provide the public with information needed to safely navigate the property and stay off conservation areas. Using the LiDAR data from GeoNB, approximately 5 kilometers (km) of pre-existing trails were identified on a canopy height model. With that information, the goal of maintaining at least 5 km of trail system is established by spring 2026. The assessment tool is used to make sure trails are safe for public use. The assessment used is derived from the Trail Environment Screening Tool (TEST) developed by the Shuswap Trail Alliance for Recreation Sites and Trails BC (Shuswap Trail Alliance for Recreation Sites and Trails BC, 2020). The TEST assessment focuses on the aspects that are relatable to the LFP, and other aspects were removed (motorized vehicle recommendations, road crossing/use, and wildlife habitat assessment, as that is being monitored separately). Data collected includes start and end points of

trails, trail length, planned usage, trail width/height (TEST recommends trails are 10 feet (ft) wide and have at least 8 ft of overhead clearance), elevation, grade, terrain, obstacles and proximity to sensitive habitat. The aim is to ensure the public maintains the same amount of recreational area prior to the development of the property. Maintaining and repairing existing trails ensures that there is no decrease in habitat due to recreational infrastructure. If the pre-existing trail system is unfit or less than 5 km is usable, other options like installing extra trails to meet the 5-km goal are considered. The implementation of new trail systems is only considered outside of OECM areas and critical habitat for species at risk.

The previously managed lands of the LFP have the potential to be used in new ways for people to gather and implement outdoor classrooms. The new recreational opportunities add educational value to the community of Grand Bay–Westfield, encouraging groups of people to learn about the biodiversity and ecosystems in the area. To make these outdoor classrooms as minimally invasive and least destructive as possible, they are built along the preexisting road to avoid cutting into the field and forest. As requested by the client, three different potential classroom options will be proposed. Options include but are not limited to a large gazebo to act as the main classroom with seating, an amphitheater, or a small stage set up with surrounding seating. Another goal is to install education stations along the trail system highlighting different habitats and species to further facilitate education. The education stations give a less invasive approach, keeping users on the trails and protecting the forested area. Keeping the stations along the main trail allows larger groups to use these educational features as opposed to smaller trails that may not accommodate large-sized groups. This will help create inclusive and engaging educational opportunities for local educational groups, which will support the goal of increasing educational tours and field trips by 60% (20%/year) over the next 3 years (by 2028) which will be indicated by the number of trips recorded by the town of Grand Bay Westfield.

On the west side of the causeway there is a boat launch used by the public. As it is already in place, the goal is to maintain accessibility and decrease usage of motorized vessels by 30% by the spring of 2027, by installing signage in and around the boat launch area. The client wants to keep the area motor free; however, they do not have authority over the water body, therefore, increasing signage promoting motor free recreation may be beneficial.

Goal 4: Rights-holder & Stakeholder Engagement

The client wishes to build relationships with rights-holders and stakeholders to foster a collaborative effort in making the LFP a positive experience for surrounding land managers, environmental groups, and the multi-generational users. In addition to building relationships, the client also requests that new potential partners are considered in the management planning process to further enhance collaboration between the province of New Brunswick and non-governmental organizations. There will be a rights-holders engagement session with the Wolastoqey Nation in New Brunswick (WNNB) after the first communication is initiated by the client. Once approval is received from the client, the engagement session will take place to ensure rightsholders are aware of the project goals and hold space for the group to voice questions and concerns surrounding the project. The objective of the interview is to create a collaborative dialog around potential project impacts on Wolastoqey Aboriginal and Treaty rights, including historical, archaeological, environmental, and technical impacts. The stakeholder engagement is completed through conducting semi-structured surveys to allow the stakeholders to express their values. This information is used to help build beneficial relationships. ERD-NB currently partners with the Grand Bay-Westfield Recreation Department and Nature Conservancy of Canada (NCC) on the LFP project. The goal is to continue to maintain these relationships and create three more partnerships for a total of five by spring 2026. Conservation groups considered for partnership include but are not limited to Ducks Unlimited, Nature Trust NB and the Atlantic Costal Action Program (ACAP) in Saint John.

Data was collected for ecological, environmental, economic and social values from the partners and prospective partners involved in the project. The data is then analyzed and used to improve upon these subjects collaboratively creating the management plan. Educational and recreational opportunities that hold space for conservation and inclusiveness are a part of the client's request for a strategic plan. With the help of the Grand Bay-Westfield Recreation Department, a public survey was conducted. The goal of this information is to apply it to the creation of recreational and educational opportunities that align with the public's interests and values. Incorporating rights-holders and stakeholders, as well as public stakeholder values into management operations help increase rights-holders and stakeholders by 60% (20%/year) by spring 2028. Partner stakeholder engagement will be measured by an annual online survey involving questions regarding engagement between partners. Stakeholder engagement is

measured yearly with QR code surveys regarding the use of educational and recreational opportunities. The method for the follow-up survey would be similar to the one used for the initial survey conducted by the Grand Bay-Westfield Recreation Department.

Methods

Management Plan for the Department of Natural Resources and Energy Development: Lonewater Farm

Methods

The methods section for this report is broken into two parts: the sample strategy, and sample design. The sample strategy outlines what and how data were collected in the field, whereas the sample design describes the locations of data collection and sample intensity. These two sections are further divided into segments outlining the forest, wildlife, hydrology, recreation, and social and historical data collection methodologies. The inventory and assessment of the LFP was completed between late September and early November of 2024. The full methods section can be found in Appendix A – Methods of this report.

Results

Management Plan for the Department of Natural Resources and Energy Development: Lonewater Farm

Results

Forest Characteristics

Forest Inventory Analysis

The LFP is a land base with a forest dominated by balsam fir, red spruce, and white birch at 50%, 15% and 9% respectively. There is a total of 12 different stand types, as shown in Table 2, with an average of 1,499 ± 179 stems per ha and a volume of 214.3 m^3/ha (Figure 2 & Figure 3, Table 2).

Table 2. Summary showing the forest stand types, area (ha), volume (m^3/ha), basal area (m^2/ha) and density (stems/ha) on the LFP.

Stand Type	Area (ha)	Volume (m^3/ha)	Basal Area (m^2/ha)	Density (stems/ha)
*Balsam Fir Mixedwood	3.0	249.0	86.8	1,800
Balsam Fir Spruce	7.7	136.7 ± 192	83.3 ± 115	1,775 ± 2,400
Birch Mixedwood	15.2	189.6 ± 70	51.2 ± 30	1,021 ± 620
Eastern Cedar Mixedwood	3.5	257.0 ± 109	72.9 ± 4	1,875 ± 215
Eastern Cedar Softwood	8.2	242.4 ± 16	88.0 ± 7	2,717 ± 250
Intolerant Hardwood	14.2	245.4 ± 75	41.9 ± 23	1,264 ± 340
Intolerant Softwood	16.4	250.9 ± 27	81.1 ± 19	1,290 ± 300
Spruce Fir	1.8	182.4 ± 40	90.7 ± 2	1,875 ± 105
Spruce Mixedwood	8.3	196.6 ± 25	63.2 ± 15	1,183 ± 290
Spruce	13.6	219.4 ± 145	60.6 ± 27	1,050 ± 325
Tolerant Mixedwood	12.8	196.7 ± 104	61.4 ± 43	1,063 ± 815
Tolerant Softwood	34.1	204.9 ± 76	60.1 ± 28	1,075 ± 590
****Average**	**138.8**	**214.3**	**70.1**	**1,500**

*Stand only has one plot, standard deviation not applicable.

** All lines refer to average with the exception of area, which is the sum total.

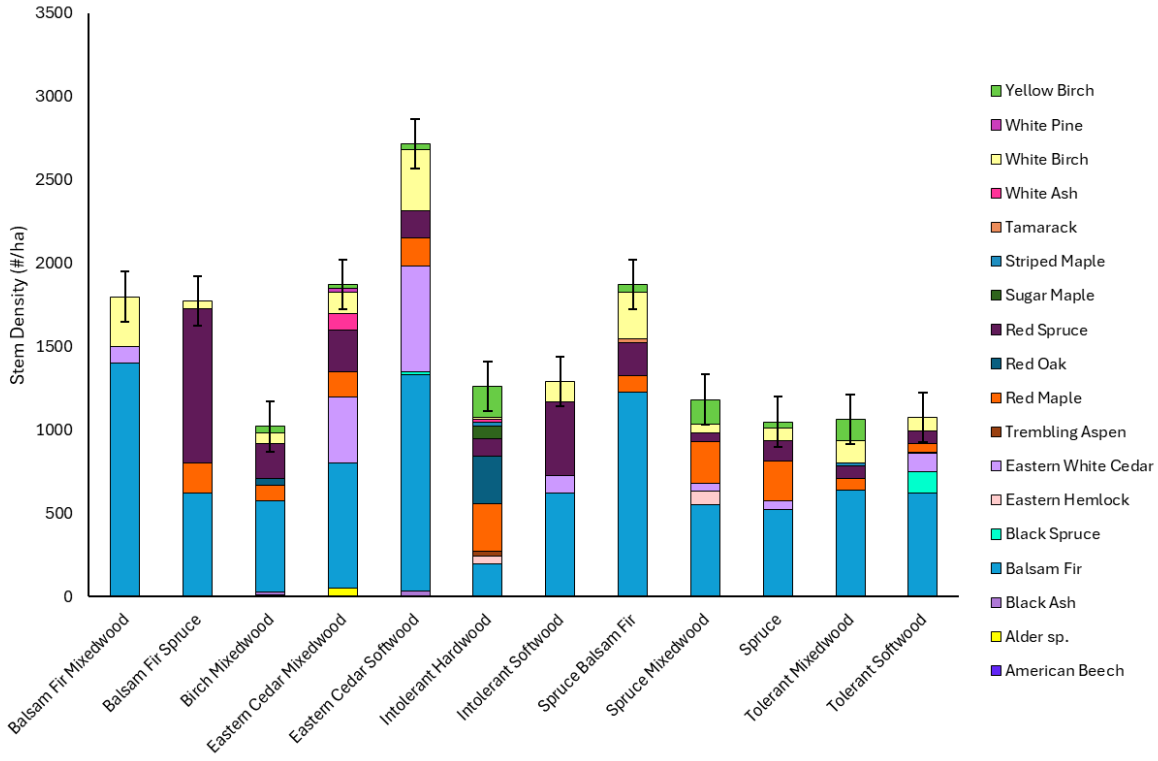

Figure 2. Species distribution by density of mature trees for all stands at the LFP.

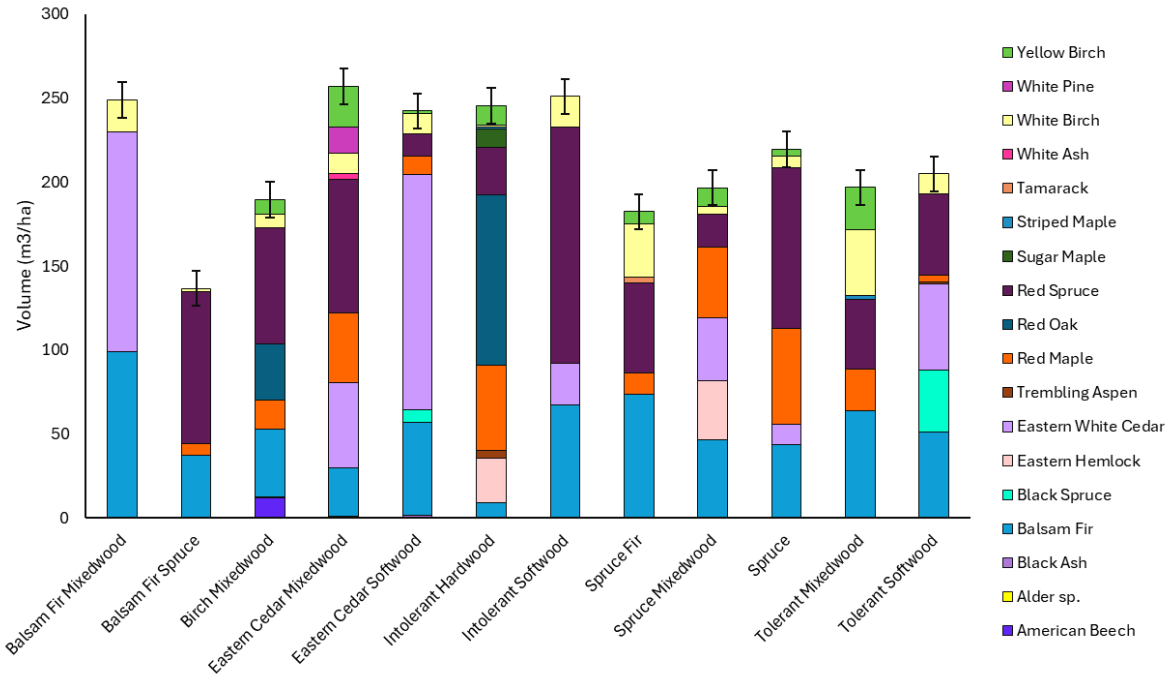

Figure 3. Total volume of mature trees for all stands on the LFP.

An example of the diameter distribution is captured in Figure 4, which shows that the majority of the Tolerant mixedwood stand's density is in the smaller DBH classes; 10 cm and 15 cm. The density continues to decrease as the DBH class increases with a maximum DBH being in the 40 cm category. The trend of having the majority of stems in a smaller DBH class shown by this stand is representative of most of the forest stands on the property.

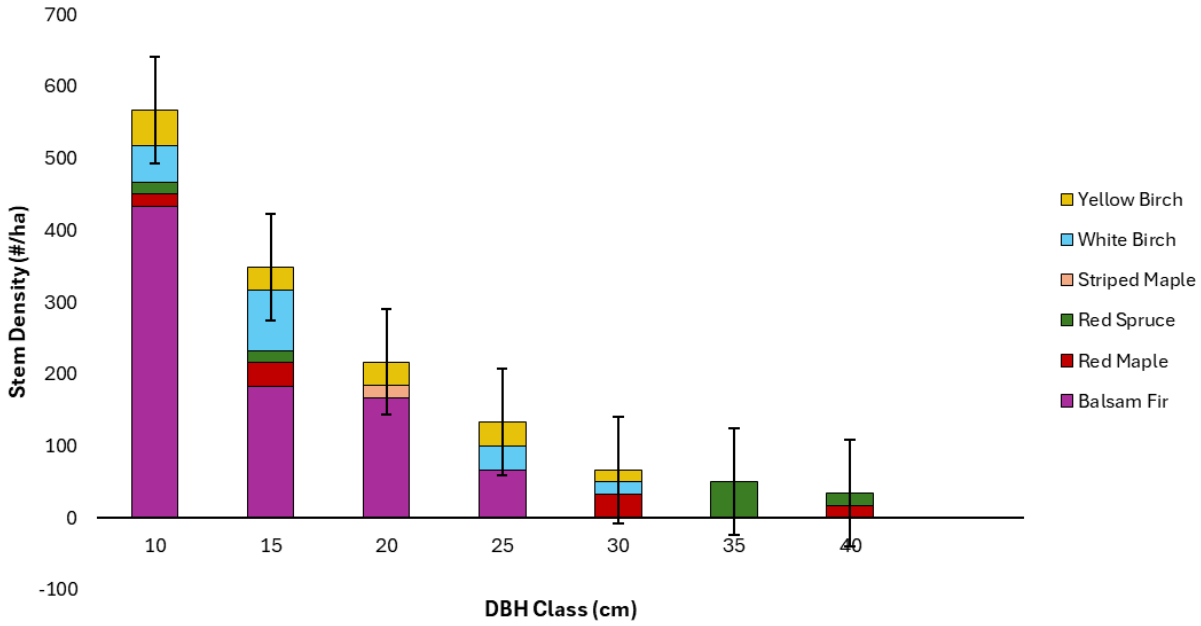

Figure 4. Tolerant mixedwood stand on the LFP shown in 5-cm diameter classes by species.

Figure 5 shows the sapling stem density for all stand types. The snags of this forest mostly fall in the Class 7 decay category with the following most common classes being 5 and 6. Class 7 has a snag density of 61 stems/ha, while classes 5 and 6 have densities of 43 stems/ha and 32 stems/ha respectively. The site conditions data can be found in Appendix D Table 2 and Appendix D Table 3.

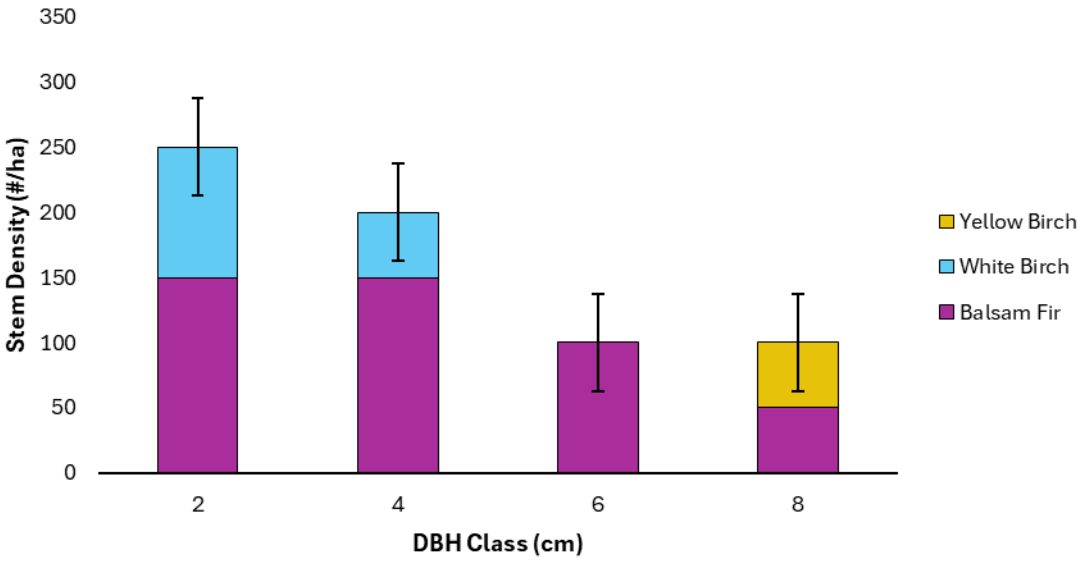

Figure 5. Sapling stem density per ha of the LFP in the Tolerant Mixedwood stand. This showcases trees that have a diameter at breast height ranging from 1-8 cm.

The following tree species were found regenerating in the Tolerant Mixedwood stand:

- Balsam Fir
- Red Maple
- Red Spruce

Forest Inventory Audit

The plots used in the forestry audit were determined by using a random number generator to select six plot numbers, equivalent to 10% of the total number of plots. The plots selected were plots number 2, 13, 24, 37, 40, and 43. The inventory audit provides comparative information on the accuracy of the initial inventory by comparing tree species, diameter at breast height (DBH), height and crown base, as well as sapling species and DBH. The assessment was self-audited using the same sampling methods and sampling locations as the original inventory. During the inventory, the initial data was not referenced to minimize biases during the auditing process.

A Welch Two Sample T-test for DBH was conducted in R to determine any statistically significant differences between the audited data to original data. This test was chosen over the paired T-test because the variances, the order of measurements, and the number of trees recorded in subsequent sampling events were not the same. The mean DBH between sampling events was

shown to be statistically insignificant for both sapling plots ($p = 0.9416$) and tree plots ($p = 0.9423$), reinforcing confidence in the accuracy of measurements.

A Paired Two Sample T-test was used to compare the heights and crown base height of trees recorded during the initial inventory and the audit. This is possible due to the individual identification of height trees. The average total height was shown to differ significantly between the original collection and the audit ($p = 0.01131$). No significant difference was observed in average crown base heights ($p = 0.2405$).

Wildlife

Autonomous Recording Units

Five autonomous recording units (ARUs) were placed randomly throughout the property and began recording on June 28th, 2024, until August 5th, except one which ran until July 24th, 2024. The *Raven Pro* software was used to analyze the audio files and provided the species as well as the number of times they were identified. Over 400,000 analyzed detections identified 405 species of birds, 16 of which are at-risk species listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the Species at Risk Act (SARA) (Environment and Climate Change Canada, 2023; Department of Natural Resources, n.d.). These 16 samples were further analyzed by ornithologist Joe Nocera and his grad student, Kiirsti Owen, to provide an extra degree of confidence and remove erroneous identifications (Table 3).

Table 3. The at-risk bird species recorded and identified by the ARUs and confirmed by Kiirsti Owen, the number of times they were detected, and if they were confirmed present or likely present.

Species name	Count of recorded calls	Confirmed
Bank Swallow	2	Yes
Barn Swallow	2	Yes
Canada Warbler	233	Likely
Common Nighthawk	408	Yes
Eastern Wood-Pewee	35	Yes
Evening Grosbeak	53	Yes
Rusty Blackbird	25	Likely
Wood Thrush	8779	Likely

Field and Marsh

The field and marsh on the LFP were sampled using eight 1 m^2 plots (six in the field and two in the marsh) to determine vegetation species, density, and heights. These data will be used to ascertain the suitability of the field and marsh as habitat for at-risk animal species.

It was found that the majority (54%) of the field vegetation was common timothy grass *(Phleum pratense*). The total number of plant species identified within the field survey plots was 11 (Figure 6).

The marsh vegetation was significantly more homogenous with a total species count of four (Figure 7).

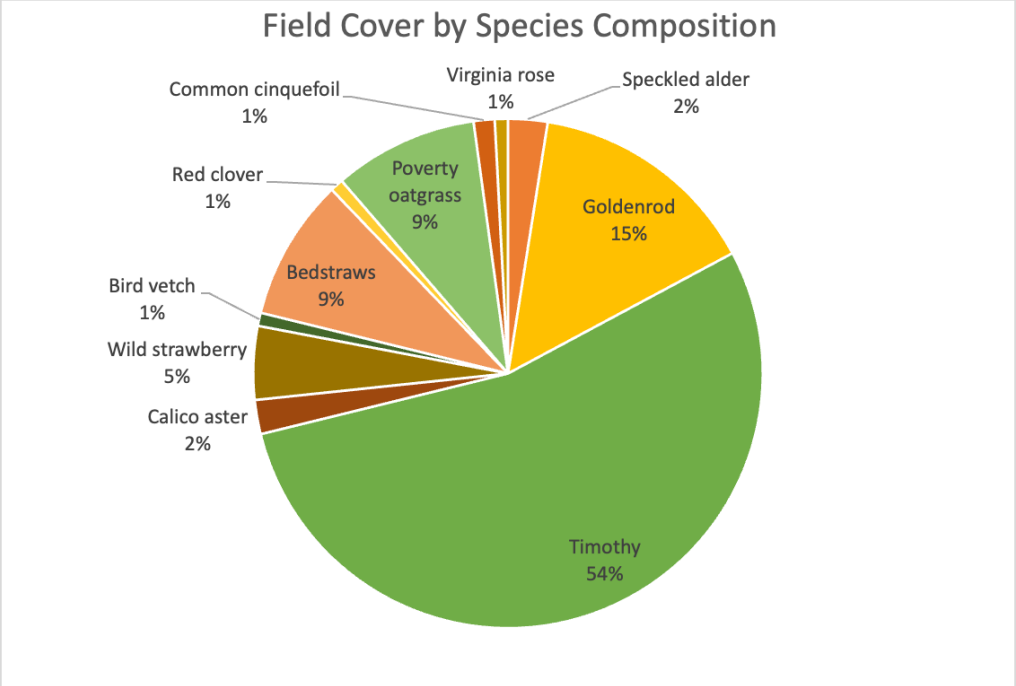

Figure 6. Proportion of the field vegetation cover by species with Timothy grass dominating. Data comes from six 1 m^2 plots placed randomly in the field of the LFP, collected on October 24th, 2024.

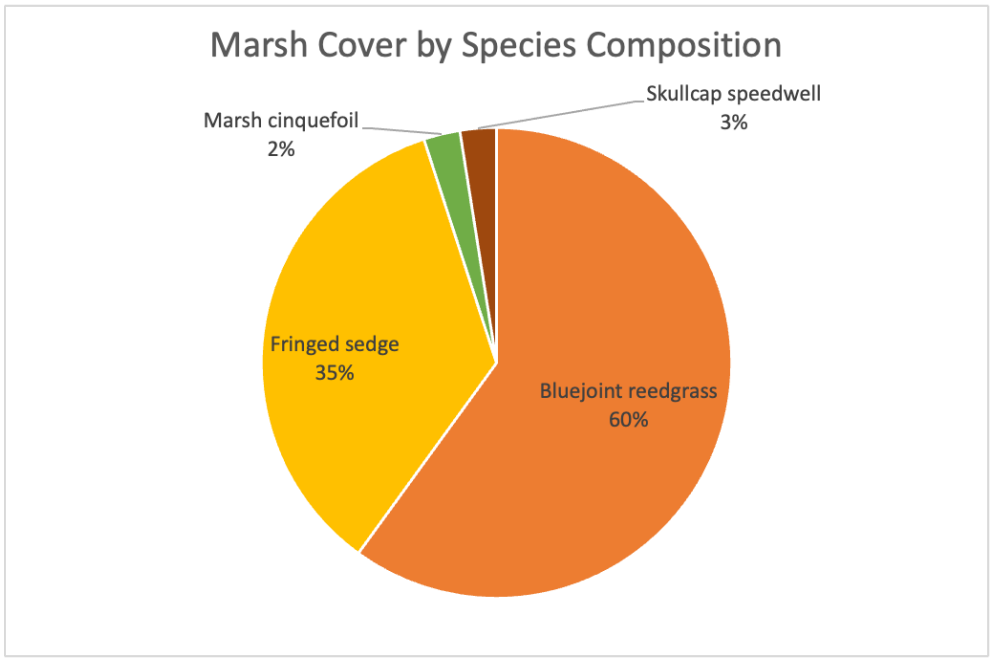

Figure 7. Proportion of the marsh vegetation cover by species with bluejoint reedgrass dominating. Data comes from two 1 m^2 plots placed randomly in the marsh of the LFP, collected on October 24th, 2024.

Milkweed

Five distinct patches of milkweed were found on the property and mapped using Avenza Maps (Figure 8). The patches totalled an area of approximately 1,300 m^2.

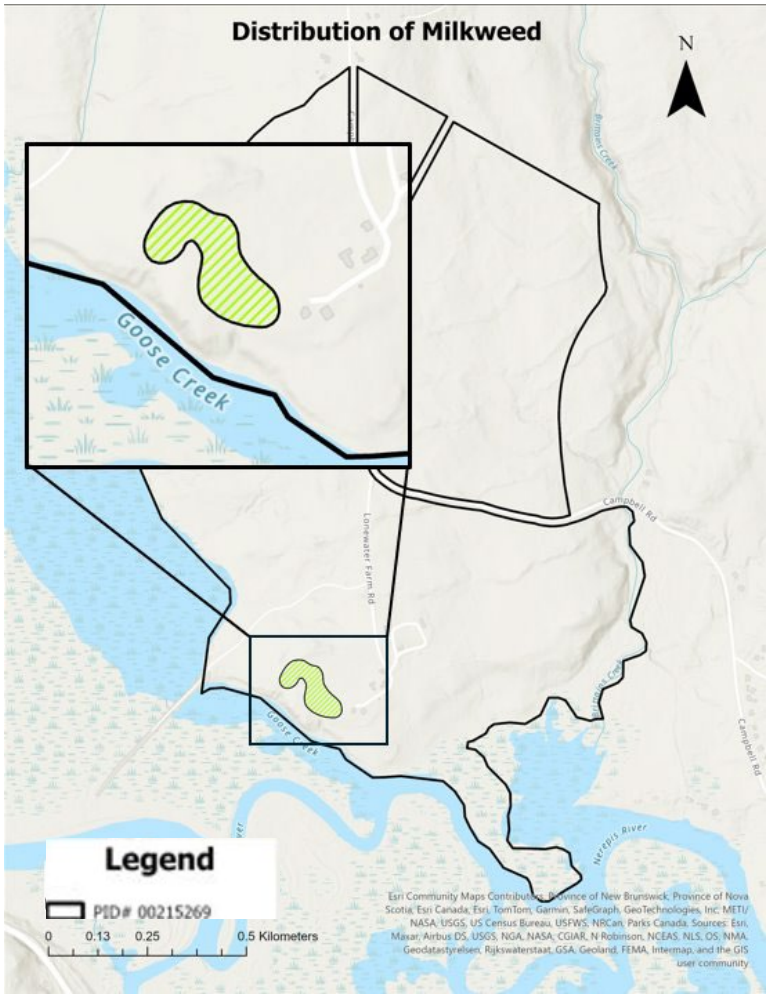

Figure 8. A map showing the distribution of milkweed on the LFP in New Brunswick. The five milkweed patches were merged for better representation of the area they cover.

Invasives and undesirables

Invasive and "undesirable" vegetation species were located during field surveys on the property and mapped using Avenza Maps. Undesirable species include those that negatively impact the usability and safety of the property, such as Poison Ivy, and invasive species include non-native plants that negatively impact the growth and reproduction of native species. The following species were identified when performing other assessments or surveys and thus, were not specifically surveyed for.

During field work, seven invasive species and one undesirable species (Poison Ivy) were identified as seen in Figure 9. Reed Canary Grass (*Phalaris arundinacea*), Bittersweet Nightshade (*Solanum dulcamara*), Woodland Angelica (*Angelica sylvestris*), Glossy Buckthorn, Himalayan Balsam (*Impatiens glandulifera*), Poison Ivy, Huckleberry (*Gaylussacia* sp.), and Silver Poplar (*Populus alba*) were all identified. The highest number of an invasive species noted was Canary Grass that was prevalent in the field where nine instances of the invasive were found. Glossy Buckthorn is a prolific invasive species, (Fagan & Peart, 2004) and six patches were noted along the waterfront that will need to be removed.

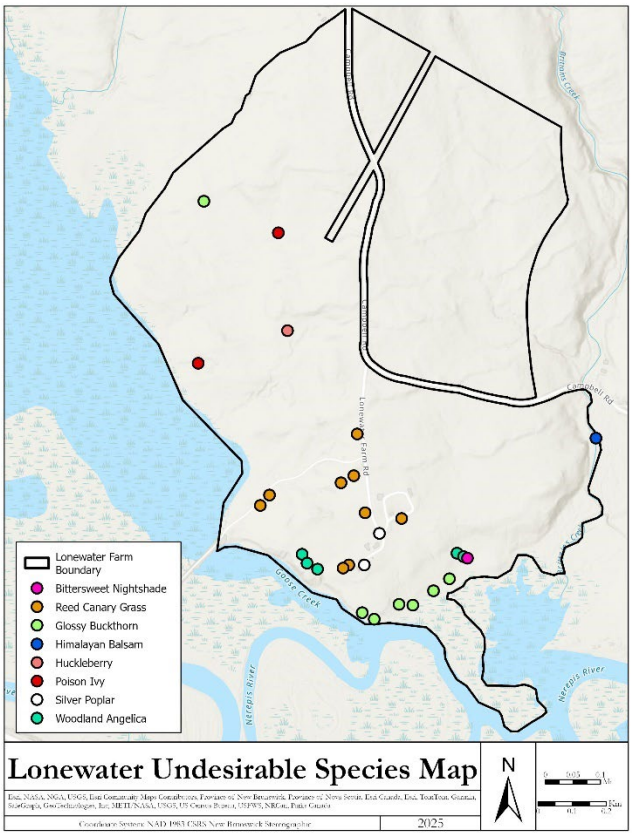

Figure 9. A map of the LFP with highlighted points of invasive and undesirable species. The most prevalent invasive species that were located were glossy buckthorn and reed canary grass.

CABIN

An assessment of Brittains Creek was performed on October 4th, 2024, at the coordinates 45.383641, -66.241836 using the Canadian Aquatic Biomonitoring Network (CABIN) protocol (Figure 10). We assessed stream chemistry, channel dimensions, stream bed substrate, and benthic macroinvertebrate (BMI) diversity.

Primary findings from the CABIN assessment come from the BMI data. Certain BMI taxa are particularly sensitive to water pollution and disturbance (such as Ephemeroptera, Plecoptera, and Tricoptera) and whose presence is an indicator of excellent water quality (Wright & Ryan, 2016). A preliminary assessment of BMI diversity and abundance in Brittains Creek indicates good water quality, but an absence of pollution (Table 4 - Table 7).

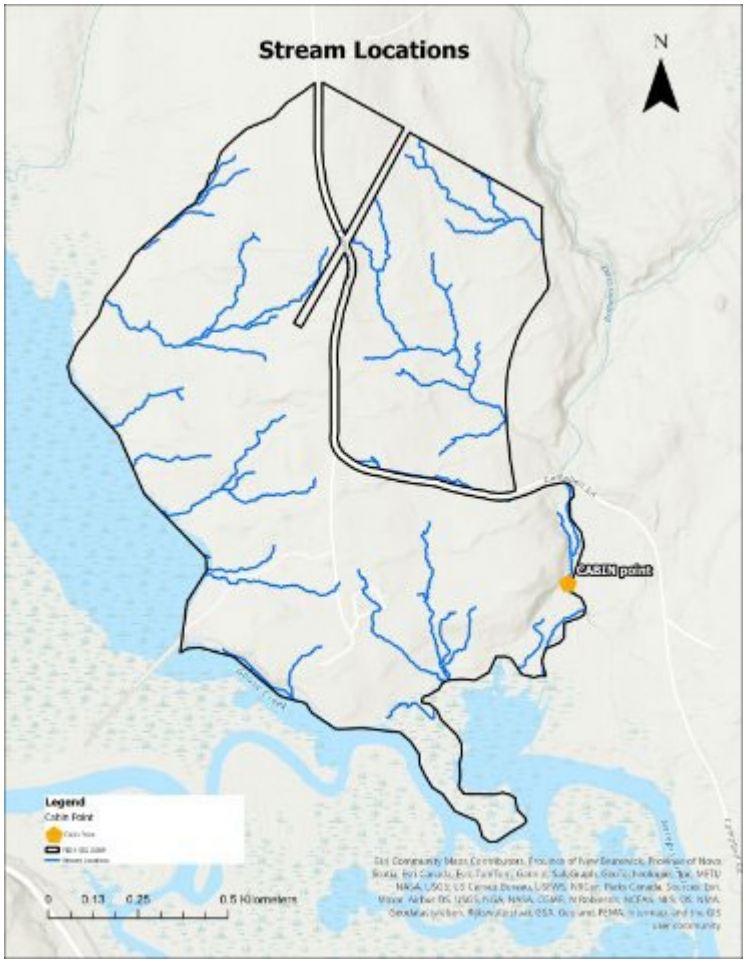

Figure 10. A map of the CABIN location point in Brittains Creek on the LFP.

Table 4. The chemistry data from the CABIN assessment of Brittains Creek, taken on October 4th, 2024.

Metric	Value	Unit
Air Temp	19	Celsius
Water Temp	13.8	Celsius
pH	7.01	pH
Specific Conductance	56.1	µs/cm
DO	2.06	mg/L
Salinity	0.03	

Table 5. The cross-sectional channel dimensions from the point in Brittains Creek where the CABIN assessment was performed, taken on October 4th, 2024.

Distance from shore (m)	Depth (cm)
0.83	12
1.66	23
2.49	27
3.32	32
4.15	28

Table 6. A summary of benthic macroinvertebrates, identified down to the family, sampled during the CABIN assessment of Brittains Creek, taken on October 4th, 2024.

Common Name	Phylum	Class	Order	Family	Count
Dobsonfly	Arthropoda	Insecta	Megaloptera	Corydalidae	9
Horsefly	Arthropoda	Insecta	Diptera	Tabanidae	6
Water Penny	Arthropoda	Insecta	Coleoptera	Psephenidae	6
Mayfly	Arthropoda	Insecta	Ephemeroptera	Baetidae/Heptageniidae	15
Mayfly	Arthropoda	Insecta	Ephemeroptera	Baetidae/Heptageniidae	2
Mayfly	Arthropoda	Insecta	Ephemeroptera	Baetidae/Heptageniidae	2
Stonefly	Arthropoda	Insecta	Plecoptera	Perlidae	20
Dragonfly	Arthropoda	Insecta	Odonata	Aeshnidae/Libellulidae	2
Midge Larva	Arthropoda	Insecta	Diptera	Chironomidae	22
Nematode	Nematoda				1
Caddisfly Larva	Arthropoda	Insecta	Trichoptera	Hydropsychidae	6
Water Snipe	Arthropoda	Insecta	Diptera	Athericidae	1
Pyralid	Arthropoda	Insecta	Lepidoptera	Pyralidae	1
Unknown					5

Table 7. A summary of the proportion of Ephemeroptera, Plecoptera, and Tricoptera (EPTs) found in the benthic macroinvertebrate sample from the CABIN assessment of Brittains Creek, as well as several diversity measures taken at the Order level. Data was collect on October 4th, 2024.

%EPT	45.91837
EPT Taxa	5
Shannon Div	1.888843
Shannon Eq	0.411964
Simpson Div	0.822428

Wetland Delineation

Wetlands along the south-eastern and south-western borders of the property were delineated on October 27th and November 5th, respectively. The delineation followed the methods outlined in the Watercourse and Wetland Alterations (WAWA) standards for New Brunswick (Department of Environment and Local Government, 2021). The original wetland size identified from provincial GIS data was 5.3 ha, and the new proposed boundaries increased the wetland size to 10.9 ha (Figure 11). The new proposed wetland consists of floodplain, evident from high-water marks and drift deposits. Not all sites showed hydric soil indicators, but this could be a result of previous disturbance to the area.

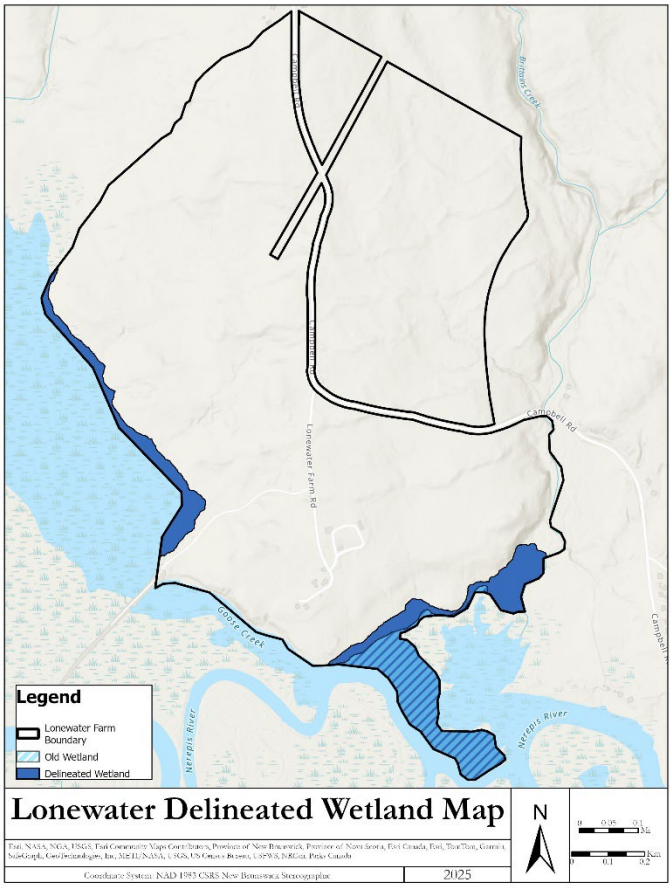

Figure 11. New and old delineated wetlands on the LFP. Old wetlands are highlighted in transparent hatched blue lines, and new wetlands highlighted in blue follow the south-eastern and south-western property boundaries

Dump Sites

Since this property used to be a farm and has since been actively used by the public, there are several dump sites, as well as smaller, scattered patches of litter throughout the property. During the forest inventory and other inventory methods many dumpsites were found. A total of 10 dump sites were located on the LFP, which includes old farm equipment and old hunting infrastructure that could cause harm to the public (Figure 12).

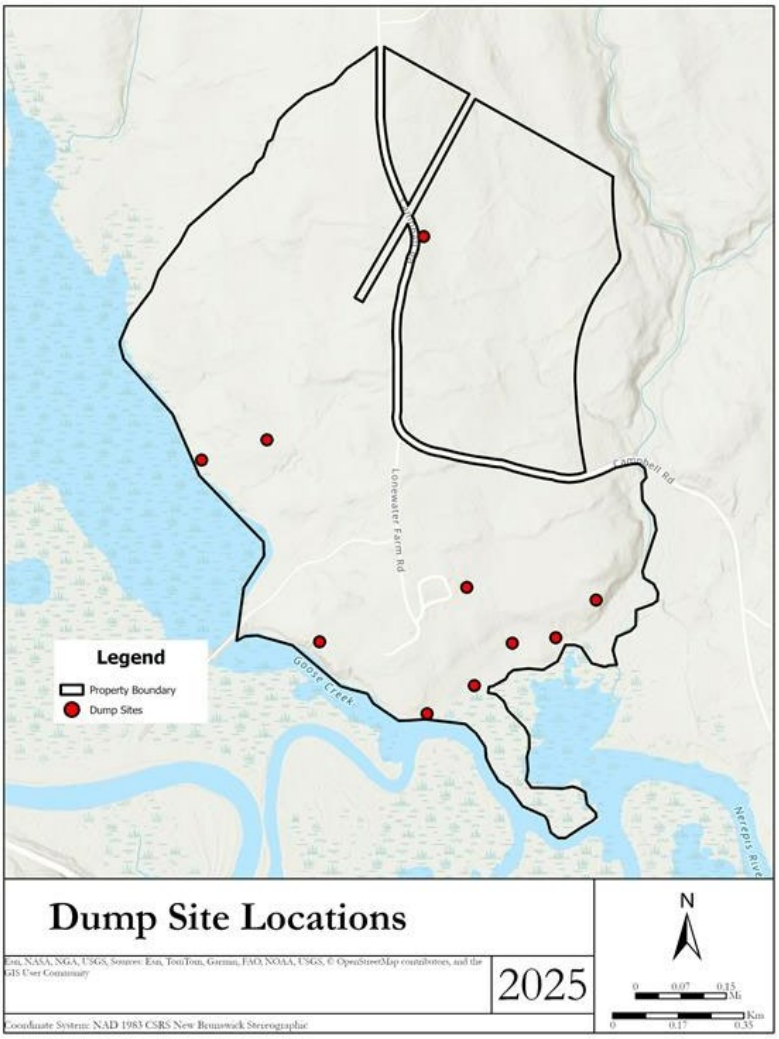

Figure 12. A map indicating the location of 10 garbage dumping sites.

Stream and Trail Mapping

Trails were mapped using Avenza Maps and trail assessments were performed using TEST and TRACS standards and scored according to the attributes assessed. Attributes that fell within test standard included trail width, overhead clearance, terrain features, obstacles and proximity to sensitive habitat such as milkweed, cedar stand nesting trees. Unfavourable attributes were associated with a negative value and favourable attributes were associated with a positive value, ultimately determining the overall feasibility of the trail. Trails with a score of 15 points or higher will be considered for restoration and trails that are less than 15 points are being considered for omission. The result was 2.67 km of acceptable trails for restoration and 1.04 km of potential trails. Within the context of our project, a potential trail is defined as a trail that meets all the criteria within the test standard and has a cumulative score higher than 15 but has limitations due to meandering the property boundary (Figure 13).

To aid in determining sensitive habitat areas, ArcGIS flow accumulation and flow direction analysis tools were used to derive a stream location map. To ensure the accuracy of the derived layer, presence or absence were assessed at the point of commencement and point of termination of each location. Once all streams were identified, post ArcGIS work included classifying each stream as either ephemeral or perennial.

Lonewater Farm User Survey

The Grand Bay-Westfield Recreation Department provided a short user survey to the users of the LFP from July 25th, 2024, to October 31st, 2024. There was a total of 149 different responses to the survey minus one (148) as it was a test response submitted by the Grand Bay-Westfield Recreation Department. See Appendix A – Methods for the full survey and Appendix B – Results for full results. Most survey participants visit on a frequent basis, 82% of the people visit weekly to several times a year. Hiking is the most popular activity people enjoy at Lonewater Farm, making up 24% of entries; people also enjoy the proximity to water, with many people enjoying fishing, kayaking and canoeing on the shores of Lonewater Farm. Participants stated that they were most interested in implementing non-motorized trails and pathways, which complements the land users' preference for hiking and interest in guided nature walks and fitness programs. Many people who participated in the survey also stated that they valued the natural state of the property and were not interested in any new developments or programming on the property. Most people who visited Lonewater Farm value nature and wildlife; 77% of participants stated they felt at least knowledgeable about the local wildlife and plant species in Lonewater Farm. Demographically, ages 25-64 are the most frequent visitors as they make up 82% of the users. Gender was divided almost evenly between males and females, with 2% of participants identifying as non-binary or they prefer not to say.

Grand Bay-Westfield Demographics

The population of Grand Bay-Westfield as of 2021 is 4,967, with a population density of 83 per km^2. The average age of the population is 40 to 64 years old. The majority of Grand Bay-Westfield's population identifies as Caucasian Canadian citizens. The primary religions in Grand Bay-Westfield are Christianity and Catholicism. The majority of the population has a high school or equivalent certification at minimum, and many people hold either a college diploma or a trade certificate. The unemployment rate was 6% in 2023, just below the national unemployment rate of 6.7% (Government of Canada, Statistics Canada, 2025). Crime does not seem to be a prevalent issue in this area (see Appendix B – Results for tables of demographic information).

Historical land use

Historical photos were purchased from the Province of New Brunswick to assess previous land use. Property lines are overlayed to give context to the land. The photos used range from 1935 to 2023. Current mapped trails were overlayed with a traced layer of trails and disturbances noted from 1945, 1962, and 1976. These dates were chosen because they represent the most comprehensive view of the property and show the most distinct changes in property management (see Appendix C- Historical Photos). In the 1945 photo (Appendix C Figure 2), there are two small areas of disturbance in the lower right portion of the property, likely used to harvest firewood, or the area could have been disturbed by a wind event. There are 3 trails noted from the 1945 aerial photo that can also be seen in the 1962 aerial photo (Appendix C Figure 12 and Appendix C Figure 13), indicating that these trails were of importance and likely maintained for frequent use, possibly used as service roads to access a dump site, which was located during 2024 field data collection and marked on the map. The border of the managed field portion of the property began to move inward from 1945 to 1976 (Appendix C Figure 11, Appendix C Figure 12, Appendix C Figure 13), indicating the regeneration of the surrounding forest and its successional development. In 1976, the aerial photograph (Appendix C Figure 5) indicates eight areas of disturbance that were not identified in previous photos. It is ~~likey~~likely that these areas are related to human activities as all disturbed areas have defined trails directly linked to each site (Appendix C Figure 11~~).~~). ~~-~~T ~~T~~he aerial photo suggests harvesting operations; this is supported by the presence of past harvesting tracks noted throughout the property.

Modeling

Management Plan for the Department of Natural Resources and Energy Development: Lonewater Farm

Growth & Yield

The forecasting of forest change over time provides insight into future conditions relating to species composition, forest growth, habitat availability, and effects on the project's objectives. For this project, the LFP was forecasted into the future under its current conditions with no management and no major disturbances, changes, or events. This shows the natural growth, mortality, and species composition changes that will occur within the stands of the forested area on the property under status quo. Forecasting a status quo scenario will provide a baseline to which results from other scenarios, such as climate change or disturbances, can be compared. The forecast for this management plan begins in the year 2025, covering a 25-year period ending in 2050; this time horizon was selected because despite data accuracy, there is uncertainty in modelling forest change over time as there is an infinite number of factors and specificities that could impact it, and the greater the time horizon, the greater the uncertainty.

To provide our client with more information, two climate change sensitivity analyses were forecasted on the property, specifically representative concentration pathway (RCP) 4.5 and RCP 8.5 forecasts. A sensitivity analysis assesses how the plan will perform over time under different constraints or uncertainties. The RCP scenarios simulate climates based on different levels of greenhouse gas emissions. RCP 4.5 describes a scenario in which emissions peak in 2040 and then decline. RCP 8.5 shows emissions continuing to rise through the 21st century and is the "worst-case" climate change scenario.

The PICUS modelling software was used to forecast the LFP forest structure changes over time. This is a model that simulates how trees interact in patches of 10 x 10-meters. It can predict the composition change of the stem density, basal area, and volume of a forest, all while accounting for climate change. The model also accounts for spatially explicit interactions between patches using a 3D light module, simulates explicit seed dispersal as well as ecosystem carbon, nitrogen, and water cycles (Lexer & Hönninger, 2001). This software was selected because there is no harvesting for this management plan.

The PICUS model is a stochastic model, so each stand runs a total of 3 times and the outputs are averaged. This is done for all scenarios, "climate-normal" (CN), RCP 4.5, and RCP 8.5. The analysis involves predicting the composition change of the stem density (in stems/ha), the basal area (in m^2/ha), and the volume (in m^3/ha) forecasted 25 years into the future. Refer to

Appendix F – Forest Model Outputs to view the graphs outlining the changes for all these metrics for all stand types under each climate scenarios.

For the Intolerant Hardwood stand, which is where most wildlife habitat was found, density decreases for the next 15 years and then begins to increase. This is a result of forest succession as trees compete for resources. As trees die, resources such as space and light become readily available which stimulates the growth of regeneration and saplings.

There is a specific amount of growing degree days that is optimal for species growth. Different temperatures/climates have different amounts of growing days. In southern New Brunswick, many species are slightly below their peak of growing degree days. Under climate change, there are more warm days, so more growing days. By having a moderate increase in temperature, as in the 4.5 scenario, it allows those species to be closer to that ideal range. The 8.5 scenario would exceed the optimal range for some species of the region. This is shown in the overall trend for the Intolerant Hardwood stand; 4.5 increases in density much sooner than the other scenarios since the conditions are considered ideal for some species in this stand type. The reason 8.5 has a similar trend to climate normal, is because both are on either side of that peak; climate normal is on the lower side and 8.5 is on the upper side. Further explanation on growing degree days can be found in Wang et al. (2025).

The same trend is shown across the other stand types; decrease for approximately 15 years and then an increase, which is a pattern reflective of forest succession taking place. The same patterns are also shown at the species level in all stand types; climate resilient species whose peak growing degree days occur in a slightly warmer climate do well and become more abundant under the RCP scenarios while non-climate resilient species continue to decline. Species with a slower growing rate show more gradual and slower increases than species with a high growth or reproductive rate.

Wildlife Habitat

Birds

Of the bird species listed as present and likely present in Table 3, breeding habitats for forest nesting species likely to be nesting on the property have been modelled, which are Canada Warbler *(Cardellina canadensis*), Eastern Wood-Pewee *(Contopus virens*), Evening Grosbeak

(Hesperiphona vespertina), and Wood Thrush *(Hylocichla mustelina*). The others in Table 3 have been discounted since critical nesting habitat is either not present on the property or our database does not include the necessary features to determine habitat quality with enough certainty.

The habitat suitability model for Canada Warbler took into account the understory density, species composition, distance from hard forest edges, and distance from riparian areas. The habitat quality follows a linear relationship with understory density, proportion of deciduous trees, and distance from hard forest edges, and is inversely proportional to distance from riparian areas.

The model for Eastern Wood-Pewee considered understory density, species composition, distance from hard forest edges, distance from roads, distance from riparian areas, and stem density. The habitat quality follows a linear relationship with distance from roads and proportion of deciduous trees, and is inversely proportional to understory density, distance from riparian areas and distance from hard forest edges.

The model for Evening Grosbeak considered canopy closure, species composition, canopy height, and the proportion of the following desirable species: Balsam Fir, White Spruce, and Trembling Aspen. The habitat quality follows a linear relationship with the proportion of desirable species and canopy height and is inversely proportional to the proportion of deciduous trees. A medium canopy closure is preferred, with high and low values being less desirable.

The model for Wood Thrush took into account the understory density, species composition, canopy height, canopy closure, and distance from riparian areas. The habitat quality follows a linear relationship with understory density, canopy height, canopy closure, proportion of deciduous trees or mixedwood condition, and is inversely proportional to distance from riparian areas.

White-tailed deer

Variables included in the deer suitability model are tree species composition, percent canopy cover, and distance from roads. White-tailed deer tend to prefer mixed wood stands with high canopy cover for overwintering habitat as they provide adequate food and cover simultaneously. Roads are also avoided as they are a significant cause of mortality. These

preferences are spatially represented in Appendix G Figure 5, indicating areas of high and low winter habitat suitability.

Recommendations and Operations

Management Plan for the Department of Natural Resources and Energy Development: Lonewater Farm

Trail Placement

Trail placement recommendations for the LFP are based on species-at-risk critical habitat assessments, deer overwintering habitat, and minimum trail length requirements. In order to reduce further harm to species-at-risk (and deer), it is important that trails are not established in important feeding or breeding grounds. To ensure this, critical breeding grounds for several at-risk bird species and overwintering habitat for deer are mapped, and proposed trail locations are placed in areas that would minimize habitat disturbance (Figure 13). The proposed trails are 1.9 km long and wind through several different forest types, improving user experience. They also utilize existing trails to minimize the amount of work required to create them and minimize environmental disturbance. Stream crossings are also avoided when possible, and 90-degree crossings are used when necessary. The construction of these new trails aligns with Goal 3.

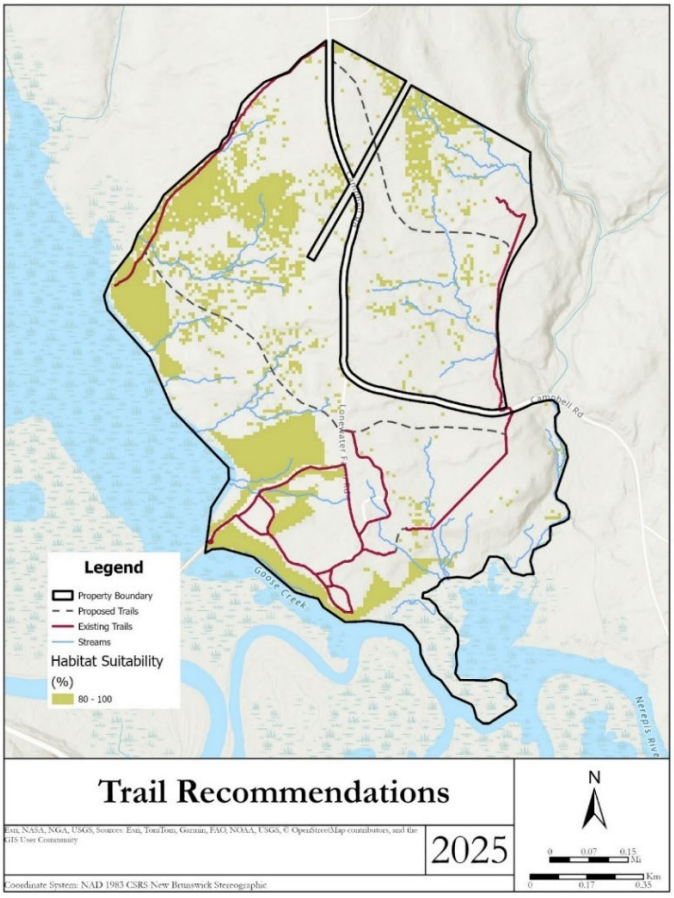

Figure 13. Proposed locations of new trails (dashed lines) to avoid conflict with target species breeding and overwintering habitat (80-100% suitability) and minimize stream crossings.

Educational enrichment

To increase the learning opportunities for the LFP user base, it is recommended that a sheltered learning center such as a gazebo be built to house educational plaques and materials and to provide an educational space for field trips or other groups interested in using or learning about the property. We recommend that the learning facility be built on the site where the previous rehabilitation facility was located in order to reduce its environmental impact. Plaques can include historical and ecological information about the property, information about noteworthy species native to the property, and maps of the trails around the property, including information about their accessibility and length.

It is suggested that informational signs and plaques are also made and placed along the trails on the property, giving descriptions of various native vegetation and animal species in the areas where they are located. Maps and arrows should also be placed at junctions to guide people along the trails. ACAP Saint John and Ducks Unlimited both stated that they may be willing to partner with the town of Grand Bay-Westfield to finance and build these educational structures. This recommendation meets the project Goals 3 (recreation) and 4 (engagement).

Habitat Creation

Monarch butterflies, an endangered species of arthropod (Environment and Climate Change Canada, 2025), have been identified as present on the LFP, and patches of milkweed (critical breeding habitat for monarchs (Environment and Climate Change Canada, 2025)) have been found and mapped on the LFP (Figure 8). Since the client is not interested in managing sapling growth in the field to maintain it as a field, it is likely that over time the milkweed will become excluded, and monarchs will lose prime habitat on the LFP. To mitigate this issue and promote monarch breeding in the area, it is suggested that milkweed be planted in garden boxes surrounding the proposed gazebo and maintained throughout the summer. We recommend that seeds harvested from the local milkweed patches be used for planting to maintain the local genetic diversity of the plants. Signs describing milkweed and its significance can also be placed around the garden boxes to educate users.

Barn swallows, a listed species of bird (Environment and Climate Change Canada, 2019), have been detected on the property from the ARUs. However, there are currently no structures

on the property that can support barn swallow nesting. The proposed gazebo is designed in a way that promotes barn swallow nesting without interfering with the educational functionality of the building. The swallows would be able to nest up along the beams on the interior perimeter of the gazebo, specifically not directly overhead of the benches, to avoid negative interactions between gazebo users and the birds. These habitat creation recommendations meet Goal 1 (conservation) and could be implemented with the help of ACAP Saint John.

Dump sites

A variety of garbage and dump sites have been located spread across the LFP, including some that contain old pieces of farm equipment. It is recommended that all located garbage (Figure 12) be removed from the property to reduce the human impact on the land and reduce the potential for patron injury. However, some sites are easier to clean up than others, and cleaning some may negatively impact the land more than leaving them. With that in mind, we recommend that sites that are close to trails be removed first, as they will be the easiest and will have the least environmental impact. The sites that contain large items or pieces of farm equipment should be assessed on an individual basis to determine if their extraction would cause more environmental harm than good. We recommend that if dump sites cannot be extracted without the use of heavy equipment they be left where they are and, where necessary, be accompanied by signs warning users of the dangers.

Since dump sites were located during our forest survey, there are likely other garbage and dump sites located throughout the property that were not found. For this reason, it is recommended that further dump site surveys be conducted to continue to find and remove garbage. This can be done with traditional surveys involving volunteers going for walks through the forest, but it may also be worthwhile to have a system where LFP users can report garbage or dump site locations themselves. There could be a QR code placed on a sign at the entrance of the property that brings users to a page where they can report the location and type of garbage that they find. These recommendations meet Goal 2 (restoration). ACAP Saint John stated they may be willing to assist with the implementation of these recommendations.

Invasive plants

It is recommended that, where possible and feasible, invasive plants located on the LFP (Figure 9) be removed and the removal sites continually monitored to ensure that they do not return. However, most of the invasive species found on the LFP are not easily removed, or an attempt at their removal could easily cause them to spread even more (New Brunswick Invasive Species Council, n.d.). Silver poplar (*Populus alba*) appears to be the one species that can be removed without too much planning (Tree Canada, n.d.). We only found two silver poplars, both in the middle of the field which means they are easy to access and remove. The main stems can be girdled or cut down to kill them, and the root suckers that will likely continue to sprout over the next few years can be chopped by hand or mowed (Tree Canada, n.d.). The remainder of the species listed in Figure 9 will require extensive consultation with professional invasive species removal specialists. If it is deemed appropriate to make use of pesticides, this will be done safely and in compliance with the Pesticides Control Act. The Nature Conservancy of Canada and the Nature Trust of New Brunswick are two organizations that have stated that they may be willing to help with invasive species strategizing and removal.

Like the dump site surveys, the invasive species surveys were incidental, which means that it is likely that patches of invasive species may have been missed. For this reason, we recommend that further invasive species surveys be carried out to locate areas that were possibly missed.

Boat launch

To maintain the boat launch accessibility while reducing motorized vessel usage, it is suggested that the boat launch be modified so that boats can no longer be launched by trailer. This would allow only hand-launched boats like canoes and kayaks to be used from this boat launch, meeting the project boat launch objective. Signs would need to be placed at the boat launch to let users know about the changes and the area would need to be maintained to ensure that people do not modify the launch. If significant conflict with users is foreseen in the event of the physical prevention of motorized vessel launch, signs discouraging their use could be erected instead. These options align with Goal 1 by promoting the conservation of a healthy aquatic ecosystem, while maintaining opportunity for recreation (Goal 3).

Future surveys

The inventory of this project was conducted from late summer to early autumn, usually the period where many herbaceous plants have wilted, and amphibians and reptiles are no longer active. To better understand the population of ground vegetation species that are present on the property, it is recommended that a survey be conducted early to mid-summer to identify rare plant species or species at risk. Due to the property's proximity to rivers and wetlands, it is also recommended that amphibian and reptile surveys be conducted. These surveys would aid in conservation efforts (Goal 1) and may help inform some remediation decisions (Goal 2). The Nature Conservancy of Canada may be able to assist by providing resources for habitat a species identification and monitoring.

Partner organizations

In alignment with Goal 4, it is recommended that a board of members is formed, including ERD-NB, the town of Grand Bay-Westfield, and conservation groups interested in partnering in the management and maintenance of the LFP as an OECM area. Having a board of experienced professionals involved in creating a strategic management plan and regular meetings can help ensure the follow-through of goals and objectives. Building partnerships between the government, municipalities, and ENGOs to reach shared goals and mandates will ensure that all aspects of the project's implementation are covered. This collaboration allows conservation groups to offer continued input, increasing the likelihood of balancing both conservation and recreation.

Stakeholder and rights-holder engagement

It is not only recommended but necessary to engage with the rights-holders; there is a legal duty to consult when making decisions about crownland resources (Government of New Brunswick, 2011). This includes meaningful engagement and consultation early in the planning phase and often throughout the life of the project. During the consultation sessions with local Indigenous groups, it is highly recommended to take the information gathered and implement it into the management and operation plan, ideally leading to long-term collaboration and partnership. The follow-through after engagement sessions increases the continuity of trust, which is essential in fostering a meaningful relationship and contributing to the 94 calls to action for truth and reconciliation (Government of New Brunswick, n.d.).

Stakeholder surveys conducted by the Town of Grand Bay-Westfield should be considered when choosing which features to implement (Appendix B – Results). It is recommended that further consultation is done on a larger scale to involve a broader demographic than only those who already use the property. Targeting a larger audience will build a greater understanding of what residents want and generate interest in the project, ideally increasing the usership. It is advisable to consult with educators and local schools to determine which features would be beneficial for outdoor education, as education is a project objective. Incorporating feedback from stakeholders creates a strong sense of involvement and connection to the project, which can significantly boost user engagement.

OECM

An OECM is a geographically defined area that is not technically a protected area, but still achieves long-term conservation of biodiversity, either intentionally or as a byproduct of its management. OECMs are a key land designation tool used to help Canada reach the goal of conserving 30% of land and in-land waters by 2030, and designating the Lonewater Farm Property as one would help both Canada and the province meet conservation goals. All 167 ha of the Lonewater Farm property currently meet the requirements of an OECM and would remain an OECM even with all of our recommendations implemented, as outlined by the Pan-Canadian Decision Support tool in Appendix H – OECM Screening Criteria .

Acts and Policies

Management Plan for the Department of Natural Resources and Energy Development: Lonewater Farm

Duty to consult - (Provincial and Federal policy)

The provincial policy outlining the duty to consult states that consultation with Indigenous groups must take place when a contemplated action or decision by the province has the potential to adversely affect Indigenous or Treaty rights (Government of New Brunswick, n.d.-f). Since the LFP is on the unceded and unsurrendered lands of the Wolastoqiyik, the decision to license the land to the town of Grand Bay-Westfield, as well as the decision to modify the land by building trails and an outdoor learning facility trigger the Duty to Consult. Indigenous groups must be notified of the contemplated action and be supplied with the information needed to give informed input. A space for further consultation and accommodation must also be made to allow for continued and ongoing collaboration to ensure that the province and Indigenous groups have a complete understanding of one another and there are no miscommunications. The management plan of the LFP takes these requirements into account by recommending consistent and ongoing Indigenous consultation throughout the entirety of the lifespan of the project.

Crown Lands and Forests Act

The Crown Lands and Forests Act regulates the use of Crown lands, controls access and occupation, and defines enforcement and penalties (Government of New Brunswick, n.d.). For the construction of an outdoor learning facility and trails by the town of Grand Bay-Westfield, a license of occupation must be granted. This may be granted for a term of up to 20 years and must be renewed once the specified term has expired. The Minister will impose the terms, conditions and reservations prescribed by regulation and any other additional terms, conditions and reservations of the license.

Occupational Health and Safety Act

The work that is proposed for the LFP, including invasive species and dump site removal, the construction of the learning facility, the construction of the trails, and the potential blocking of the boat launch all require physical labor to take place on the property. For this reason, the Occupational Health and Safety Act applies. The Act states that all workers or contractors must be trained and competent, PPE must be available and used when required, safe work procedures

must be in place, and the land must be safe when used as a workplace (Government of New Brunswick, n.d.-c). The LFP management plan takes these into consideration by recommending that all proposed work be done safely by trained workers.

Clean Water Act

An addition of 1.9km of trails is part of the recreation objective for this project. The additional trails will connect existing trails to create a loop system. Although planned trails aim to avoid stream crossing, some sections of trails will interact with the streams located on LFP. The Clean Water Act addresses the regulations around alterations of waterways including machinery use, construction, or vegetation removal within 30 meters of a stream (Government of New Brunswick, n.d.-a). Permits will be obtained before work begins, with detailed plans submitted for approval. Structures such as bridges or culverts will be maintained, inspected, and compliant with conditions set by the Minister. This management plan ensures all crossings will follow these requirements to minimize environmental impact and maintain legal compliance.

Pesticides Control Act

The Pesticides Control Act regulates the sale, use, storage, transportation, and disposal of pesticides (Government of New Brunswick, 2011). In the event that invasive plant removal involves the use of pesticides, all operations must comply with the Act. All vendors and applicators must be licensed for the type of pesticide in use and application must comply with the terms and conditions imposed by the Minister. The recommendation is that pesticide application for the purpose of invasive plant removal on LFP be conducted in compliance with the Act.

Species at Risk Act

Federal

The Federal Species at Risk Act provides legal protections and recovery plans for wildlife species at risk of extirpation or extinction in Canada (Environment and Climate Change Canada, 2016). The main function of the LFP is to conserve habitat for species at risk and the objective for this is to allocate the maximum amount of the property to OECM designation. The current wildlife data for LFP is limited to birds, which is why this project focuses primarily on at-risk bird species habitat. Subsection 58(5.1) of the Species at Risk Act specifies that, with

respect to the critical habitat of a species of bird that is a migratory bird protected by the Migratory Birds Convention Act, 1994, it is prohibited to destroy any part of their critical habitat. Any recommendation made for the LFP aligns with this act, as all trails and recreational developments avoid at-risk bird species habitat.

Provincial

The purpose of the Provincial Species at Risk act is to prevent wildlife species from extirpation from New Brunswick. The Act also states that recovery plans are created for wildlife that is considered extirpated, endangered or threatened (Government of New Brunswick, 2012). As stated above, the main goal of LFP is conservation. While recreation is another important aspect of the project, compliance with the provincial Species at Risk Act is essential. All recovery strategies published by the ministry for known species at risk on LFP are considered in management planning. Assessments will be carried out at any time of new threats or changing circumstances. All habitats occupied by a listed species will be monitored, and protection measures enacted by the Ministry will be monitored to ensure any activities on LFP do not pose an imminent threat to a listed species or its habitat. Currently, all proposed recreational infrastructure is aligned with the Species at Risk Act and does not pose a risk to bird species or their habitat identified on LFP.

Community Planning Act

This Act's aim is to promote the development of sustainable communities that balance environmental, economic, social, and cultural needs, while also providing a framework to help meet provincial priorities such as reaching 30% protection of land and water by 2030 (Government of New Brunswick, 2017). Additionally, it seeks to foster collaboration among local governments, rural districts, regional service commissions, and other agencies in delivering planning services and developing infrastructure. This Act is closely tied to the LFP management plan as the goal is to collaborate among stakeholders and Rights-holders to create an environmentally sustainable location for the Grand Bay-Westfield community to enjoy.

Fish and Wildlife Act

Both hunting and fishing take place on LFP. The Fish and Wildlife Act applies to all hunting and angling activities and related rights and matters. There was an illegal hunting blind

found on LFP along with deer bait and a strip of trees cut for shooting lanes. Section 34 of the Fish and Wildlife Act states regulations on respecting land protection, management, and scientific study of fish and wildlife, the designation of land within the province as wildlife refuges, management areas, or zones, and the proper management of these designated areas to support conservation efforts (Government of New Brunswick, 1980). This applies as conservation is the main goal of LFP.

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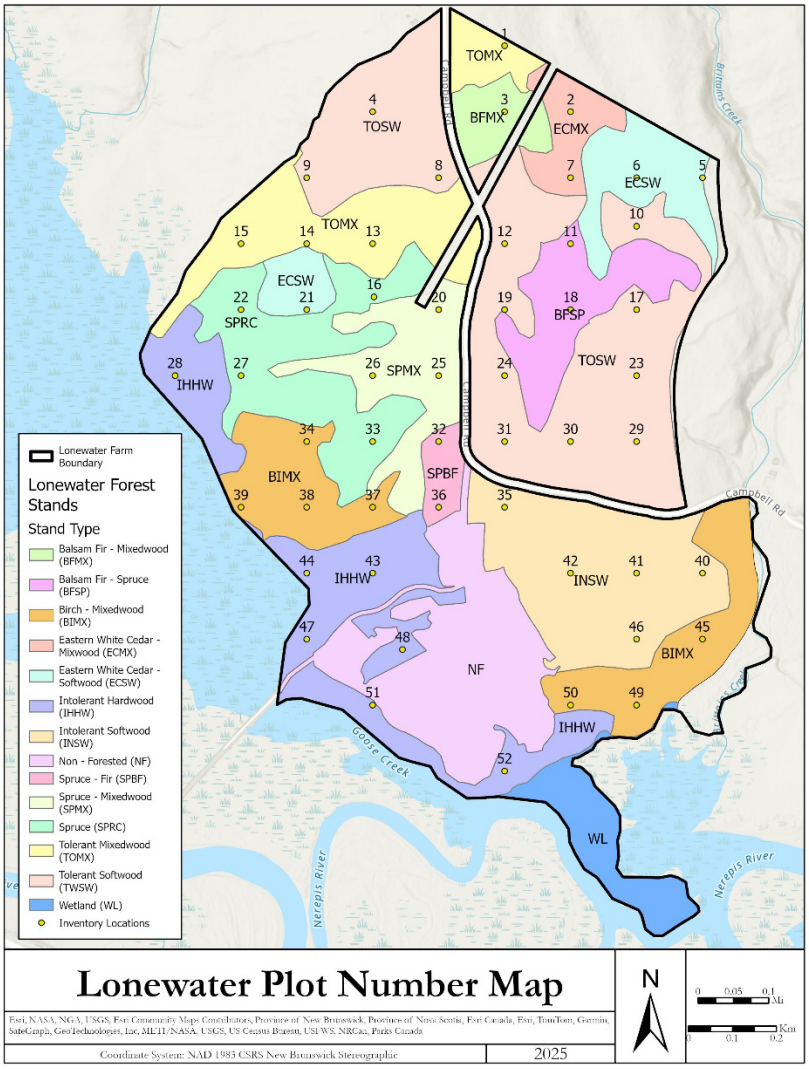
Appendices

Management Plan for the Department of Natural Resources and Energy Development: Lonewater Farm

Appendix A – Methods

Forest Sample Design

The forested area on this property is sampled using a random stratified sampling strategy. The fixed-area tree plots were randomly selected using ArcGIS Pro for a total count of 52 sampling locations, each comprising a 7.98-meter (m) radius. The fixed-area plot type was selected because every tree within the plot would be measured, ensuring the smaller diameter trees were also represented. There was no information on the age structure of the forest on this property prior to inventory, so this method allows for a more accurate count of stems and is more inclusive of all diameter classes. Data regarding regeneration is collected through regeneration plots with a 0.57-m radius centered at each tree plot using the same plot center. Within that 0.57-m radius, herbaceous plots are also completed to collect data on ground vegetation. Sapling plots have a radius of 3.99-m, also done with the same plot center as the tree plots and will be further elaborated on in the strategy section below. The intensity of all plots is based on the constraints of time and money, and to have a minimum of one sampling location per stand (Appendix A Figure 1).

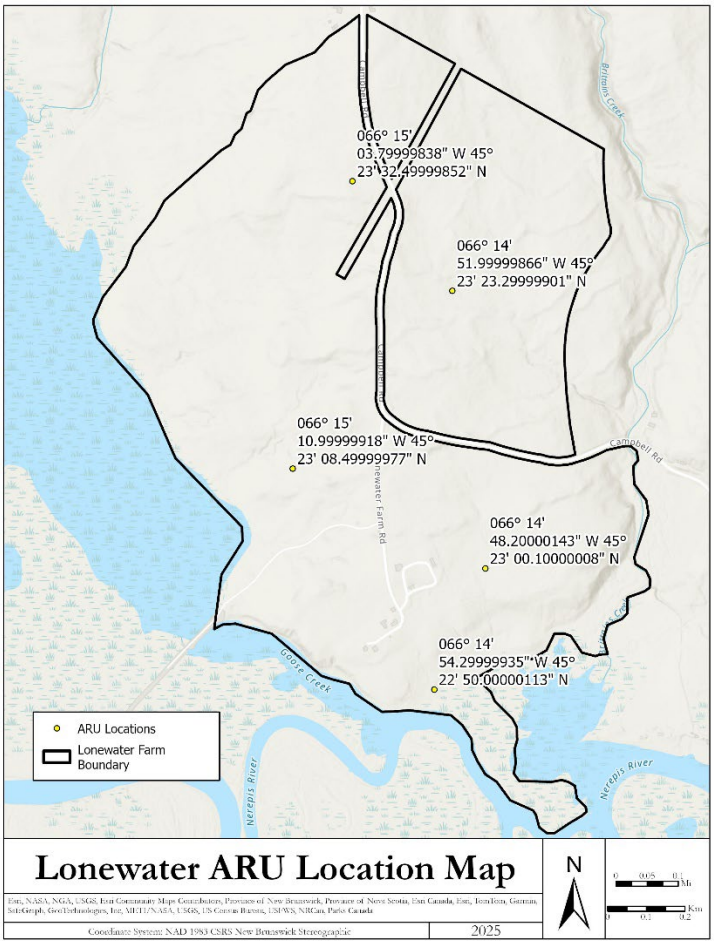


Appendix A Figure 1. Map showing the delineated stand types of the LFP using existing stand type data retrieved from the GeoNB website along with sampling plot locations. Some stands were merged based on similar dominant tree species.

Wildlife Sample Design

Birds

The five autonomous recording units (ARUs) were placed at random locations on the LFP on June 28th, 2024 (Appendix A Figure 2). All of the data from the ARUs are analyzed to determine which species are present.



Appendix A Figure 2. A map of the LFP outlining the five ARU placements and their location coordinates, provided by the Department of Natural Resources and Energy Development (ERD-NB).

The habitat types are derived from forest and vegetation data accumulated from the sample locations shown in Appendix A Figure 1.

Grassland and marsh habitat sampling is done with six, 1 meter squared (m^2) plots in the grassland and two in the marsh (Appendix A Figure 3). Grasslands are typically more diverse than an equivalent-sized forest stand (Wiens, 1974), and the increased sampling intensity reflects that. The marsh is more homogenized and subsequently receives fewer sample locations. Grassland and marsh sampling criteria are outlined in the sampling form (Appendix D Figure 9).



Appendix A Figure 3. The points in the grassland and marsh interior indicate vegetation sampling locations to determine bird habitat. The points along the waterline indicate the completed turtle sampling locations. Stand-type data retrieved from the GeoNB website.

Deer

White-tailed deer habitat is derived from the forest stand data accumulated from the sample locations noted in Appendix A Figure 1.

Monarch butterflies

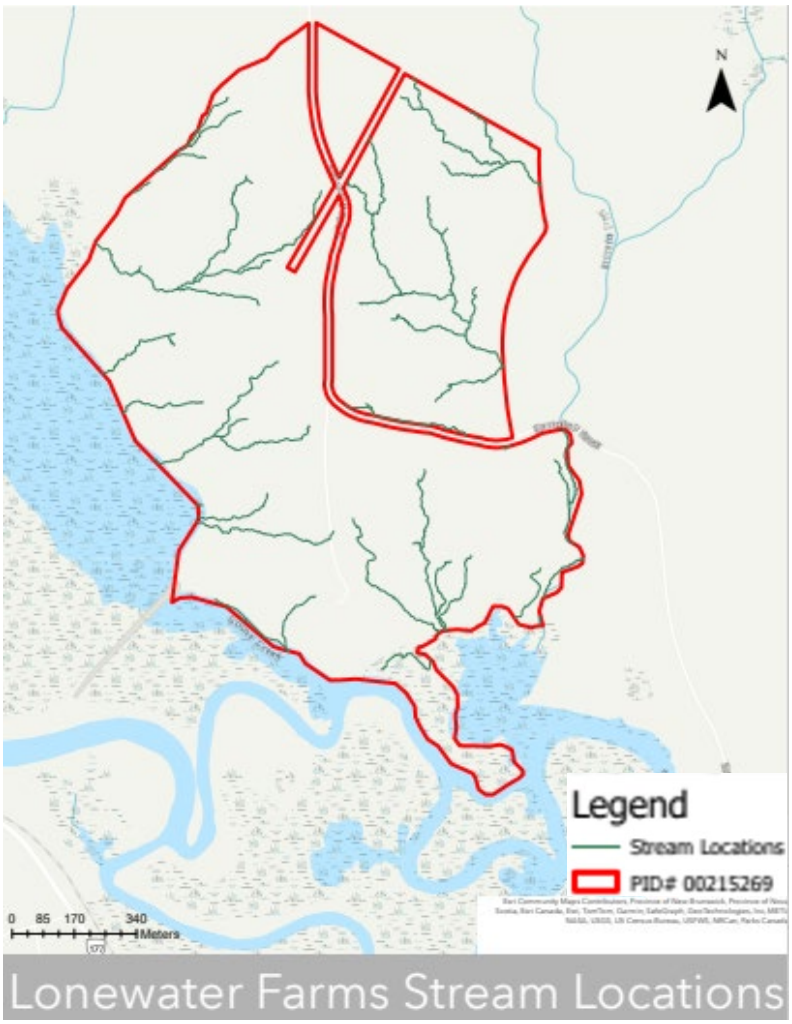
Monarch butterfly (*Danaus plexippus*) habitat is assessed by mapping the milkweed (*Asclepias spp.*) patches that have been found in the field at the LFP using Avenza.

Lichen

Lichen field surveys are specific to White-Rimmed Shingle Lichen (*Fuscopannaria leucosticte*) and are conducted using wandering transects within the Eastern White Cedar (*Thuja occidentalis*) stands, scanning for leaning cedar trees (Committee on the Status of Endangered Wildlife in Canada, 2019). Leaning trees are visually scanned from breast height to 4 m up the trunk, as that is the primary habitat for this species (Committee on the Status of Endangered Wildlife in Canada, 2019). Management of such rare organisms requires third-party assistance, which is why photos of lichens are sent to the Nature Trust of New Brunswick as well as the New Brunswick Museum for aid in identification.

Hydrology Sample Design

Preceding the hydrology inventory, a desktop assessment is used to estimate and predict the locations of the streams relative to the Nerepis River, the connecting body of water. Ground truthing and identification of other hydrological features identified using GIS are described in greater detail within the Hydrological Feature Identification/Mapping section. A Canadian Aquatic Biomonitoring Network (CABIN) assessment is completed on the Brittains Creek running along the eastern property border. This provides insight into ecosystem health and function, as well as potential impacts of surrounding land use. Wetland boundaries are delineated and compared with mapped wetlands accessible through the GeoNB data catalogue. Additionally, stream locations across the property are shown in Appendix A Figure 4 and were mapped via ArcGIS Pro software.



Appendix A Figure 4. Map showing the streams located within the LFP in Grand Bay-Westfield. The red lines are the property boundaries, and the green lines indicate streams.

Recreation Sample Design

An inventory of recreational components is completed to assess pre-existing features and potential areas for new structures. Features inventoried include existing trail systems, boat landing accessibility, and potential locations for outdoor classrooms. Methods of inventorying these features are outlined in the Recreational Sample Strategy section of this report. The goal of recreational inventory is to use the data collected to provide structure in the strategic plan regarding recreational opportunities. The Town of Grand Bay-Westfield in collaboration with ERD-NB expressed the importance of creating educational and recreational opportunities that align with the conservation values of the stakeholders, aiming to create an inclusive space for multi-generational users.

Social and Historical Sample Design

The social assessment aspect is conducted with a variety of tools and methods further explained in the sample strategy. Three main areas assessed are: public engagement, stakeholder values and historical inventory. The data collected from these assessments is used to make informed decisions concerning the recreational development and conservation methods proposed in the management plan.

Forest Sample Strategy

Forest inventory consists of four types of plots per plot center: tree plot, sapling plot, regeneration plot, and herbaceous plant plot. All plot inventories are starting north and rotating in a clockwise direction around plot center. One person is holding out a measuring tape/plot cord at plot radius length, one person is holding the tape end at plot center, and one person is recording (this can be the person holding the plot center end). Mark plot center with a stake to easily find later during audit process.

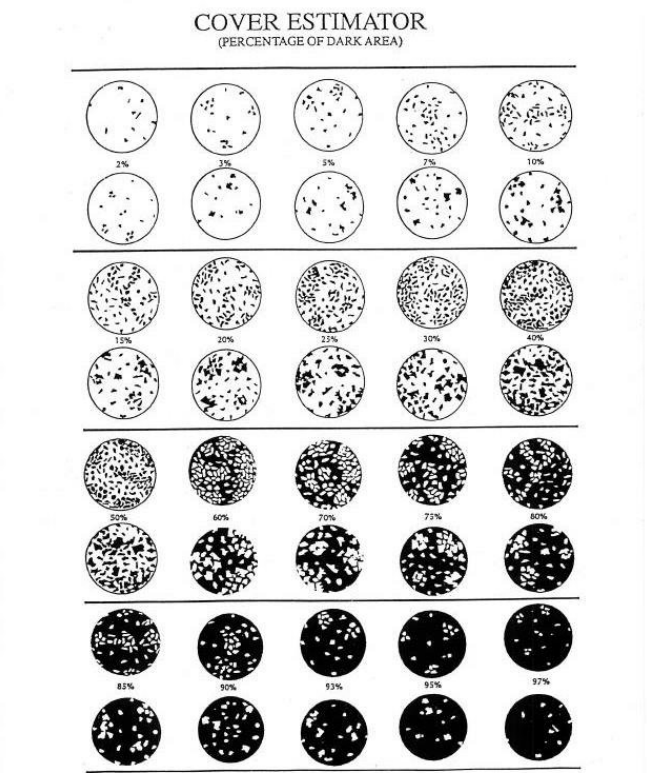
Tree Plot

Record all trees that are within the 7.98-m plot radius with a diameter at breast height (DBH) greater than or equal to 8 cm (Kelley et al., 2021). DBH is the diameter of a tree taken at 1.3 m from the ground. Note tree species (Appendix A Table 6) and DBH of every tree, whether dead or alive, as well as any comments about abnormalities including gash along tree bole, rot, die back of the crown, burls or standing dead tree (snag). The decay class of each snag within the plot is recorded using Appendix A Figure 5 to determine any potential wildlife habitat. Height is measured using a Nikon Forestry Pro hypsometer on the "Vertical Separation" setting. Trees selected for height measurement are the ones that have a basal area factor (BAF) greater than 27 m^2/ha. This is known as the "Big BAF" method using the widest side of an angle gauge. If no trees fall within the Big BAF, then a total of three trees are measured. Measure height of the first DBH tree inventoried, then every third tree until three height trees have been measured. If only one or two trees fall within the Big BAF, then the first DBH tree and every third tree after is measured until three height trees have been measured. If no trees are found within a plot, there will be no height tree data for that plot. The live crown ratio (LCR) of the height trees is measured by recording the height of the lowest live branch. The three height trees are marked with flagging tape to easily re-identify during the audit process. Estimate percent canopy cover,

refer to Appendix A Figure 6 to help with estimation and record the number of cohorts within the plot. If possible, do this using a tree of the same species as age will be easier to assess. Trees of different species have varying growth rates and assessing age differences may be more challenging.

Appendix A Table 11. List of species abbreviations as well as scientific names.

Species Code	Common Name	Scientific Name
AL	Alder	*Alnus spp.*
BA	Black ash	*Fraxinus nigra*
BF	Balsam fir	*Abies balsamea*
BS	Black spruce	*Picea mariana*
BW	Basswood	*Tilia americana*
BE	American beech	*Fagus grandifolia*
CC	Choke cherry	*Prunus virginiana*
EWC	Eastern white cedar	*Thuja occidentalis*
EH	Eastern hemlock	*Tsuga canadensis*
GA	Green ash	*Fraxinus pennsylvanica*
GB	Grey birch	*Betula populifolia*
IW	Ironwood	*Ostrya virginiana*
JP	Jack pine	*Pinus banksiana*
LTA	Largetooth aspen	*Populus grandidentata*
MA	Mountain ash	*Sorbus americana*
MAL	Apple	*Malus spp.*
PC	Pin cherry	*Prunus pensylvanica*
QA	Quaking aspen	*Populus tremuloides*
RM	Red maple	*Acer rubrum*
RO	Red oak	*Quercus rubra*
RP	Red pine	*Pinus resinosa*
RS	Red spruce	*Picea rubens*
SM	Sugar maple	*Acer saccharum*
STM	Striped maple	*Acer pensylvanicum*
TL	Tamarack	*Larix laricina*
WA	White ash	*Fraxinus americana*
WB	White birch	*Betula papyrifera*
WP	White pine	*Pinus strobus*
WS	White spruce	*Picea glauca*
YB	Yellow birch	*Betula alleghaniensis*



Appendix A Figure 5. Percent cover estimator (Meny and Dreitz 2014).

Sapling Plot

Record all trees within 3.99-m plot radius with a height greater than 1.3-m to ensure DBH can be measured. Measure and record species ID and DBH of all trees with a DBH greater than 1-cm and less than 8-cm.

Regeneration Plot

Record tree regeneration within 0.57-meter plot radius that would be classified under 1.3-m in height. Record percentage that the regeneration covers within the 1 m^2 plot. Refer to Appendix A Figure 6 to help determine percent cover.

Herbaceous Plant Plot

Record all herbaceous plants that are within the 0.57-m plot radius. Note the species ID and percentage that the plant species covers within the plot. Refer to Appendix A Figure 6 to help determine percent cover. Herbaceous plants include forbs (flowering plants), ferns, graminoids (grasses, sedges, and rushes), clubmosses, bryophytes, horsetails, and some low woody species; these species will be included in the accepted National Forest Inventory (NFI)

species lists (Canadian Forest Inventory Committee, 2008). Invasive species that are not part of the NFI list are also recorded for monitoring and future management. Rare plants that are not in a plot but noticed either outside the plot or while navigating between plots are recorded along with the coordinates/GPS point.

Wildlife Sample Strategy

The goals for the management of the LFP emphasize the importance of conservation while also creating a space for wilderness education for the Town of Grand Bay-Westfield. To reconcile these two goals and work within seasonal and labour constraints, the wildlife management strategy is centered around detecting habitat for species at risk that are identified as present as well as socially valued species, such as white-tailed deer (*Odocoileus virginianus*). Species at risk are those that are endangered, threatened, and of special concern as defined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and include those species listed by COSEWIC and the New Brunswick Species at Risk Public Registry (Environment and Climate Change Canada, 2023; Department of Natural Resources, n.d.).

Surveying for various mammals, amphibians, and turtles could not be completed due to several significant challenges that hindered the would-be effectiveness of the study. Firstly, the timing of the survey was not ideal. Many mammals, amphibians, arthropods, and reptiles have specific seasonal behaviors that are crucial to their visibility during surveys. For example, many amphibians, including frogs and salamanders, are most active during the spring and early summer months, especially during breeding seasons (Wiens, 1974; Jackson & Ultsch, 2010). Similarly, many mammals, such as certain species of bats are more active during particular times of the year, often during warmer months when they are more likely to emerge from hibernation or to breed (Barclay et al., 2004). Turtles, too, show seasonal patterns, such as nesting during specific periods of the year (Jackson & Ultsch, 2010). Arthropods are difficult to survey as well, as they are most active in the spring. Conducting the survey outside of these peak activity periods (as our project did not commence until September) would result in an incomplete and inaccurate representation of the populations.

In addition to the seasonality factor, there was a lack of adequate surveying capability. The survey methods, including equipment and manpower, were insufficient to properly track and document the various species in question. For example, many amphibians are small, elusive, and

found in specific microhabitats like wetlands or underbrush, requiring specialized tools such as pitfall traps, aquatic surveys, or environmental DNA sampling (Wilkinson, 2015). Turtles can be difficult to locate due to their cryptic nature and their need for specialized habitat-specific searches. Similarly, detecting mammals often requires the use of remote cameras, tracking devices, or acoustic monitoring, which would not have been feasible given the field season constraints on our team. Surveying arthropods also poses unique challenges that require specialized knowledge and equipment to complete effectively, which is outside the scope of this project. To ensure future success, adjustments to both the seasonality of the survey and the survey methods would be critical.

Birds

Five ARUs were placed at randomly chosen points on the property on June 28th, 2024, to record bird vocalizations (Appendix A Figure 2). The batteries of the ARUs ran until August 5th, 2024, except one, which died on July 24th. The ARUs recorded audio for 1 minute every 10 minutes from 30 minutes before sunrise until 30 minutes after sunset.

To determine actual occupancy, data from all five ARUs are analyzed using the *Raven Pro software* and Joe Nocera's PhD Candidate Kirstii Owen.

Mammals

Due to their social value, the only species being assessed that is not at risk is white-tailed deer. Deer yards are determined by cross-referencing forest sample data with typical deer yard vegetation and topography (Telfer, 1970) which is then mapped using GIS.

Monarch Butterflies

Arthropods tend to select habitat on a scale too fine for our dataset to accommodate, with the exception of the Monarch butterfly. Monarch butterfly breeding and feeding grounds are limited to milkweed plants (Environment and Climate Change Canada, 2022). Since there are known patches of milkweed on the LFP, Monarch habitat suitability can be determined by mapping the milkweed patches that have been found in the field at the LFP.

Vascular Plants

If any listed vascular plants are sighted while traversing the property, their location is marked. The immediate surroundings are searched for more of these species, and a survey of the

area is performed, which includes noting habitat features such as forest cover type, drainage, slope position, microtopography, vegetation, and canopy closure. Forest plants such as butternut (*Juglans cinerea*), black ash (*Fraxinus nigra*), and pinedrops (*Pterospera andromedea)* are most likely to be found during forest sampling, however, other herbaceous at-risk plants are found along the river, stream banks, and marsh (Environment and Climate Change Canada, 2022). It should be noted that many of the smaller herbaceous plants are less likely to be seen given that the survey period is not taking place in the spring.

Lichen

Lichen surveys to determine presence are performed exclusively for white-rimmed shingle lichen because it has very specific habitat requirements that are easily verifiable using a wandering transect in eastern white cedar bogs (Committee on the Status of Endangered Wildlife in Canada, 2019). Leaning eastern white cedar is the primary habitat for this species, of which there are several stands on the property (Committee on the Status of Endangered Wildlife in Canada, 2019). All other rare lichens in New Brunswci are comparatively generalist (Environment and Climate Change Canada, 2022) and, thus, cannot be searched for specifically within the project timeline. For these remaining lichens, a habitat assessment is performed using forest and vegetation data that is accumulated from the sample plots noted in Appendix A Figure 1.

Wildlife Habitat Modelling

Modelling habitat involves researching a species' critical habitat requirements (for example, breeding habitat for migratory birds) using the COSEWIC and SARA definitions and then mapping those attributes on the LFP using ArcGIS Pro, the forest survey dataset, and LiDAR data. Each habitat attribute is weighted based on its significance and then scaled so that each forest segment can be given a suitability value for that attribute.

Stand level forest attributes are derived from the output of the PICUS model and linked to individual stand shapefiles within ArcGIS Pro. This allows for the spatial representation of forest attributes to include in the species' habitat suitability model. Weighted variables are rasterized and summed, assigning a value to each 10m-by-10m cell. High values indicate high suitability.

Birds

Of the bird species listed as present and likely present in Table X, breeding habitats for forest-nesting species likely to be nesting on the property are modelled. These species include the Canada warbler, Eastern wood-peewee, evening grosbeak, and wood thrush. The other species in Table 3 are not assessed since critical nesting habitat is either not present on the property or the forest database does not include the necessary features to determine habitat quality with enough certainty.

Mammals

The only mammal on the list of potential occupants with habitat qualities capable of being accurately mapped using data gathered for this project are white-tailed deer. Variables included in the deer suitability model are tree species composition, percent canopy cover, and distance from roads. Cells are given value from 1 to 45, with 1 representing the lowest suitability and 45 the highest.

Hydrology Sample Strategy

Hydrological Feature Identification/Mapping

To provide more accurate data to inform the recommendation of trail locations or to identify sensitive areas, ground truthing is performed to verify the presence of the streams mapped through ArcGIS Pro (Appendix A Figure 8). A walk around the property boundary is performed in such a manner that each outflow point (Appendix A Figure 8 - blue circle as example) is crossed. If a stream is present, it is followed up until no longer visible, at which point GPS coordinates are recorded for modification of the stream map. Otherwise, the walk continues until the next stream is encountered.



Appendix A Figure 6. Partial map showing streams created with ArcGIS Pro (green), the property boundary (red) and an outflow (blue).

Standing bodies of water, potential wetlands, and potential vernal pools are identified by visual assessment as crews are walking to forest inventory plot locations. The perimeters of any standing bodies of water or vernal pools will be tracked by GPS. As vernal pools are typically dry in the late summer and fall, they are identified by the presence of depressions containing the following indicators: water-stained, decomposing leaves and debris; trees with buttressed trunks; tree trunks with stains marking high water levels; and wetland plants growing in dry soil (Appendix A Figure 9).



Appendix A Figure 7. A dry vernal pool displaying water-stained, decomposing leaves and debris.

Wetland Delineation

The northern boundary of the mapped wetland on the property found on the GeoNB website is confirmed by the completion of a wetland delineation following the protocol outlined by the DELG (2021), and any newfound wetlands will be delineated and mapped. The boundary of the mapped wetland is confirmed starting from the westernmost point of the wetland and moving east to the property boundary or until no wetland is present.

CABIN Assessment

A CABIN stream assessment is conducted along Brittains Creek because it is one of the main sources of water that borders the property. A representative sampling reach is selected onsite the day of the assessment as per Environment Canada's CABIN Field Manual (Environment Canada, 2012). A riffle habitat is selected for a 3-minute kick sampling effort using a standardized 400µm mesh net. All data sections within the field sheet (Appendix D Figure 1 - Appendix D Figure 8) are filled out and a family-level macroinvertebrate classification is completed in the field.

Recreational Sample Strategy

Trail System

Existing trail systems are identified on foot on the entirety of the LFP using visual assessments to locate trail entrances and complete the trail's alignment (location, layout configuration and length) dataset (Wei-Ning Xiang, 1996). Avenza maps is used via tablet while walking trail systems to capture trail alignment and map in real time. While walking through the trail system, a trail risk assessment (Appendix A Table 9) is conducted. This assessment is semi-derived from U.S Forest Service, Department of Agriculture's Trail Assessment and Condition Survey (TRACS) user guide (U.S Forest Service, 2011) and Trail Environment Screening Tool (TEST), developed by the Shuswap Trail Alliance for Recreation Sites and Trails BC (Shuswap Trail Alliance for Recreation Sites and Trails BC, 2020).

Appendix A Table 22. Trail assessment document derived from the Trail Environment Screening Tool (TEST), developed by the Shuswap Trail Alliance for Recreation Sites and Trails BC. (Shuswap Trail Alliance for Recreation Sites and Trails BC, 2020). Additional supporting information supported by U.S Forest Service, Department of Agriculture's Trail Assessment and Condition Survey (TRACS) user guide (U.S Forest Service, 2011). One document is completed per mapped trail.

Trailhead coordinates:			Trail end coordinates:			
Trail Length (kms):						
Trail Use:	Foot (kms):		Cycling (kms):		Other (kms):	

Average Trail width:	>10 ft	<10ft	Average trail clearance:	>8ft	<8ft
Primary Use:	Winter	Spring	Summer	Fall	All
Elevation Range:		Min:		Max:	
Average grade:	Flat (avg slope >2%)	Gentle (Avg slope 2-5%)	Moderate (avg slope 5-10%)	Steep (avg slope 10-15%)	Very Steep (<15%)
Gound Evenness:	Hillsides	Steep Hill	Hills	Gentle Hills	No Hills
Terraine:	Rocky	Marsh	Forest	Field/meadow	Other:
Tail Obstacles	Protruding roots	Vining ground cover	Matted grass/ field	Water crossing	Other:
Sensitive Wildlife Habitat within 30m of trail:	Stream bank	Milkweed	Marsh	Cedar stand	Nesting tree/ snag	Other:
Comments:					

Data collected via Avenza are used to provide insight into the interconnectedness of trail shed and accessibility. The data collected is mapped with the entire trail network and with pinpointed areas with risk factors. After the existing trail network is established, the remaining amount of trail to meet the 5-km trail system goal is purposed in the management plan section. The importance of creating maps of existing and potential trail systems supports the clients' strategic plan goals of having accessible outdoor recreation areas. Mapping allows for the creation of map plaques placed on the LFP for public information and maps also help the recreation department in pinpointing areas that need maintenance before launching trail system to public.

Boat Landing

The LFP has a boat landing accessible to the general public that is actively used. Maintaining what is already in place is all that is necessary currently with the addition of signage that reminds the public of local rules and regulations surrounding recreational boating and promoting the use of non-motorized boats. ERD-NB does not have exclusive rights to the waterbody and therefore cannot explicitly limit the use of motorized boats on the waterway, however, the use of alternative boating activities can be promoted.

Risk associated with the boat launch at the LFP is associated with misuse of the infrastructure by way of littering and vandalism. The associated pollution of the watershed when

loading and unloading boats is of concern but not explicitly manageable at this time given the shared rights between ERD-NB and Ducks Unlimited who hold the title of the neighboring property to the north-west.

Outdoor Classroom

Areas for outdoor classroom infrastructure are only considered in the previously managed areas, including retired farm fields, building slabs, and cleared field areas. These cleared and semi-cleared areas are classified as non-forested (NF) areas (Appendix A Figure 1). Areas of environmental value or essential for species at risk are not considered for infrastructure development. Non-forested areas are assessed, and GPS pinned where site features are suitable for future infrastructure; a firm, flat, dry site will reduce the need for large machinery and equipment that can easily cause ecological harm. A risk assessment is conducted on non-forested features to assess areas that are unsuitable for public engagement or infrastructure implementation. Risks include, but are not limited to, floodplain areas, presence of uneven ground, soft ground (susceptible to rutting) or within 30-m of OECM areas. Areas considered for outdoor classrooms are not finalized until OECM areas are identified in the forest inventory to ensure that recreational areas do not encroach on environmentally significant areas.

Social and Historical Sample Strategy

Public Engagement

Public engagement, in accordance with the client's desire, aims to incorporate social and historical values into the management plan. The Town of Grand Bay-Westfield performed a field survey (Bhattacherjee, 2012) to better understand the public's interest in recreational opportunities that the LFP may offer. The sampling process aims to focus on the public that is already engaged with the land on the LFP, the survey is made accessible by scanning a QR code. The QR code is installed at the entrance to Lonewater near the yellow gate and another on the entrance to the road leading to the boat launch. This QR code was originally made accessible solely on the property to assess how many people use the land; however, this survey was shared on Grand Bay-Westfield's Facebook page, which may bias the results. The survey being offered exclusively via QR code could also bias the results as not everyone has access to a mobile phone or internet. The survey opened on July 25th, 2024, and concluded October 31st, 2024. Questions within the survey include:

- How often do you visit Lonewater Farm?
    - First time
    - Once a year
    - Several times a year
    - Monthly
    - Weekly
- What is your primary reason for visiting today? (Select all that apply)
    - ATV
    - Bird Watching
    - Fishing
    - Hiking/ Walking
    - Kayaking/ Canoeing
    - Photography
    - Picnicking
    - Other
- Please indicate the facilities you would like to see Lonewater Farm develop (Select all that apply).
    - Biking Trails
    - Boat Launch (hand and motorized)
    - Education/ Visitor Centre
    - Non-motorized trails and pathways
    - Observation Decks
    - Picnic Areas
    - Playgrounds
    - None
    - Other
- Please indicate the type of programming you may be interested in (Select all that apply).
    - Children's Activities
    - Educational Workshops
    - Fitness/ Exercise
    - Guided Nature Walks

    - None
    - Others
- How knowledgeable do you feel about the local wildlife and plant species in Lonewater Farm?
    - Very Knowledgeable
    - Knowledgeable
    - Somewhat Knowledgeable
    - Not Knowledgeable
- Age
    - Under 18
    - 18-24
    - 25-44
    - 45-64
    - 65+
- Gender
    - Male
    - Female
    - Non-Binary
    - Prefer not to say
- Postal Code

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Survey results are submitted for analysis by Rick Adams, the Recreation Programs Coordinator for the Town of Grand Bay-Westfield. The data collected from the field survey is qualitative and quantitative in nature, meaning the analysis of the data consists of identifying themes, patterns and relationships of the responses, as well as creating histograms to display data. This data is used to influence the management plan for the prospected recreation areas on the LFP.

The goal of this field survey is to ensure the public feels engaged in project development. Positive community engagement is essential in maintaining positive perceptions of the project and boost community cooperation. This is essential to achieve the LFP's goal of creating

recreational and educational opportunities for the residents of Grand Bay-Westfield and surrounding communities.

The client has expressed a desire to continue public engagement following forest inventory to further assess public interest in future recreational and educational opportunities. Recommendations for further survey and engagement methods are included in the Recommendations and Operations section of this report.

Stakeholder and Rightsholder Engagement

Meetings with stakeholders take place in person or via Microsoft Teams to discuss stakeholder values, and address questions and concerns with conservation and recreational development of the LFP. Understanding stakeholder values is crucial to ensure management plans align with the goals of associated conservation and recreational groups. The goal of meeting with stakeholders is relationship building as this is part of creating a strategic plan to collaborate with stakeholders and potential partner organizations.

Meetings consist of semi-structured interviews with one or more representatives from each stakeholder group. The groups interviewed are:

- Natural Resources and Energy Development (ERD-NB)
- Grand Bay-Westfield Recreation Department
- Ducks Unlimited
- Nature Trust NB
- Nature Conservancy of Canada (NCC)
- ACAP Saint John

Rightsholder group interviewed are:

- Wolastoqey Nation New Brunswick (WNNB)

The semi-structured interview gathers qualitative data with a set of seven unbiased, non-leading questions:

1. What are your associations values and or mission?
2. In what ways do you see this project impacting your associations values or mission?
3. What are your association's opinions on conserved and protected areas?
4. What do you think the impacts of implementing recreational infrastructure will have on your association's values or mission?
5. How would you define the success of this project?
6. Are there challenges that might prevent the success of the project?
7. Are there resources that currently exist, that your association would be willing to share?

The data gathered from the stakeholder and rightsholder interviews are qualitative. The analysis will focus on identifying themes, patterns, and relationships within the responses. This information is used to ensure stakeholder values are considered in management planning.

To assess if client values align with the given interviewed organizations, we will cross reference the interviews questions to determine partnership suitability. Once this is established a resource list will be compiled to determine what project benefits are associated with each individual partnership such as volunteer opportunities, tree planting, nest boxes, and event collaboration. Refer to Appendix A Table 10.

Appendix A Table 33. Stakeholder interview table showing alignment between the partner and the client's values.

Client Values	**Partnerships**				
	Town of Grand Bay-Westfield	ACAP Saint John	Ducks Unlimited	Nature Conservancy of Canada	Nature Trust New Brunswick
Land Conservation and Protection	✓	✓	✓	✓	✓
Low-Impact Outdoor Recreation	✓	✓	✓	✓	✓
Environmental Education	✓	✓	✓	✓	✓
Reducing Motorized Recreation	✓	✓	×	✓	✓

Appendix A Table 4. Potential partnership organizations with resources that could be shared between the client and conservation groups in partnered land management.

Organization	Resources Sharing Opportunities
ACAP Saint John	Tree Planting
	Water quality monitoring
	Green infrastructure funding
	Dump removal
	Educational outreach
	Restoration
Ducks Unlimited	Inspections on site
	Water level and flows
	Signage and youth education
	Wetland field trips
Nature Conservancy of Canada	Restoration
	Trails Development
	Invasive species management
	Habitat monitoring
	Sharing habitat and species data
Nature Trust	Educational Advice
	Invasive species removal

Historical Inventory

Data is collected to create a history profile of the LFP in accordance with the project requirements such as identifying historical values and previous land uses. A variety of information is collected to have complete work of history, including:

- Demographic
- Past land use
    - Agricultural history
    - Past harvesting operations
    - Landowners
- Disturbance regime

    - Frequency
- Cultural uses
    - Indigenous history
    - Settlement history

The data collected ~~is~~ are sourced from public documents and resources such as:

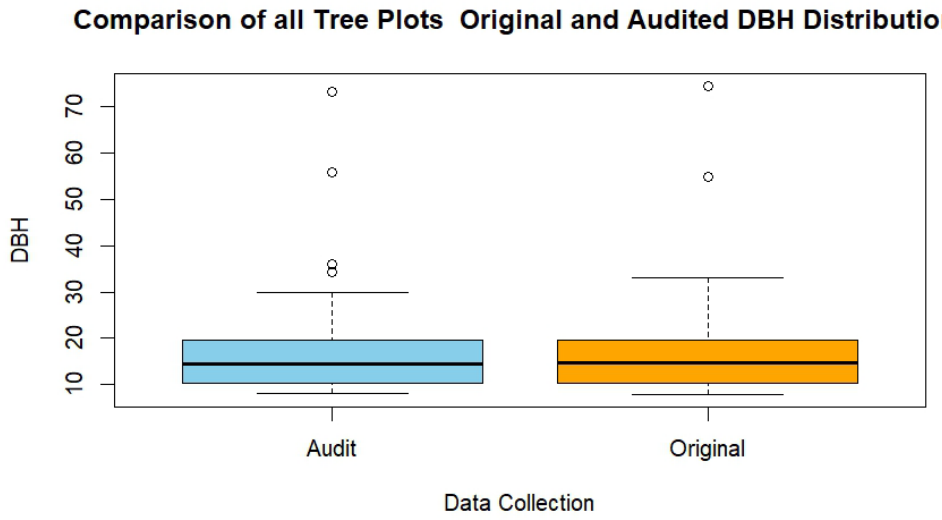
- Provincial archives
- DNR aerial photos
- Local historian Ray Riddell
- Provincial census

A characterization of the local demographic around the site is conducted to give context to the area and its surroundings, using provincial census data. Past land uses are assessed with a combination of historical aerial photos to visualize disturbances throughout the years. Provincial archives focusing on any documentation on historical weather events in the area are used to determine disturbance regime and frequency. Cultural uses are determined via provincial archives and contact with the local historian, Ray Riddell. Amalgamating this data completes a clear and concise historical makeup to support project goals.

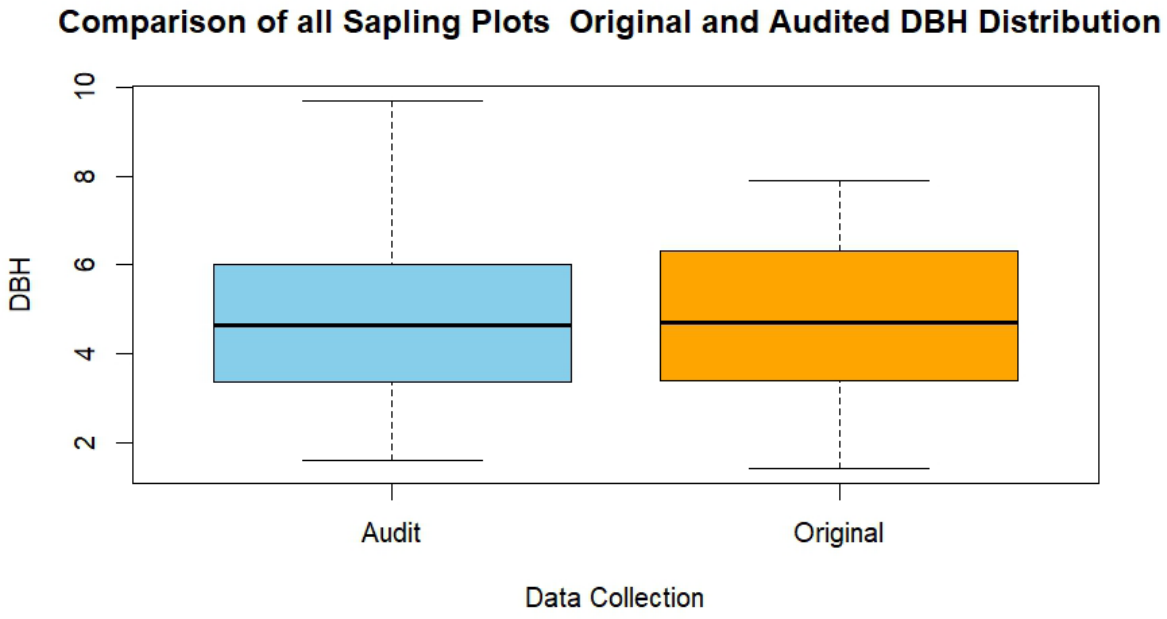
Appendix B – Results

Forest Audit Data

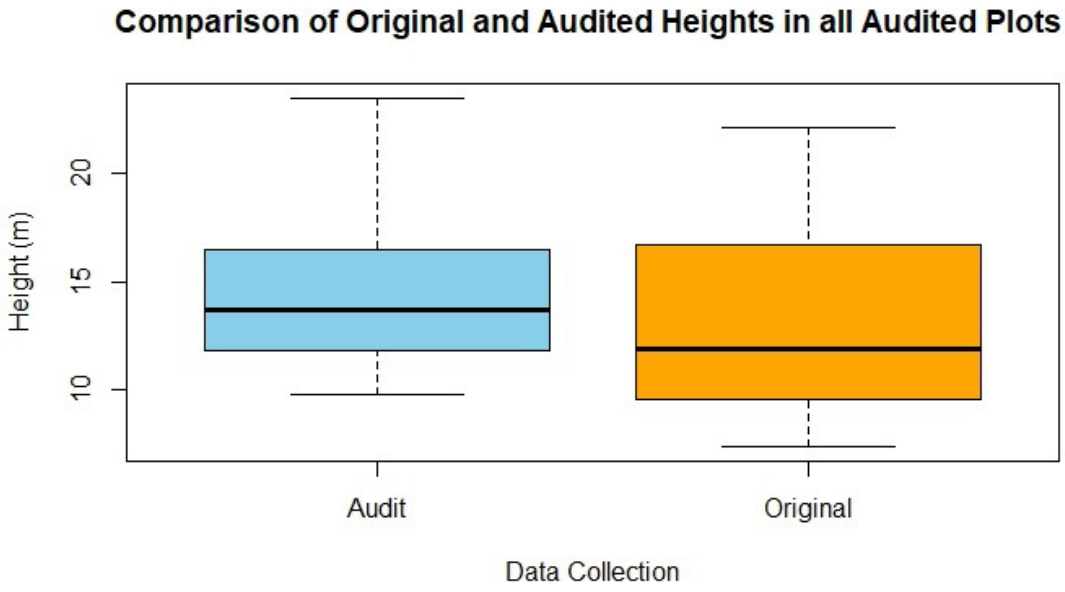
The results from the Welch Two Sample T-test for DBH and Paired Two Sample T-test height are seen in the graphs below. A p-value of 0.9416 indicates that there is no statistically significant difference between original inventory and audit.



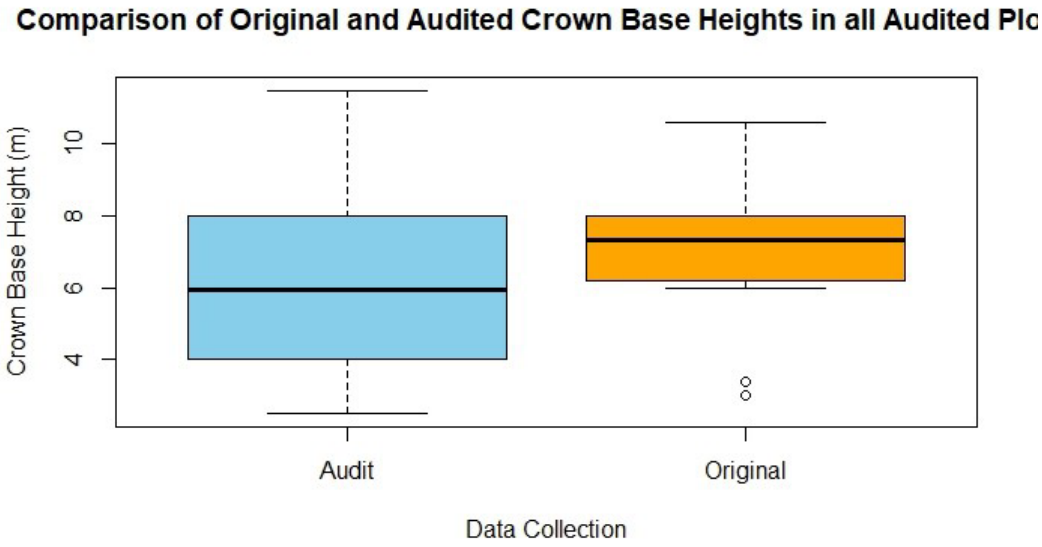
Appendix B Figure 1. Statistical analysis of tree DBH measurements for the LFP forest inventory. ~~A p-value of 0.9416 indicates that there is no statistically significant difference between original inventory and audit.~~



Appendix B Figure 2. Statistical analysis of sapling DBH measurements for the LFP forest inventory. A p-value of 0.9423 indicates that there is no statistically significant difference between original inventory and audit.



Appendix B Figure 3. Statistical analysis of tree height measurements for the LFP forest inventory. A p-value of 0.01131 indicates that there is statistically significant difference between original inventory and audit.



Appendix B Figure 4. Statistical analysis of tree crown base height measurements for the LFP forest inventory. A p-value of 0.2405 indicates that there is no statistically significant difference between original inventory and audit.

Grand Bay-Westfield User Survey

Appendix B Table 1. 149 responses were recorded via an online survey conducted by the Grand Bay-Westfield Recreation Department from July 25th, 2024, to October 31st, 2024.

How often do you visit Lonewater Farm?		
	Percent	**Entries**
First time	11%	17
Weekly	30%	45
Monthly	15%	22
Several times a year	37%	55
Once a year	7%	10

Appendix B Table 2. 363 responses recorded via online survey conducted by the Grand Bay-Westfield Recreation Department from July 25th, 2024, to October 31st, 2024. Some activities listed under the "other" category include hunting waterfowl, picnicking, historical values, running their dogs and watching the sunset.

What is your primary reason for visiting today? (select all that apply).		
	Percent	**Entries**
Bird Watching	10%	37
Photography	13%	49
Fishing	17%	61
Other	17%	62
Kayaking/Canoeing	18%	66
Hiking/Walking	24%	88

Appendix B Table 3. Online survey conducted by the Grand Bay-Westfield Recreation Department from July 25th, 2024, to October 31st, 2024. Some other mentions for facilities that participants were interested in included observation decks, playgrounds, biking trails, an education center, and garbage disposal areas.

Please indicate the facilities you would like to see Lonewater Farm develop (Select all that apply).		
	Percent	**Entries**
Boat Launch (hand and motorized)	11%	48
Biking Trails	11%	48
Observation Decks	15%	65
Picnic Areas	16%	68
Non-motorized trails and pathways	19%	82
Other Entries	27%	117

Appendix B Table 4. 240 responses recorded via an online survey conducted by the Grand Bay-Westfield Recreation Department from July 25th, 2024, to October 31st, 2024.

Please indicate the type of programming you may be interested in (Select all that apply).		
	Percent	**Entries**
Other	1%	4
Children's Activities	13%	30
Educational Workshops	16%	38
Fitness/Exercise	21%	50
Guided Nature Walks	21%	51
None	28%	67

Appendix B Table 5. 149 responses recorded via online survey conducted by the Grand Bay-Westfield Recreation Department from July 25th, 2024, to October 31st, 2024.

How knowledgeable do you feel about the local wildlife and plant species in Lonewater Farm?		
	Percent	**Entries**
Not Knowledgeable	23%	34
Knowledgeable	28%	42
Somewhat Knowledgeable	36%	54
Very Knowledgeable	13%	19

Appendix B Table 6. 149 responses recorded via online survey conducted by the Grand Bay-Westfield Recreation Department from July 25th, 2024, to October 31st, 2024.

Age		
	Percent	**Entries**
Under 18	3%	4
18-24	5%	8
25-44	44%	65
45-64	38%	57
65+	10%	15

Appendix B Table 7. 149 responses recorded via online survey conducted by the Grand Bay-Westfield Recreation Department from July 25th, 2024, to October 31st, 2024.

Gender		
	Percent	**Entries**
Male	50%	75
Female	47%	70
Non-Binary	1%	2
Prefer Not To Say	1%	2

Grand Bay-Westfield Demographics

Appendix B Table 8. The population density data of Grand Bay-Westfield retrieved from Statistics Canada (2023).

Population		
	Count	**Percent**
Population	4,967	
Population density per square Kilometer	83	
Age		
	Count	**Percent**
0-19	1,120	23%
20-39	1,010	20%
40-64	1,830	37%
65+	1,007	20%
Average Age	43.2	
Median Age	45.2	
Household		
Total private households	1,965	
2 or less people per household	1,190	60%
3 or more people per household	770	40%
Average household size	2.5	
Total households with children	845	43%
Average family size	2.8	
Indigenous Population		
Total survey size:	4,955	
	Count	**Percent**
Indigenous identity	95	2%
First Nations (North American Indian)	60	1%
Métis	40	1%
Non-Indigenous identity	4,860	98%
Registered or Treaty Indian	35	1%
Citizenship		
Total survey size:	4,920	
	Count	**Percent**
Canadian citizens		
Not Canadian citizens	35	0.7%
Minority population		
Total survey size:	4,995	
	Count	**Percent**
Total visible minority population	50	1.0%
Chinese	15	0.3%
Black	20	0.4%

Appendix B Table 9. Religion data collected from Grand Bay-Westfield in a 2021 survey. People surveyed were able to choose more than one Religion to self-identify as (reason for percentages equaling more than 100%).

Religion		
Total survey size:	4,955	
	Count	**Percent**
Buddhist	15	0%
Christian	3,500	70%
Anglican	475	10%
Baptist	455	9%
Catholic	1,490	30%
Jehovah's Witness	65	1%
Latter Day Saints	30	1%
Methodist and Wesleyan (Holiness)	15	0%
Pentecostal and other Charismatic	40	1%
Presbyterian	40	1%
United Church	375	8%
Other Christian and Christian-related traditions	95	2%
Other religions and spiritual traditions	25	1%
No religion and secular perspectives	1,615	33%

Appendix B Table 10. Data collected on education level and employment rate in Grand Bay-Westfield in 2021 from a survey.

Education		
Total survey size:	3,847	
		Percent
No certificate, diploma or degree		12%
High School certificate or equivalent		88%
Apprenticeship or trades certificate		58%
College or other non-university diploma		48%
University certificate or below bachelor		22%
Bachelor's degree		21%
Above bachelor's degree		5%
Employment rate		
Total survey size:	4,150	
	Count	**Percent**
Employed	2,465	60%
Unemployed	165	4%
Not in the labor force	1,515	36%
Employment rate		59%
Unemployment rate		6%
Income		
Average employment income in 2020 full time	$74,100.00	
Average employment income in 2020 part time	$29,650.00	

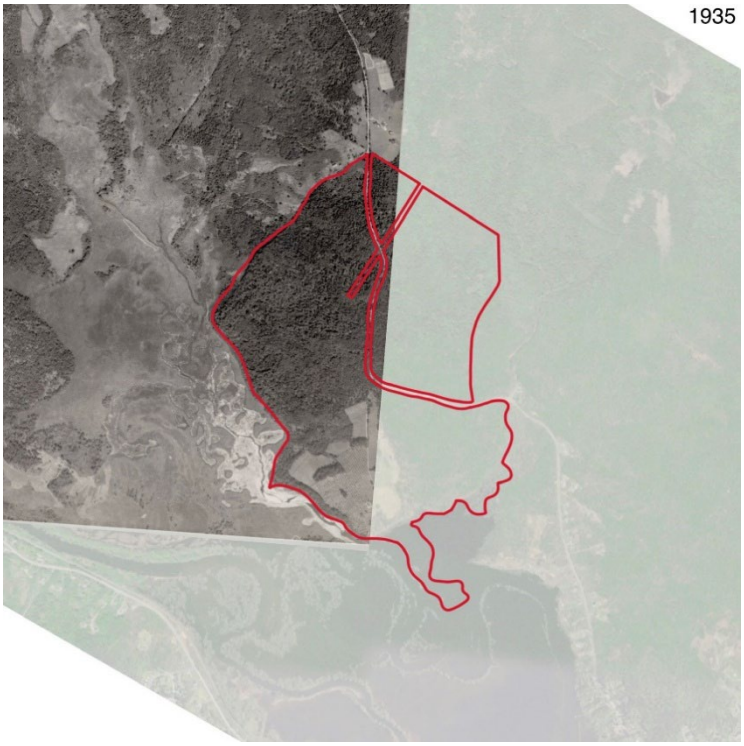
Appendix B Table 11. Commuting information collected from 2015 people in Grand Bay-Westfield in 2021 from a survey.

Commuting		
Total survey size	2,015	
	Count	**Percent**
Car, truck or van	1,965	98%
Walked	15	1%
Bicycle	0	0%
Other method	35	1%
Commuting Duration		
Total survey size	2025	
	Count	**Percent**
Less than 15 minutes	380	19%
15 to 29 minutes	1,120	55%
30 to 44 minutes	350	17%
45 to 59 minutes	115	6%
60 minutes and over	60	3%

Appendix B Table 12. Crime information was collected in November 2024 from the RCMP New Brunswick occurrences web page that is updated daily.

Crime		
	Count	**Percent**
Occurrences reported in Grand Bay-Westfield to date in 2024	1,312	
Assault	16	1%
Break and enter	8	1%
Drug offence	2	0%
Fraud	22	2%
Mental Health Act	31	2%
Robbery and extortion	0	0%
Theft of motor vehicle	8	1%
Theft of over $5,000	1	0%
All other occurrences	1,224	93%

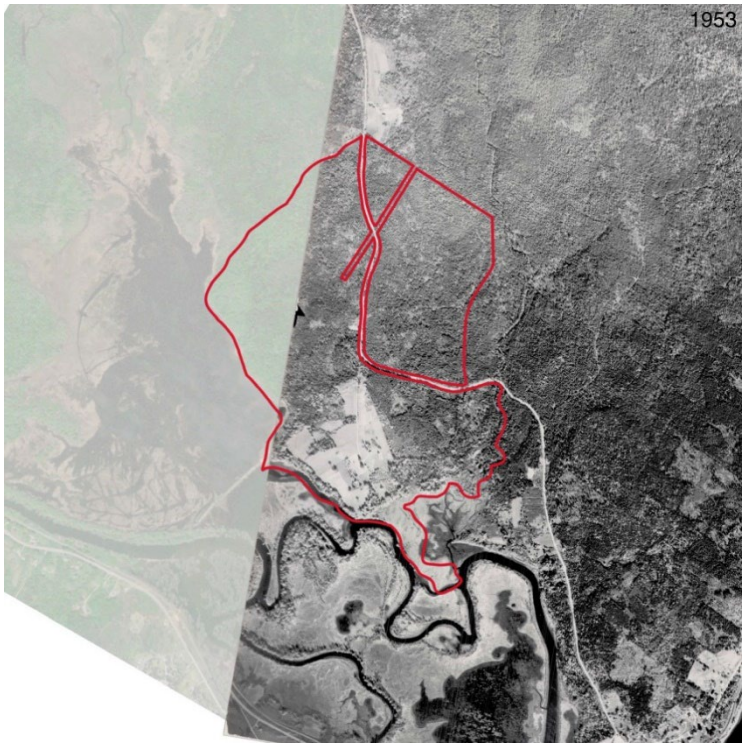
Appendix C - Historical Photos



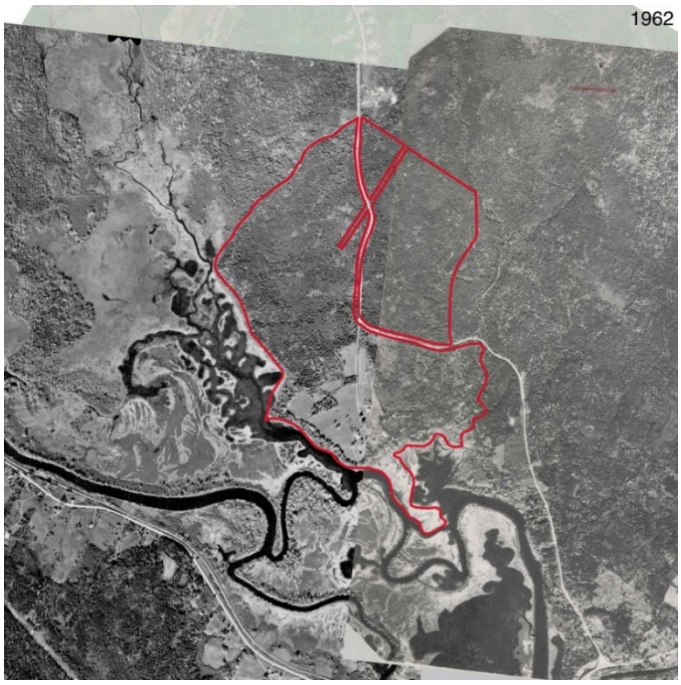
Appendix C Figure 1. Aerial photo supplied by the Department of Natural Resources New Brunswick. Photo captured in 1935, of the LFP, overlayed on top of base map. Red outline represents property line as of 2024.



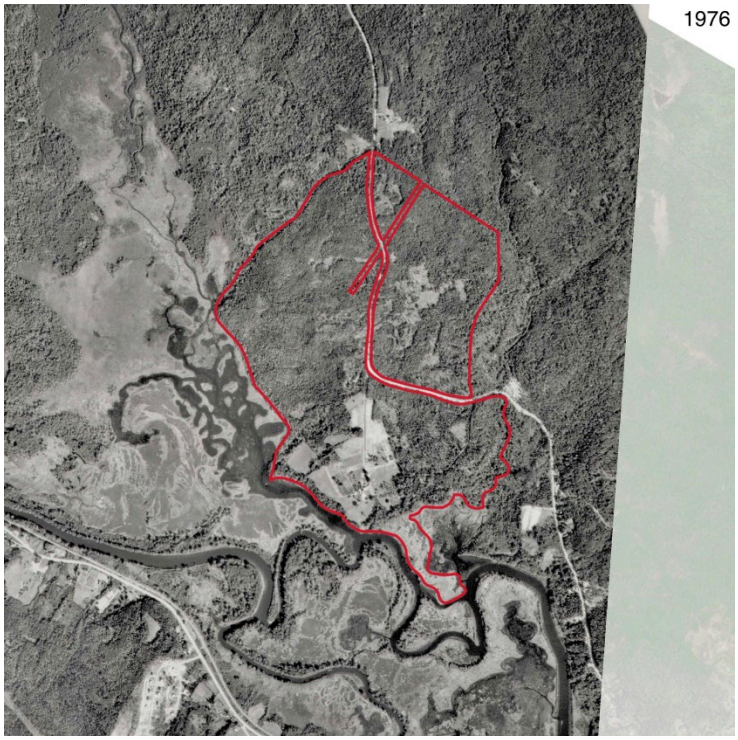
Appendix C Figure 2. Aerial photo supplied by the Department of Natural Resources New Brunswick. Photo captured in 1945, of the LFP, overlayed on top of base map. Red outline represents property line as of 2024.



Appendix C Figure 3. Aerial photo supplied by the Department of Natural Resources New Brunswick. Photo captured in 1953, of the LFP, overlayed on top of base map. Red outline represents property line as of 2024.



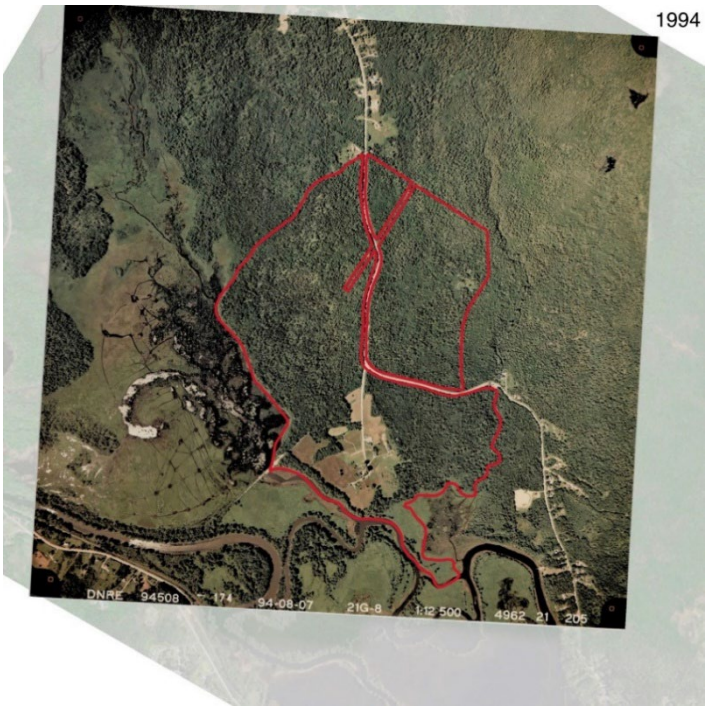
Appendix C Figure 4. Aerial photo supplied by the Department of Natural Resources New Brunswick. Photo captured in 1962, of the LFP, overlayed on top of base map. Red outline represents property line as of 2024.



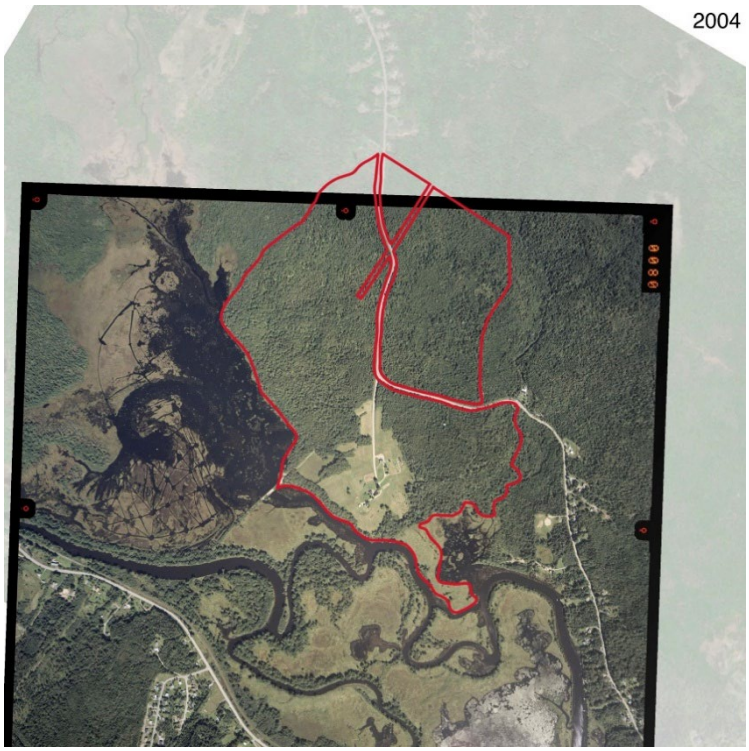
Appendix C Figure 5. Aerial photo supplied by the Department of Natural Resources New Brunswick. Photo captured in 1976, of the LFP, overlayed on top of base map. Red outline represents property line as of 2024.



Appendix C Figure 6. Aerial photo supplied by the Department of Natural Resources New Brunswick. Photo captured in 1984, of the LFP, overlayed on top of base map. Red outline represents property line as of 2024.



Appendix C Figure 7. Aerial photo supplied by the Department of Natural Resources New Brunswick. Photo captured in 1994, of the LFP, overlayed on top of base map. Red outline represents property line as of 2024.



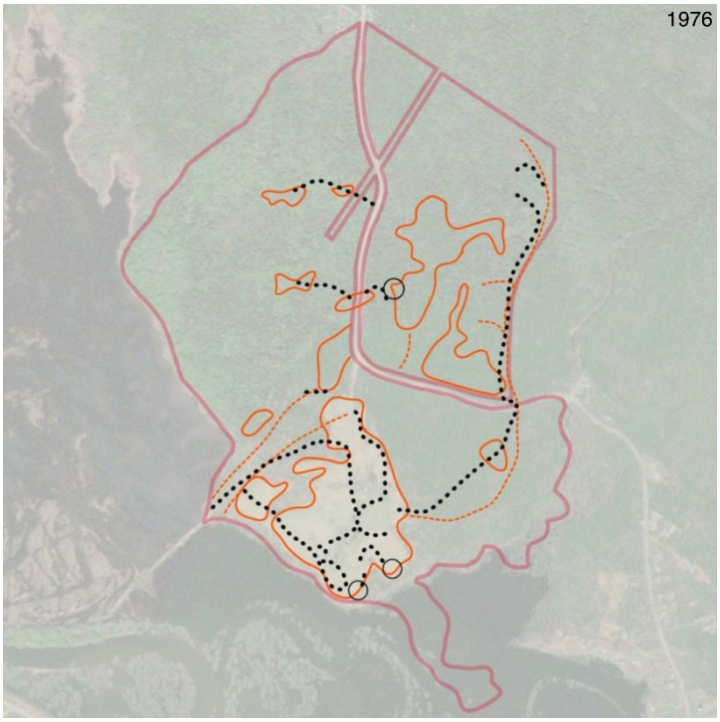
Appendix C Figure 8. Aerial photo supplied by the Department of Natural Resources New Brunswick. Photo captured in 2004, of the LFP, overlayed on top of base map. Red outline represents property line as of 2024.



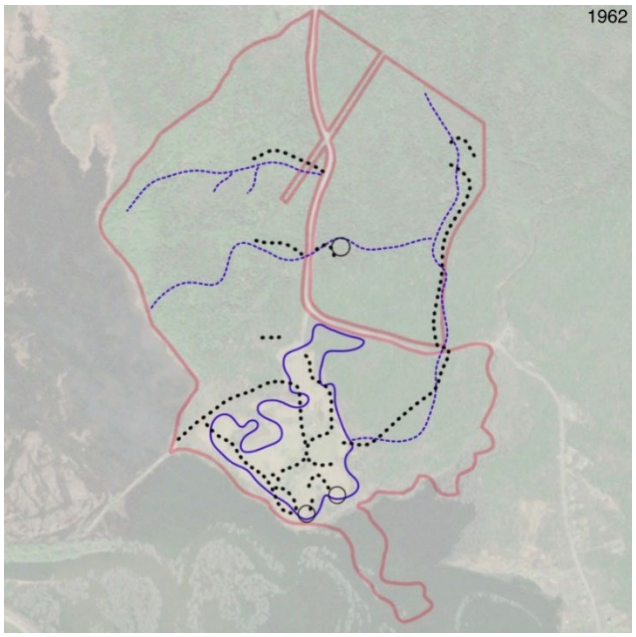
Appendix C Figure 9. Aerial photo captured from Google Earth. Photo captured in 2015, of the LFP. Red outline represents property line as of 2024. (Google Earth 7.3: 10.67.0.5. 2015).



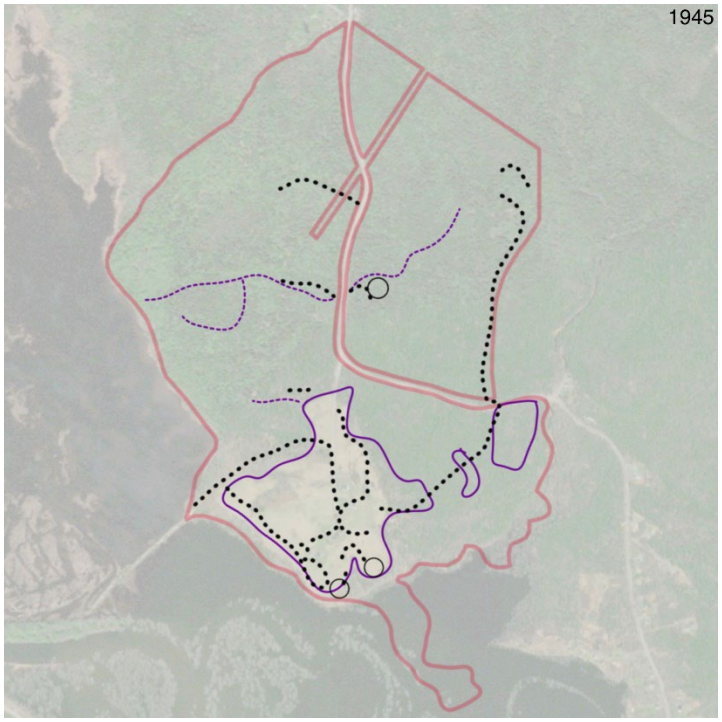
Appendix C Figure 10. Aerial photo captured from Google Earth. Photo captured in 2023, of the LFP. Red outline represents property line as of 2024. (Google Earth 7.3: 10.67.0.5. 2023).



Appendix C Figure 11. Basemap of the LFP from Google Earth captured in 2023 (Google Earth 7.3: 10.67.0.5. 2023). Red outline represents property line as of 2024. Black dotted lines represent trails mapped by 4020 team in October 2024, black circles represent known dumpsites with the LFP. Orange coloured lines represent areas of interest from 1976 that overlap with findings from 2024. Orange dotted lines indicate trails and orange shapes indicate disturbed and managed areas identified in aerial photos from 1976.



Appendix C Figure 12. Basemap of the LFP from Google Earth captured in 2023 (Google Earth 7.3: 10.67.0.5. 2023). Red outline represents property line as of 2024. Black dotted lines represent trails mapped by 4020 team in October 2024, black circles represent known dumpsites with the LFP. Blue coloured lines represent areas of interest from 1962 that overlap with findings from 2024. Blue dotted lines indicate trails, and blue shapes indicate disturbed and managed areas identified in aerial photos from 1962.

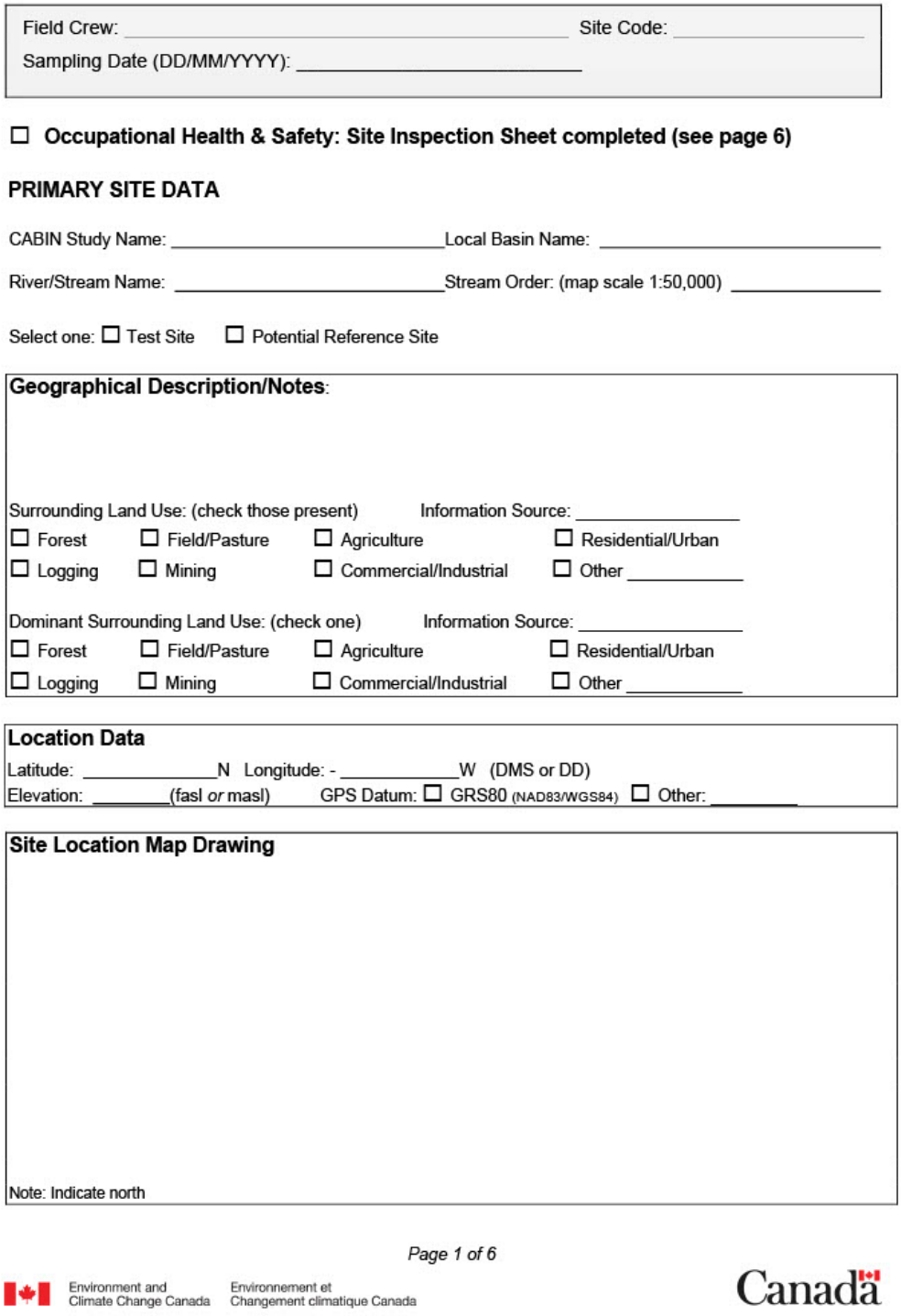


Appendix C Figure 13. Basemap of the LFP from Google Earth captured in 2023 (Google Earth 7.3: 10.67.0.5. 2023). Red outline represents property line as of 2024. Black dotted lines represent trails mapped by the 4020 team in October 2024, black circles represent known dumpsites with the LFP. Purple coloured lines represent areas of interest from 1945 that overlap with findings from 2024. Purple dotted lines indicate trails and purple shapes indicate disturbed and managed areas identified in aerial photos from 1945.

Appendix D – Materials & Data Sheets

Appendix D Table 1. Equipment list required for field inventory.

Tool	**Count**	**Sample category**
Diameter tape	3	Forest
Angle gauge	3	Forest
Hypsometer (Nikon Forestry Pro)	1	Forest
Clinometer	3	Forest
Plant ID tools (books, manuals, phones etc.)	As many as needed	Forest
Field sheets	As many as needed	Forest, Water
Plot center stakes	All	Forest
Laminated site classification guides	3	Forest
Flagging tape	As many as needed	Forest, Wildlife, Water
Garmin GPS	2	Forest, Wildlife, Water
Trail cameras	As many as needed	Wildlife
YSI meter	1	Water
Drift nets	2	Water
Meter stick	1	Water
Munsell soil color chart	1	Water
Shovel	1	Other
Field magnifier	1	Other



Field Crew: _____ Site Code: _____

Sampling Date (DD/MM/YYYY): _____

☐ **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: _____ Local Basin Name: _____

River/Stream Name: _____ Stream Order: (map scale 1:50,000) _____

Select one: ☐ Test Site ☐ Potential Reference Site

Geographical Description/Notes:

Surrounding Land Use: (check those present) Information Source: _____

☐ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Dominant Surrounding Land Use: (check one) Information Source: _____

☐ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: _____N Longitude: - _____W (DMS or DD)

Elevation: _____(fasl *or* masl) GPS Datum: ☐ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing

Note: Indicate north

Page 1 of 6

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Appendix D Figure 1. Page 1 of 6, CABIN Wadeable Streams Field Manual (Environment Canada 2012).

Field Crew: _____ Site Code: _____

Sampling Date (DD/MM/YYYY): _____

Photos

☐ Field Sheet ☐ Upstream ☐ Downstream ☐ Across Site ☐ Aerial View

☐ Substrate (exposed) ☐ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
   ☐ Riffle ☐ Rapids ☐ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
   ☐ 0 % ☐ 1-25 % ☐ 26-50 % ☐ 51-75 % ☐ 76-100 %

3. Macrophyte Coverage: *(not algae or moss, check one)*
   ☐ 0 % ☐ 1-25 % ☐ 26-50 % ☐ 51-75 % ☐ 76-100 %

4. Streamside Vegetation: (*check those present)*
   ☐ ferns/grasses ☐ shrubs ☐ deciduous trees ☐ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*
   ☐ ferns/grasses ☐ shrubs ☐ deciduous trees ☐ coniferous trees

6. Periphyton Coverage on Substrate: *(benthic algae, not moss, check one*)

   ☐ **1** - Thin layer, no obvious colour (< 0.5 mm thick)

   ☐ **2** - Yellow-brown to light green colour (0.5-1 mm thick)

   ☐ **3** - Patches of thicker green to brown algae (1-5 mm thick)

   ☐ **4** - Numerous large clumps of green to dark brown algae (5-20 mm thick)

   ☐ **5** - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (> 20 mm thick)

Note: 1 through 5 represent categories entered into the CABIN database.

BENTHIC MACROINVERTEBRATE DATA

Habitat sampled (*check one*): ☐ riffle ☐ rapids ☐ straight run

400 µm mesh Kick Net *	
Person sampling	
Sampling time (i.e. 3 min.)	
No. of sample jars	
Typical depth in kick area (cm)	

Preservative used: _____

Sampled sieved on site using the "Bucket Swirling Method":
☐ YES ☐ NO

If YES, debris collected for QA/QC ☐

* Note: Indicate if a sampling method other than the recommended 400 µm mesh kick net is used.

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Appendix D Figure 2. Page 2 of 6, CABIN Wadeable Streams Field Manual (Environment Canada 2012).

Field Crew: _____ Site Code: _____

Sampling Date (DD/MM/YYYY): _____

WATER CHEMISTRY DATA **Time:**_____ (24 hr clock) **Time zone**: _____

Air Temp: _____(ºC) Water Temp: _____(ºC) pH: _____

Specific Conductance: _____(µs/cm) DO: _____(mg/L) Turbidity: _____(NTU)

Check if water samples were collected for the following analyses:

☐ TSS (Total Suspended Solids)

☐ Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)

☐ Phosphorus (Total, Ortho, and/or Dissolved)

☐ Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate) ☐ Other_____

Note: Determining alkalinity is recommended, as are other analyses, but not required for CABIN assessments.

CHANNEL DATA

Slope - Indicate how slope was measured: (check one)

☐ **Calculated from map**

Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).

contour interval (vertical distance) _____ (m),

distance between contour intervals (horizontal distance) _____ (m)

slope = vertical distance/horizontal distance =_____

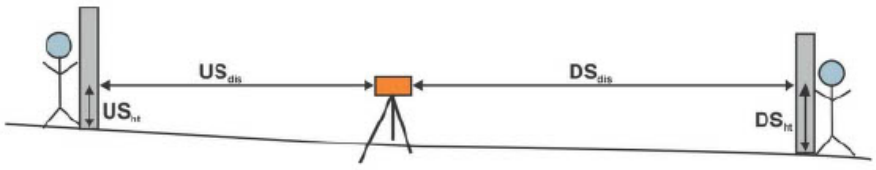
OR

☐ **Measured in field**

Circle device used and fill out table according to device:

a. Survey Equipment b. Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod			
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	$_{a}US_{dis}$=T-B	$_{a}DS_{dis}$=T-B	$US_{dis}+DS_{dis}$=
Change in height (Δht)			$DS_{ht}-US_{ht}$=
Slope (Δht/total dis)			



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Appendix D Figure 3. Page 3 of 6, CABIN Wadeable Streams Field Manual (Environment Canada 2012).

Field Crew: _____ Site Code: _____

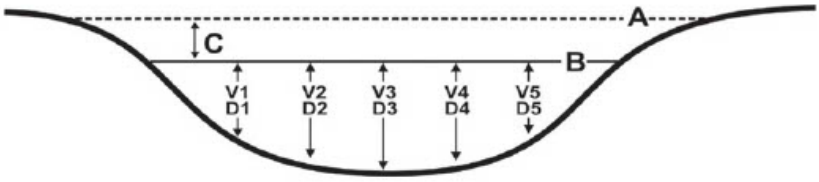
Sampling Date (DD/MM/YYYY): _____

Widths and Depth

Location at site: _____ (Indicate where in sample reach, ex. d/s of kick area)

A - Bankfull Width: _____ (m) B - Wetted Stream Width: _____ (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): _____ (cm)



Note:
Wetted widths > 5 m, measure a minimum of 5-6 equidistant locations.
Wetted widths < 5 m, measure 3-4 equidistant locations.

Velocity and Depth

Check appropriate velocity measuring device and fill out the appropriate section in chart below. Distance from shore and depth are required regardless of method:

☐ **Velocity Head Rod (or ruler)**: Velocity Equation (m/s) = √ [2(ΔD/100) * 9.81]

☐ **Rotary meters**: Gurley/Price/Mini-Price/Propeller (Refer to specific meter conversion chart for calculation)

☐ **Direct velocity measurements**: ☐ Marsh-McBirney ☐ Sontek or ☐ Other_____

	1	2	3	4	5	6	AVG
Distance from Shore (m)							
Depth (**D**) (cm)							
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
Change in depth ($\Delta D=D_2-D_1$) (cm)							
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (**V**) (m/s)							

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Appendix D Figure 4. Page 4 of 6, CABIN Wadeable Streams Field Manual (Environment Canada 2012).

Field Crew: _____ Site Code: _____

Sampling Date (DD/MM/YYYY): _____

SUBSTRATE DATA

1. 100 Pebble Count & Substrate Embeddedness

- Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.
- Indicate **B** for bedrock, **S** for sand/silt/clay (particles < 0.2 cm) and **O** for organic material.
- Embededness categories (**E**):
  - Completely embedded = 1
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Substrate Size Class	Category
Organic Cover	0
< 0.1 cm (fine sand, silt or clay)	1
0.1-0.2 cm (coarse sand)	2
0.2-1.6 cm (gravel)	3
1.6-3.2 cm (small pebble)	4
3.2-6.4 cm (large pebble)	5
6.4-12.8 cm (small cobble)	6
12.8-25.6 cm (cobble)	7
> 25.6 cm (boulder)	8
Bedrock	9

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1			26			51			76		
2			27			52			77		
3			28			53			78		
4			29			54			79		
5			30			55			80		
6			31			56			81		
7			32			57			82		
8			33			58			83		
9			34			59			84		
10			35			60			85		
11			36			61			86		
12			37			62			87		
13			38			63			88		
14			39			64			89		
15			40			65			90		
16			41			66			91		
17			42			67			92		
18			43			68			93		
19			44			69			94		
20			45			70			95		
21			46			71			96		
22			47			72			97		
23			48			73			98		
24			49			74			99		
25			50			75			100		

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

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Appendix D Figure 5. Page 5 of 6, CABIN Wadeable Streams Field Manual (Environment Canada 2012).

Field Crew: _____ Site Code: _____

Sampling Date (DD/MM/YYYY): _____

SITE INSPECTION

Site Inspected by: _____

Communication Information

☐ Itinerary left with contact person (include contact numbers)

Contact Person: _____ Time checked-in: _____

Form of communication: ☐ radio ☐ cell ☐ satellite ☐ hotel/pay phone ☐ SPOT

Phone number: ( ) _____

Vehicle Safety

☐ Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)

☐ Equipment and chemicals safely secured for transport

☐ Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary

Notes:

Shore & Wading Safety

☐ Wading Task Hazard Analysis read by all field staff

☐ Wading Safe Work Procedures read by all field staff

☐ Instream hazards identified (i.e. log jams, deep pools, slippery rocks)

☐ PFD worn

☐ Appropriate footwear, waders, wading belt

☐ Belay used

Notes:

Appendix D Figure 6. Page 6 of 6, CABIN Wadeable Streams Field Manual (Environment Canada 2012).

WETLAND DELINEATION DATA FORM – NEW BRUNSWICK

Project/Site:_____ Municipality/County:_____ Sampling Date: _____

Applicant/Owner:_____ Sampling Point: _____

Investigator(s):_____ Affiliation:_____

Landform (hillslope, terrace, etc.):_____ Local relief (concave, convex, none): _____

Slope (%):_____ Lat:_____ Long:_____ Datum: _____

Soil Map Unit Name/Type:_____ Wetland Type: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes_____ No_____ (If no, explain in Remarks.)

Are Vegetation_____, Soil_____, or Hydrology_____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation_____, Soil_____, or Hydrology_____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No _____ Hydric Soil Present? Yes _____ No _____ Wetland Hydrology Present? Yes _____ No _____	**Is the Sampled Area within a Wetland? Yes _____ No _____** If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.)	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	_____= Total Cover		
Sapling/Shrub Stratum (Plot size:_____)			
1.			
2.			
3.			
4.			
5.			
	_____= Total Cover		
Herb Stratum (Plot size:_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	_____= Total Cover		
Woody Vine Stratum (Plot size:_____)			
1.			
2.			
	_____= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____(A)

Total Number of Dominant Species Across All Strata: _____(B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____(A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____(A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

Appendix D Figure 7. Page 1 of 2, New Brunswick Wetland Delineation Field Data Sheet (DELG 2021).

SOIL Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____
Depth (cm): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (cm): _____
Water Table Present? Yes _____ No _____ Depth (cm): _____
Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (cm): _____

Wetland Hydrology Present? Yes _____ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

Appendix D Figure 8. Page 2 of 2, New Brunswick Wetland Delineation Field Data Sheet (DELG 2021).

Wildlife Assessment – Bird Data Collection **Page ___/___**

Project _____Surveyor _____Study Area (UTM) _____

Habitat Type (Marsh/Grassland) _____ Obs Date _____/_____/_____

Vegetation Structure

Vegetation Type	Present (Yes/No)	Dominant Species	Comments
Grasses			
Shrubs			
Trees			
Aquatic Vegetation			
Other (Specify)			

Vegetation Density

Vegetation Layer	Sparse (1-25%)	Moderate (26-50%)	Dense (51-75%)	Very Dense (78-100%)
Ground Cover (0-0.5m)				
Low Shrub (0.5-1m)				
Tall Shrub (1-3m)				
Tree (>3m)				

Species Observation (Nesting or Present)

Species	Nesting (Yes/No)	Number of Individuals	Comments
Grassland Species			
Marsh Species			
Other Species (specify):			

Vegetation Height

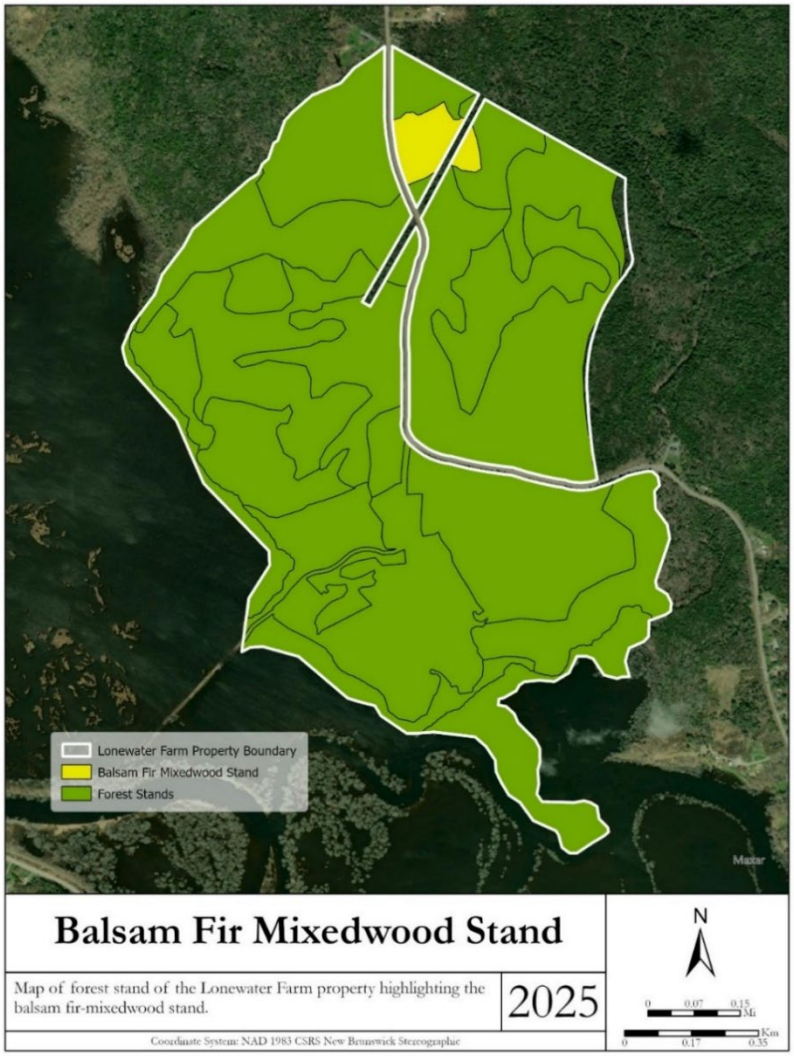
Average Vegetation Height (cm):

Appendix D Figure 9. Field data collection form used for assessing marsh/grassland habitats. The form includes sections that aid in collecting vegetation structure, density across various layers and observing species presence. This form allows for consistent and repeatable data collection for determining habitat suitability for various bird species and other wildlife.

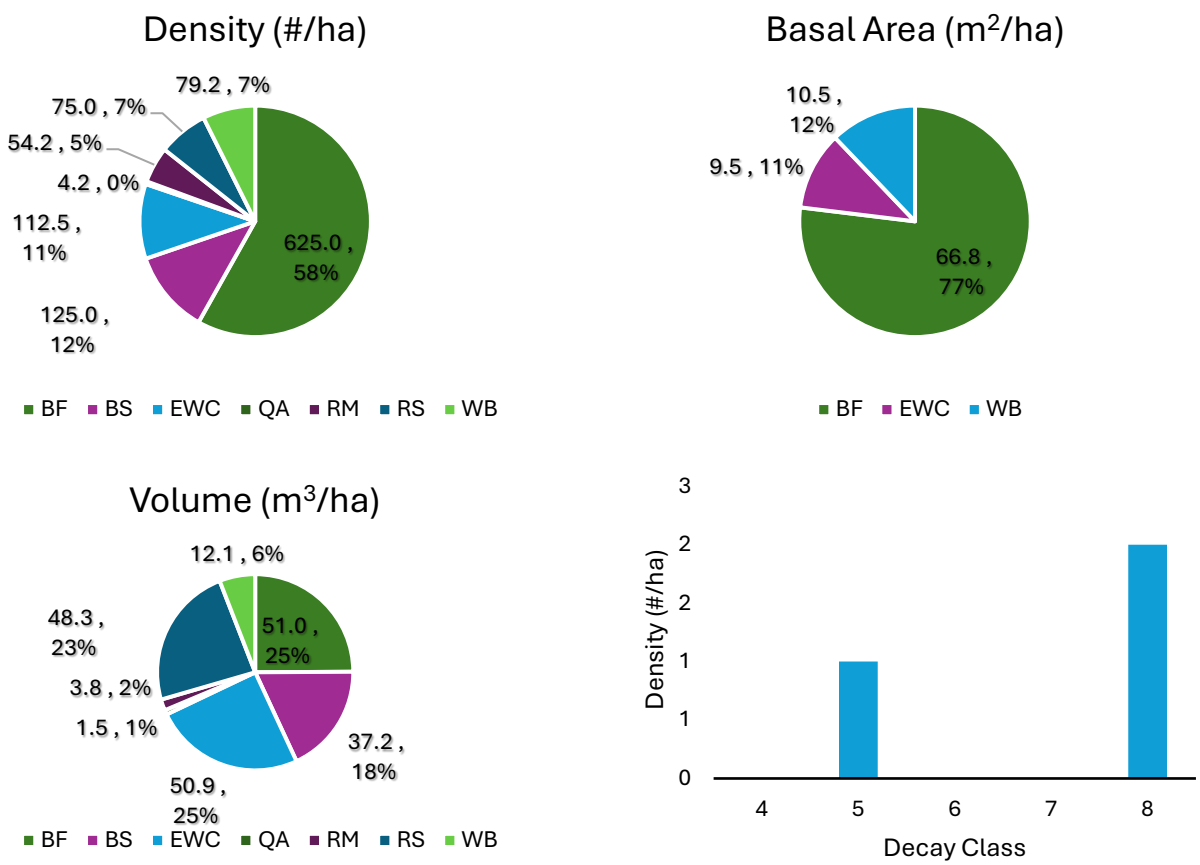
Appendix E – Stand Summaries

Balsam Fir Mixedwood

The BFMX stand type ~~is a~~ totals ~~of~~ 3 ha (Appendix E Figure 1) and had 1 sample location. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 1. Map of forest stand of Lonewater Farm highlighting the Balsam Fir-Mixedwood stand.



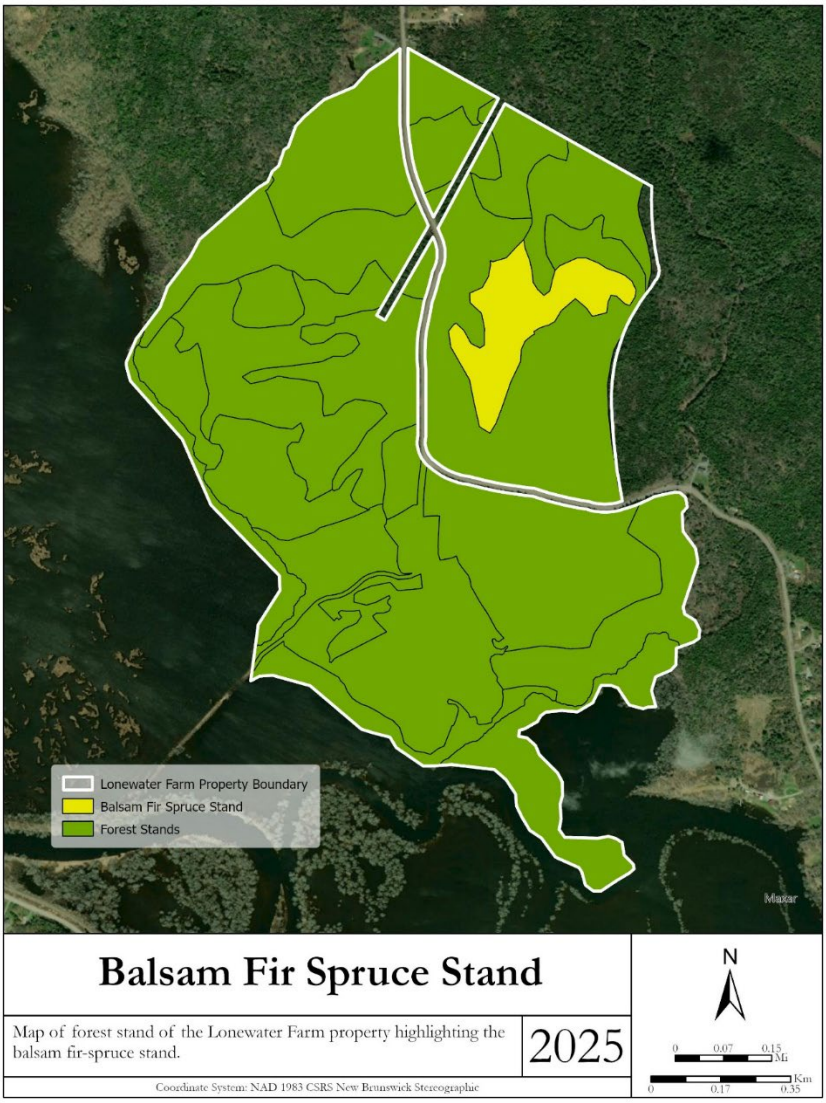
Appendix E Figure 2. Multipaneled showing the density, basal area, volume, and decay class of snags in the BFMX stand type on the LFP.

Appendix E Table 1. Summary of the density, basal area, and volume, with the top three most dominant species for each in the BFMX stand type.

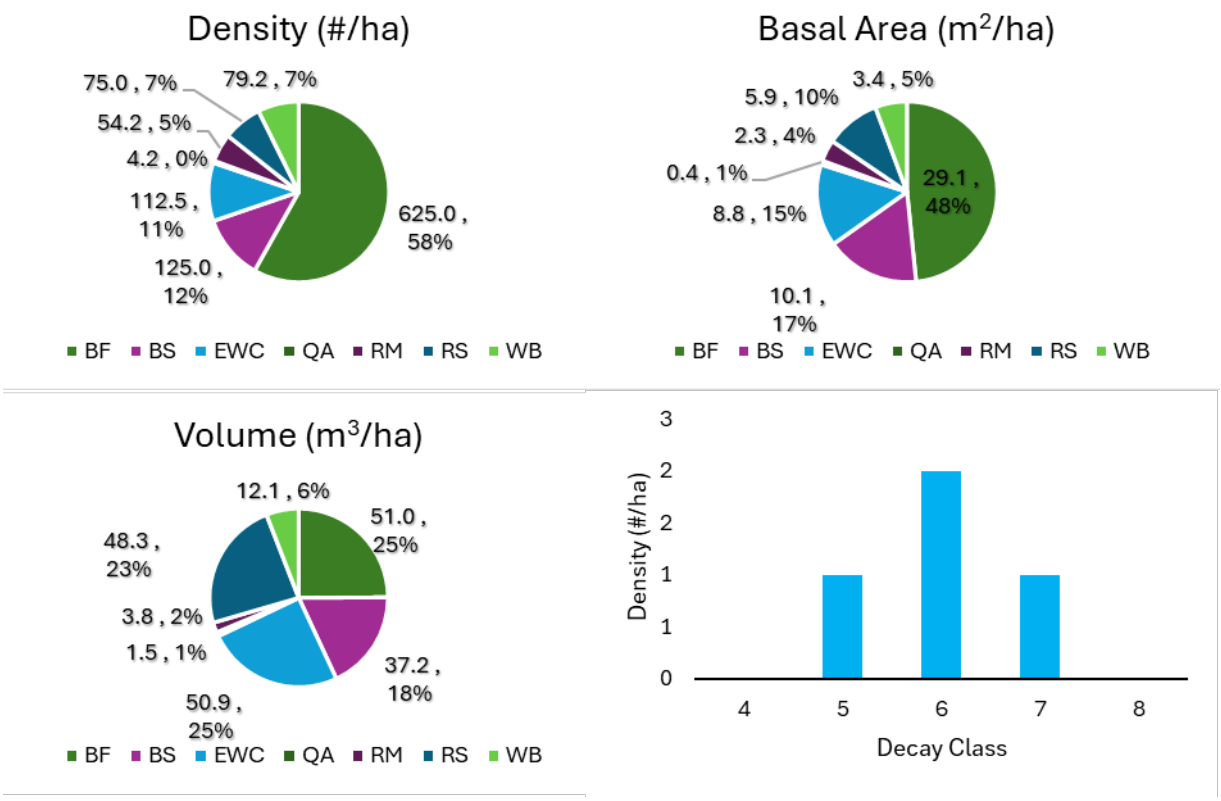
Stand Type: BFMX					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,800 ± N/A		86.8 ± N/A		249 ± N/A	
Top 3 Species					
BF	1,400 (77.8%)	BF	66.8 (76.9%)	EWC	130.9 (52.6%)
WB	300 (16.7%)	WB	10.5 (12.1%)	BF	99.1 (39.8%)
EWC	100 (5.6%)	EWC	9.5 (10.9%)	WB	19 (7.6%)

Balsam Fir Spruce

The BFSP stand type is a total of 7.7 ha (Appendix E Figure 3) and had 2 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 3. Map of forest stand of Lonewater Farm highlighting the Balsam Fir-Spruce stand.



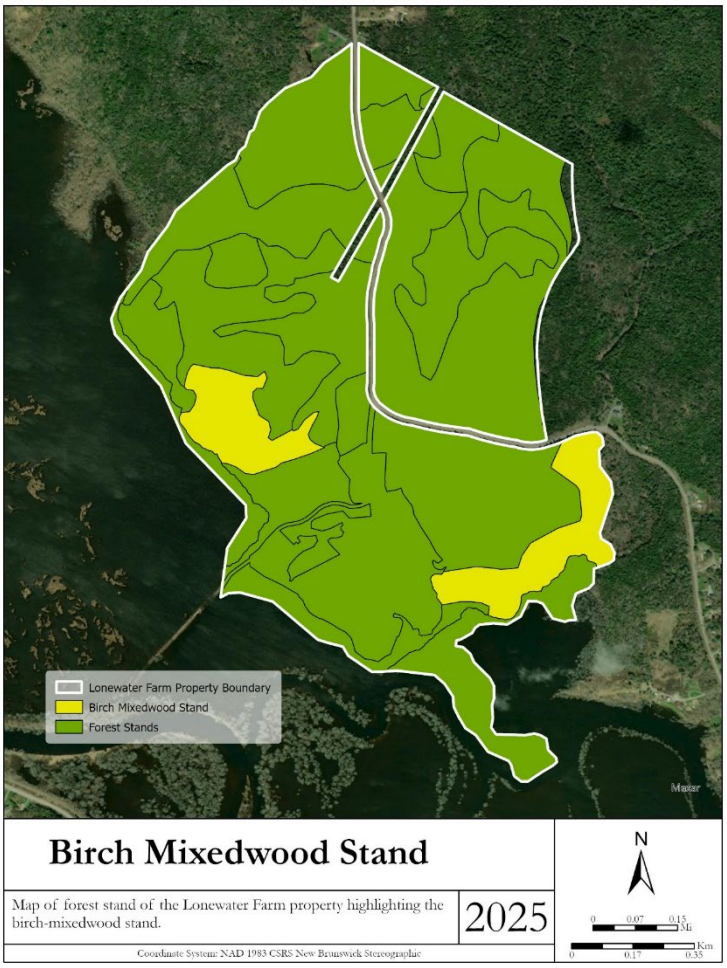
Appendix E Figure 4. Multipaneled showing the density, basal area, volume, and decay class of snags in the BFSP stand type on the LFP.

Appendix E Table 2. Summary of the density, basal area, and volume, with the top three most dominant species for each in the BFSP stand type.

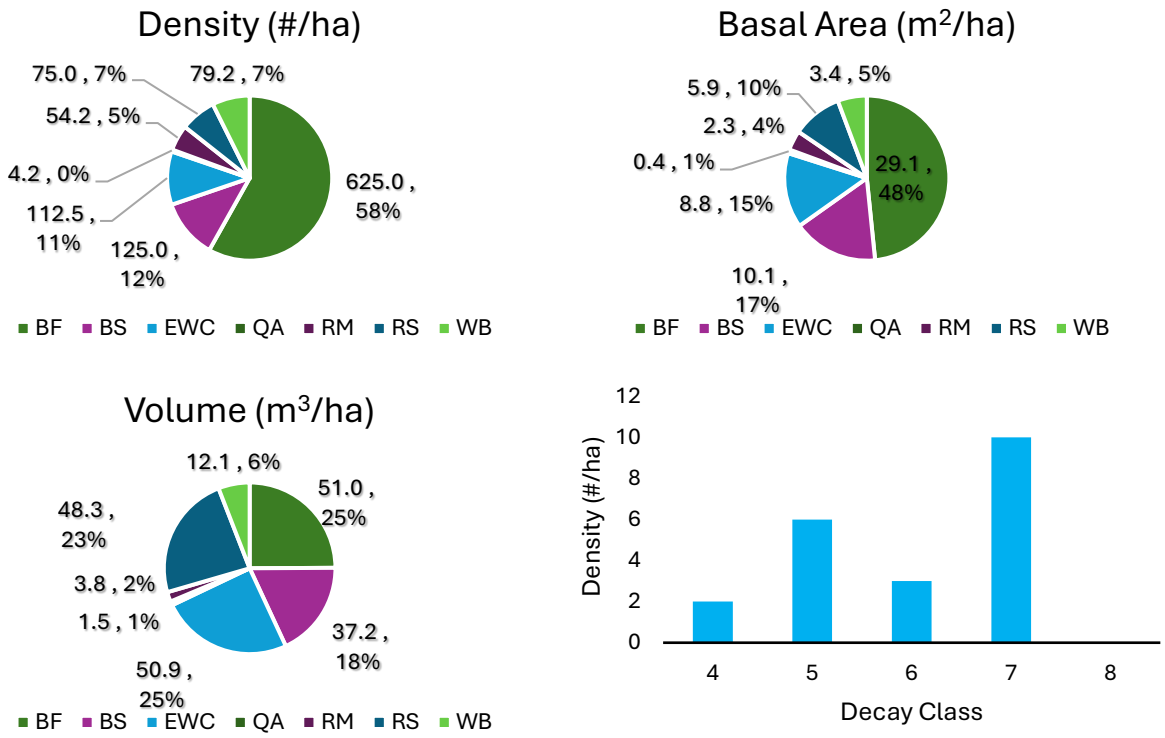
Stand Type: BFSP					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,750 ± 21,600.5		83.3 ± 1,038.3		136.7 ± 1,720.8	
Top 3 Species					
RS	900 (51.4%)	RS	48.9 (58.7%)	RS	90.5 (66.2%)
BF	625 (35.7%)	BF	26.2 (31.5%)	BF	37.3 (27.3%)
RM	175 (10%)	RM	6.5 (7.8%)	RM	7.1 (5.2%)

Birch Mixedwood

The BIMX stand type is a total of 15.2 ha split between 2 stands (Appendix E Figure 5) and had 7 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 5. Map of forest stand of Lonewater Farm highlighting the Birch-Mixedwood stand.



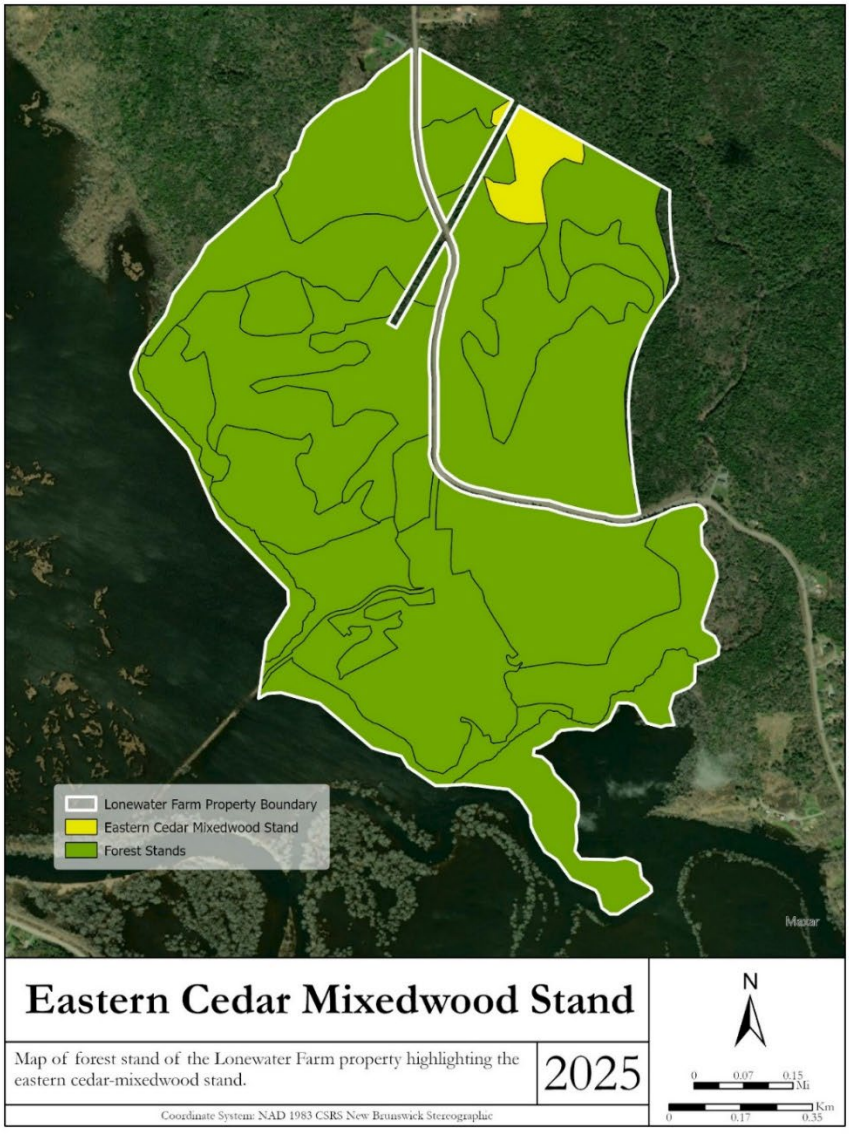
Appendix E Figure 6. Multipaneled showing the density, basal area, volume, and decay class of snags in the BIMX stand type on the LFP.

Appendix E Table 3. Summary of the density, basal area, and volume, with the top three most dominant species for each in the BIMX stand type.

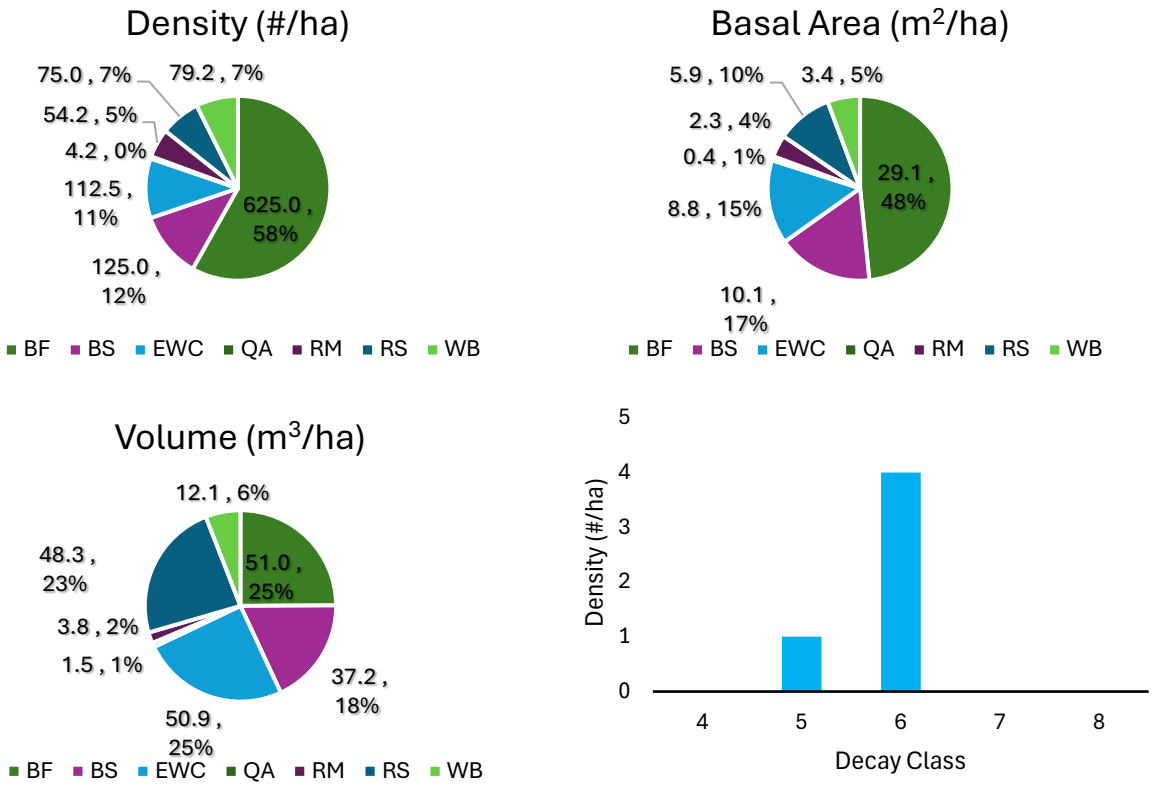
Stand Type: BIMX					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,022 ± 576		51.2 ± 28.5		189.6 ± 65.2	
Top 3 Species					
BF	550 (53.8%)	BF	21.3 (41.7%)	RS	69.5 (36.7%)
RS	215 (21%)	RS	14.2 (27.8%)	BF	40 (21.1%)
RM	93 (9.1%)	RM	6 (11.6%)	RO	33.5 (17.7%)

Eastern Cedar Mixedwood

The ECMX stand type is a total of 3.5 ha (Appendix E Figure 7) and had 2 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 7. Map of forest stand of Lonewater Farm highlighting the Eastern Cedar-Mixedwood stand.



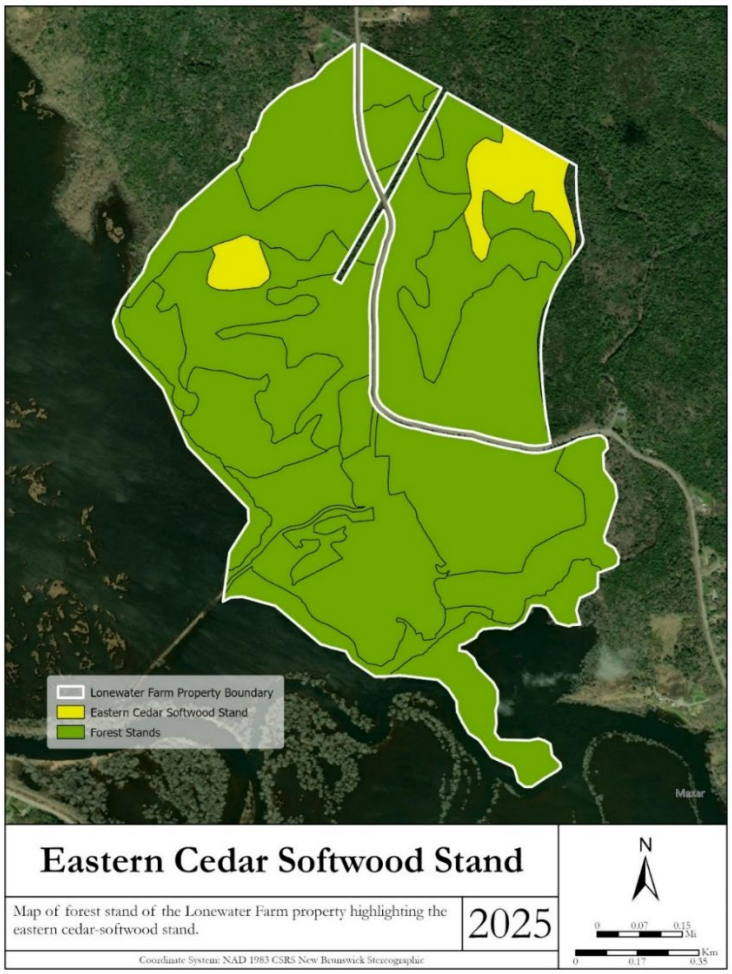
Appendix E Figure 8. Multipaneled showing the density, basal area, volume, and decay class of snags in the ECMX stand type on the LFP.

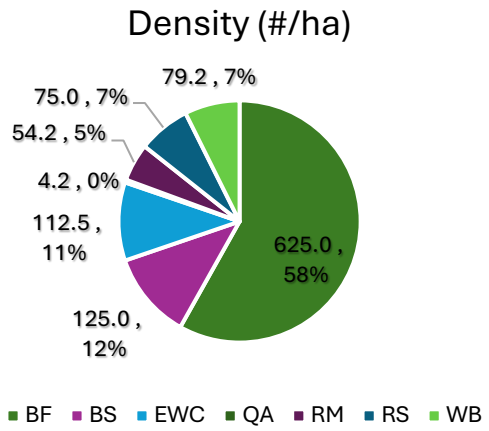
Appendix E Table 4. Summary of the density, basal area, and volume, with the top three most dominant species for each in the ECMX stand type.

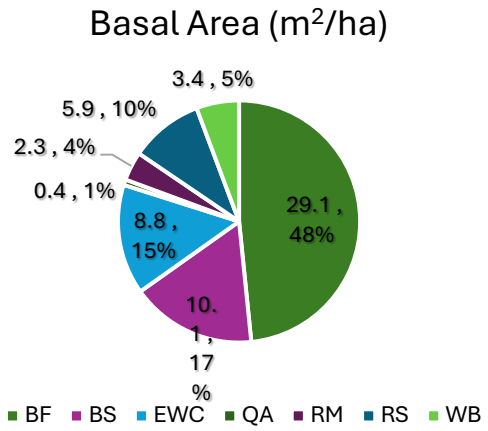
Stand Type: ECMX					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,200 ± 1,906		72.9 ± 37.3		257 ± 979.8	
Top 3 Species					
BF	375 (31.3%)	BF	17 (23.3%)	RS	79.8 (31.1%)
RS	225 (18.8%)	RS	15.4 (21.1%)	EWC	50.6 (19.7%)
EWC	200 (16.7%)	RM	13.1 (17.9%)	RM	41.5 (16.2%)

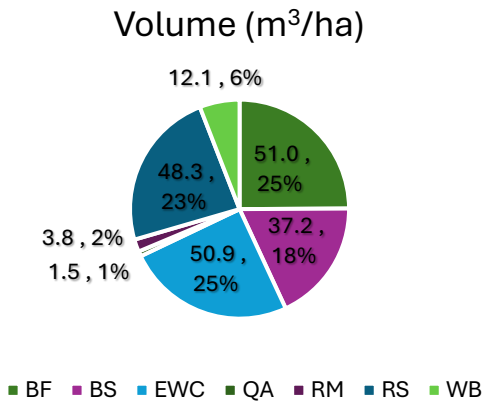
Eastern Cedar Softwood

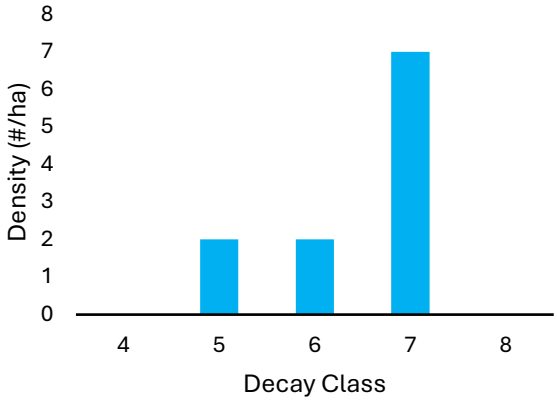
The ECSW stand type is a total of 8.2 ha split between 2 stands (Appendix E Figure 9) and had 3 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.


Lonewater Farm Property Boundary
Eastern Cedar Softwood Stand
Forest Stands
Maxar
Eastern Cedar Softwood Stand
Map of forest stand of the Lonewater Farm property highlighting the eastern cedar-softwood stand.
2025
N
0 0.07 0.15
Mi
0 0.17 0.35
Km
Coordinate System: NAD 1983 CSRS New Brunswick Stereographic









Appendix E Figure 9. Map of forest stand of Lonewater Farm highlighting the Eastern Cedar-Softwood stand.

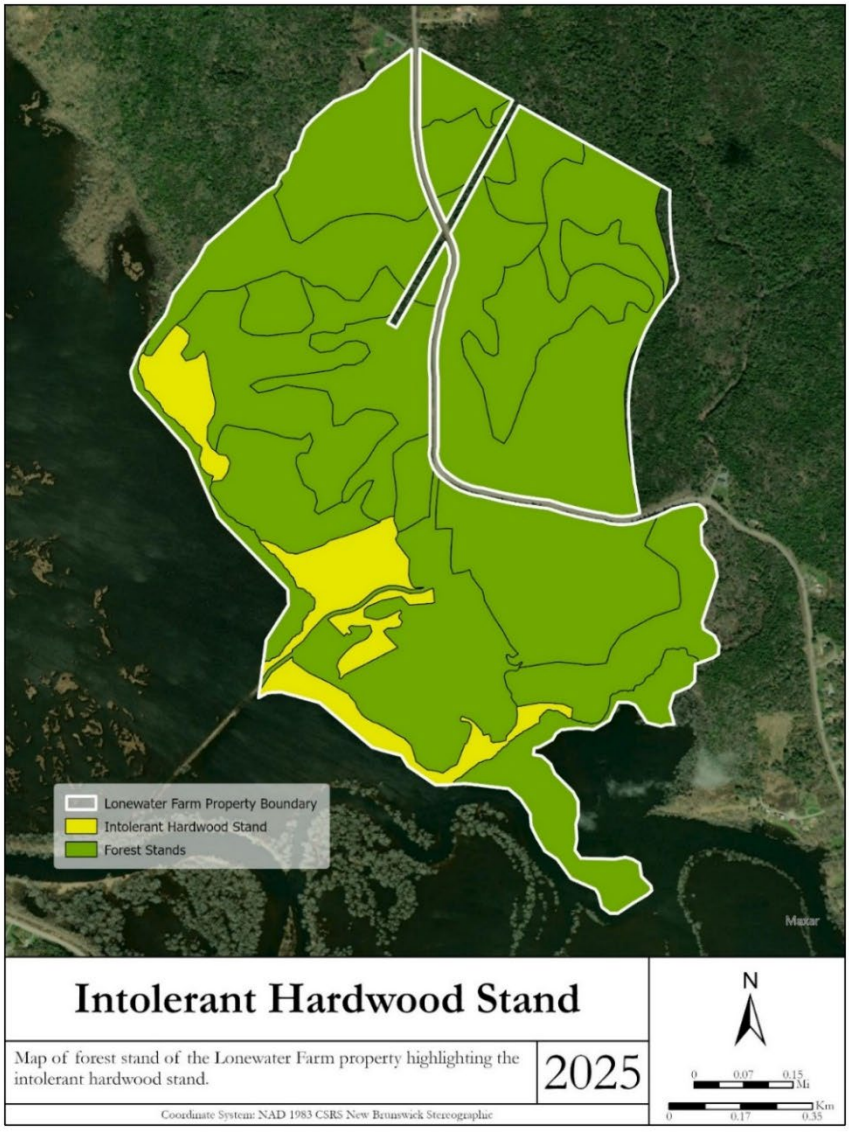
Appendix E Figure 10. Multipaneled showing the density, basal area, volume, and decay class of snags in the ECSW stand type on the LFP.

Appendix E Table 5. Summary of the density, basal area, and volume, with the top three most dominant species for each in the ECSW stand type.

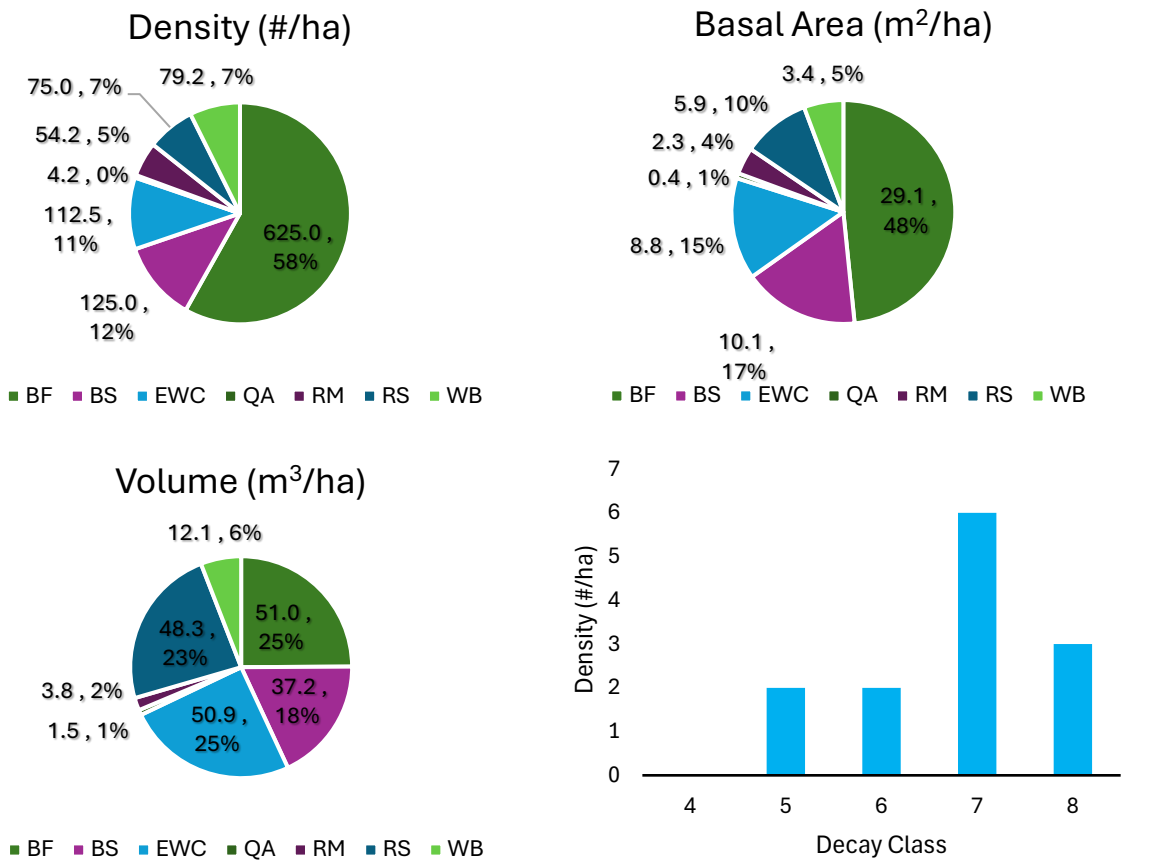
Stand Type: ECSW					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,584 ± 626		88 ± 18.2		242.4 ± 40.4	
Top 3 Species					
BF	717 (45.3%)	EWC	34.6 (39.3%)	EWC	140 (57.7%)
EWC	450 (28.4%)	BF	31.4 (35.7%)	BF	55.6 (22.9%)
WB	184 (11.6%)	WB	8.1 (9.2%)	RS	13.5 (5.6%)

Intolerant Hardwood

The IHHW stand type is a total of 14.2 ha split between 2 stands (Appendix E Figure 11) and had 7 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 11. Map of forest stand of Lonewater Farm highlighting the Intolerant Hardwood stand.



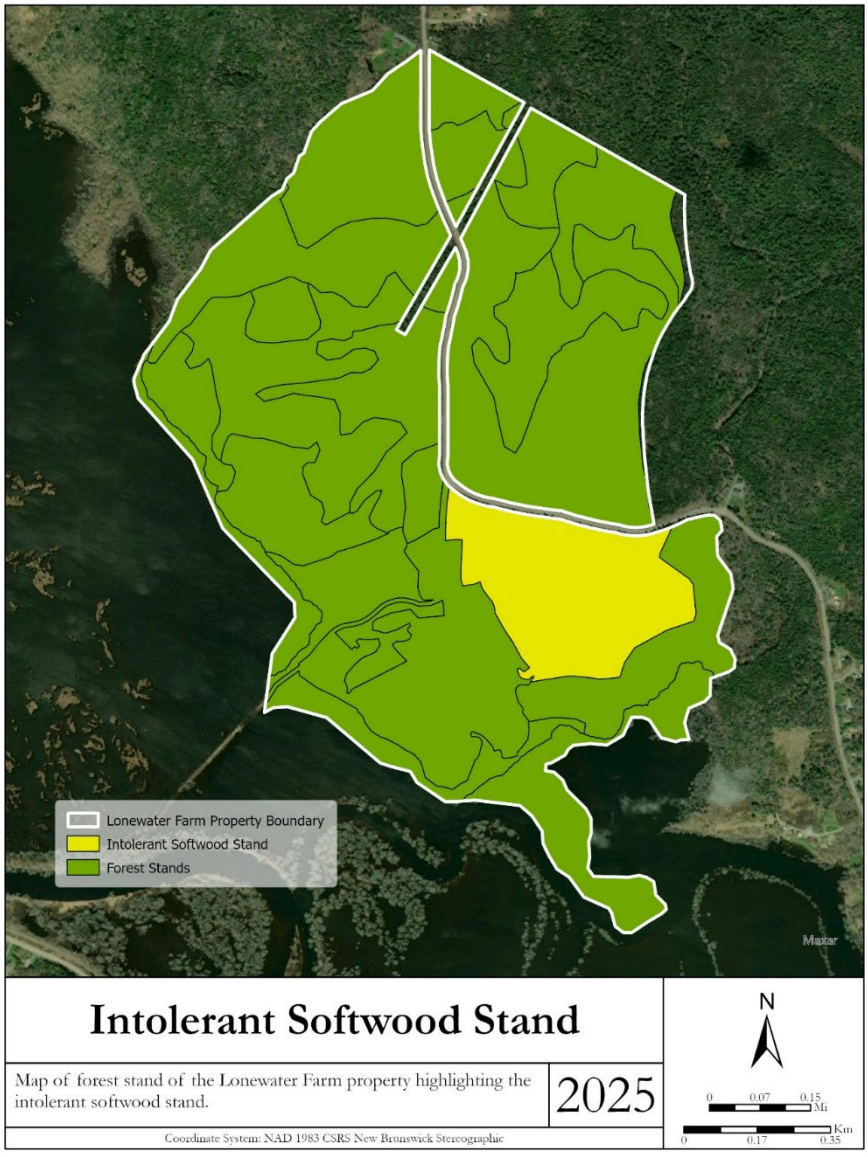
Appendix E Figure 12. Multipaneled showing the density, basal area, volume, and decay class of snags in the IHHW stand type on the LFP.

Appendix E Table 6. Summary of the density, basal area, and volume, with the top three most dominant species for each in the IHHW stand type.

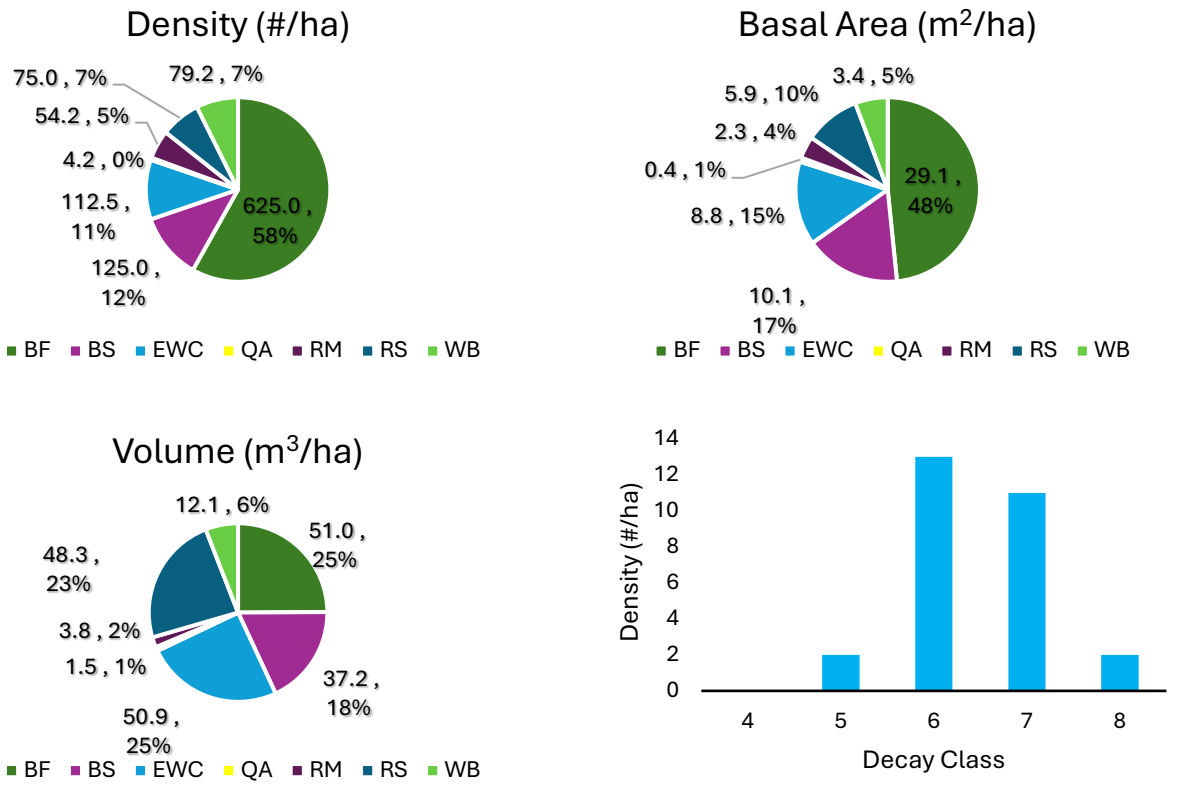
Stand Type: IHHW					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
658 ± 315		41.9 ± 21.4		245.4 ± 70	
Top 3 Species					
RO	150 (22.8%)	RO	11.7 (27.8%)	RO	101.6 (41.4%)
RM	143 (21.7%)	RM	9.5 (22.8%)	RM	50.6 (20.6%)
BF	108 (16.3%)	BF	5.3 (12.7%)	RS	28.4 (11.6%)

Intolerant Softwood

The INSW stand type is a total of 16.4 ha (Appendix E Figure 13) and had 5 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 13. Map of forest stand of Lonewater Farm highlighting the Intolerant Softwood stand.



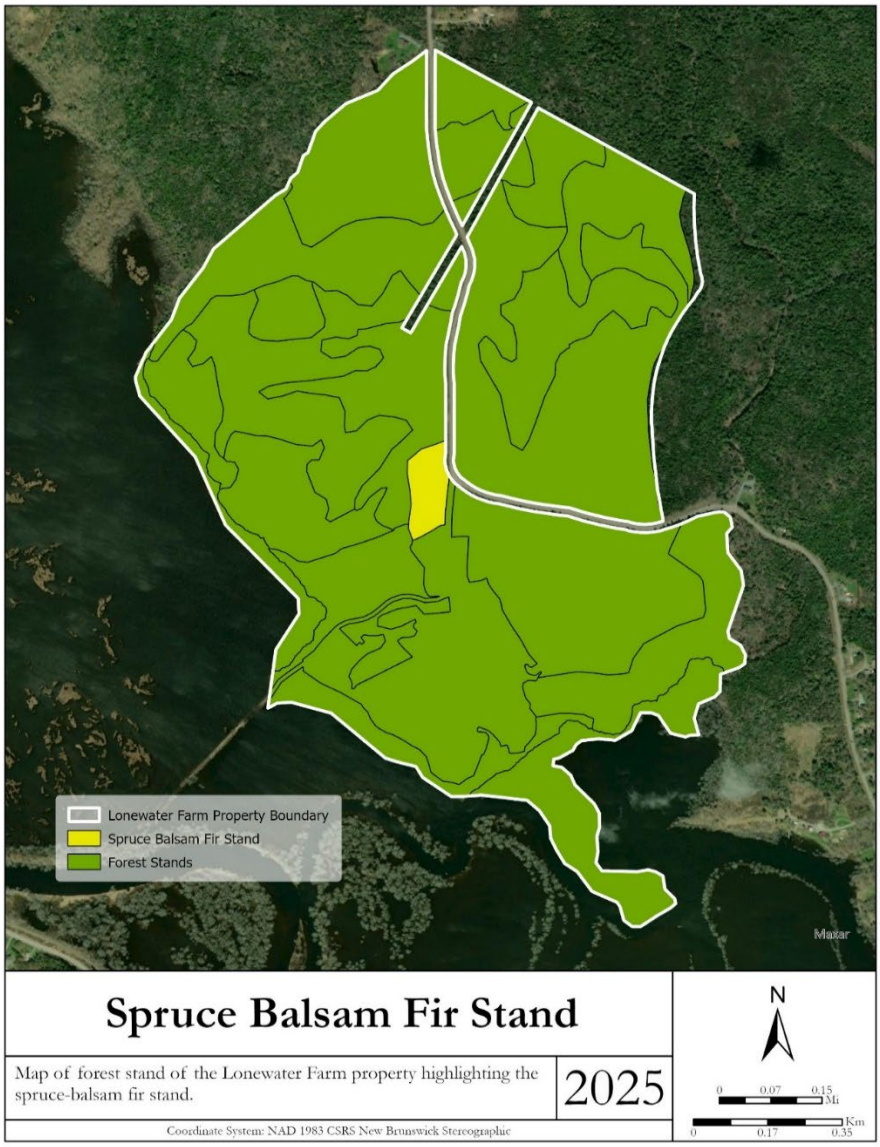
Appendix E Figure 14. Multipaneled showing the density, basal area, volume, and decay class of snags in the INSW stand type on the LFP.

Appendix E Table 7. Summary of the density, basal area, and volume, with the top three most dominant species for each in the INSW stand type.

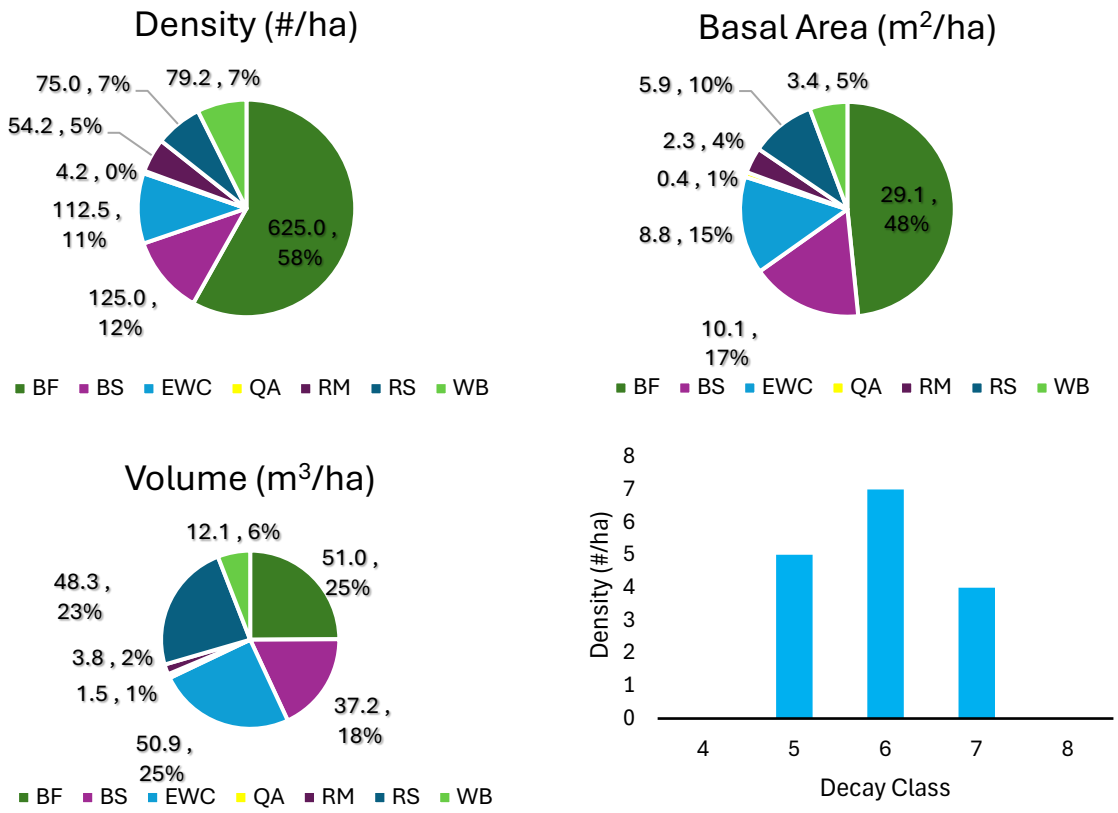
Stand Type: INSW					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,290 ± 377		81.1 ± 23.7		250.9 ± 34	
Top 3 Species					
BF	620 (48.1%)	RS	33.2 (40.9%)	RS	140.9 (56.1%)
RS	440 (34.1%)	BF	33.1 (40.8%)	BF	67.4 (26.9%)
WB	120 (9.3%)	EWC	8.1 (10%)	EWC	24.5 (9.8%)

Spruce Fir

The SPBF stand type is a total of 1.8 ha (Appendix E Figure 15) and had 2 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 15. Map of forest stand of Lonewater Farm highlighting the Spruce-Balsam Fir stand.



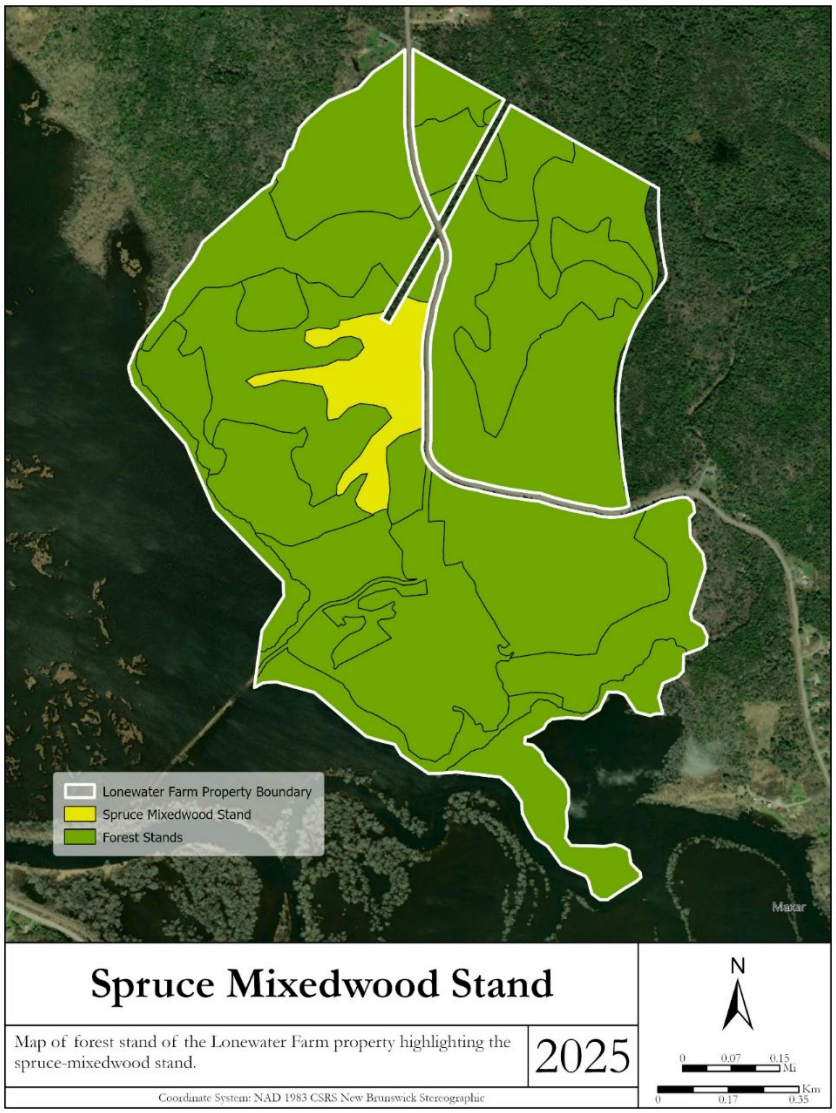
Appendix E Figure 16. Multipaneled showing the density, basal area, volume, and decay class of snags in the SPBF stand type on the LFP.

Appendix E Table 8. Summary of the density, basal area, and volume, with the top three most dominant species for each in the SPBF stand type.

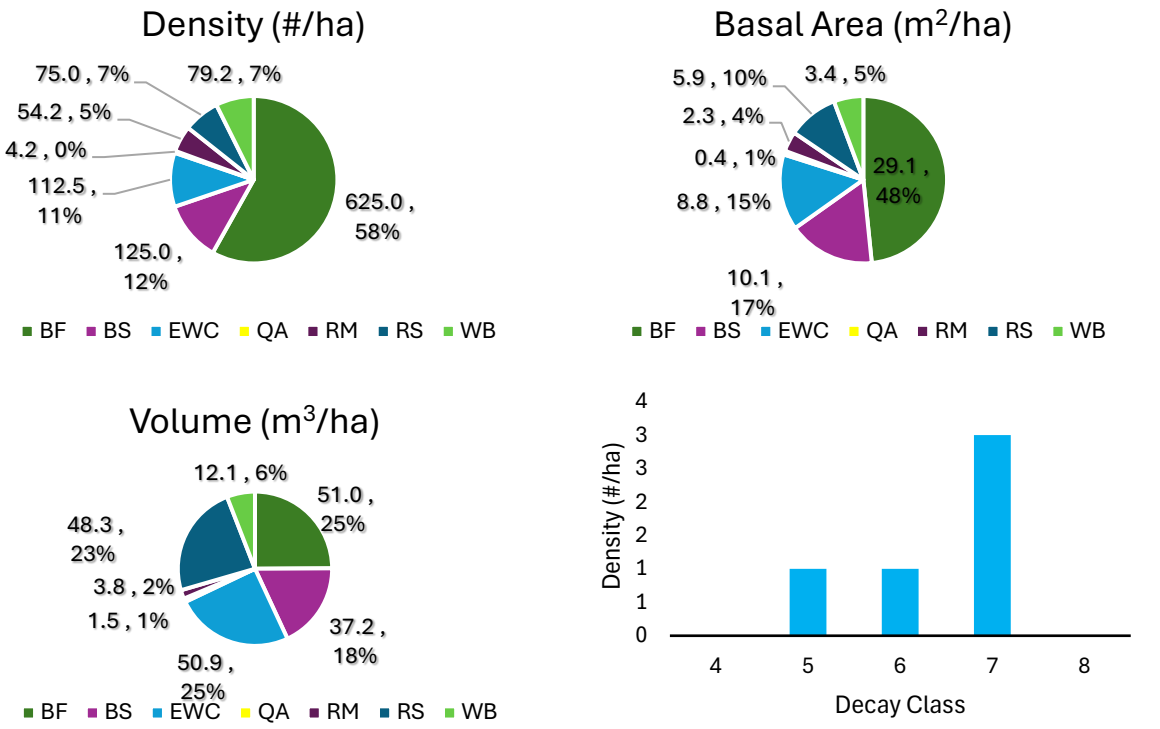
Stand Type: SPBF					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,875 ± 953		90.7 ± 13.8		182.4 ± 356.8	
Top 3 Species					
BF	1,225 (65.3%)	BF	49.3 (54.4%)	BF	73.4 (40.3%)
WB	275 (14.7%)	WB	15.9 (17.6%)	RS	53.5 (29.3%)
RS	200 (10.7%)	RS	13.9 (15.3%)	WB	31.5 (17.3%)

Spruce Mixedwood

The SPMX stand type is a total of 8.3 ha (Appendix E Figure 17) and had 3 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 17. Map of forest stand of Lonewater Farm highlighting the Spruce-Mixedwood stand.



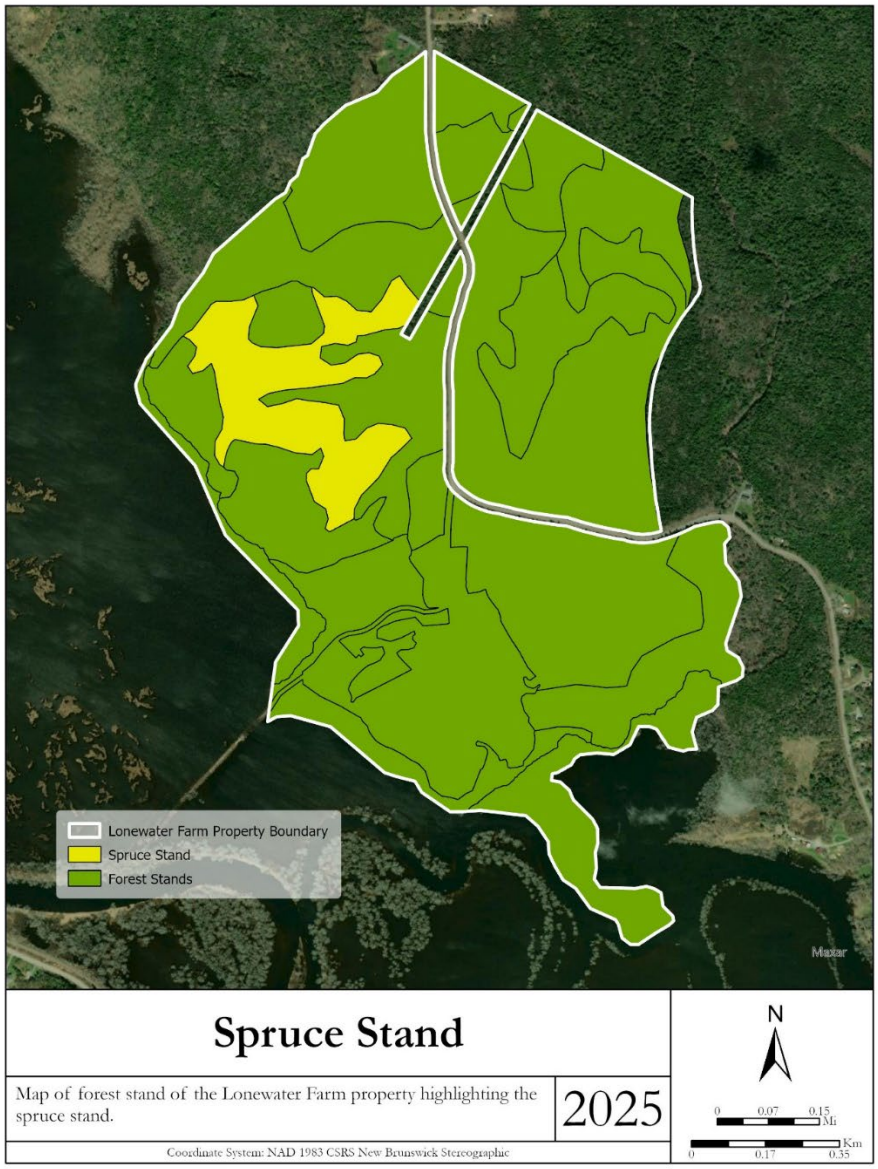
Appendix E Figure 18. Multipaneled showing the density, basal area, volume, and decay class of snags in the SPMX stand type on the LFP.

Appendix E Table 9. Summary of the density, basal area, and volume, with the top three most dominant species for each in the SPMX stand type.

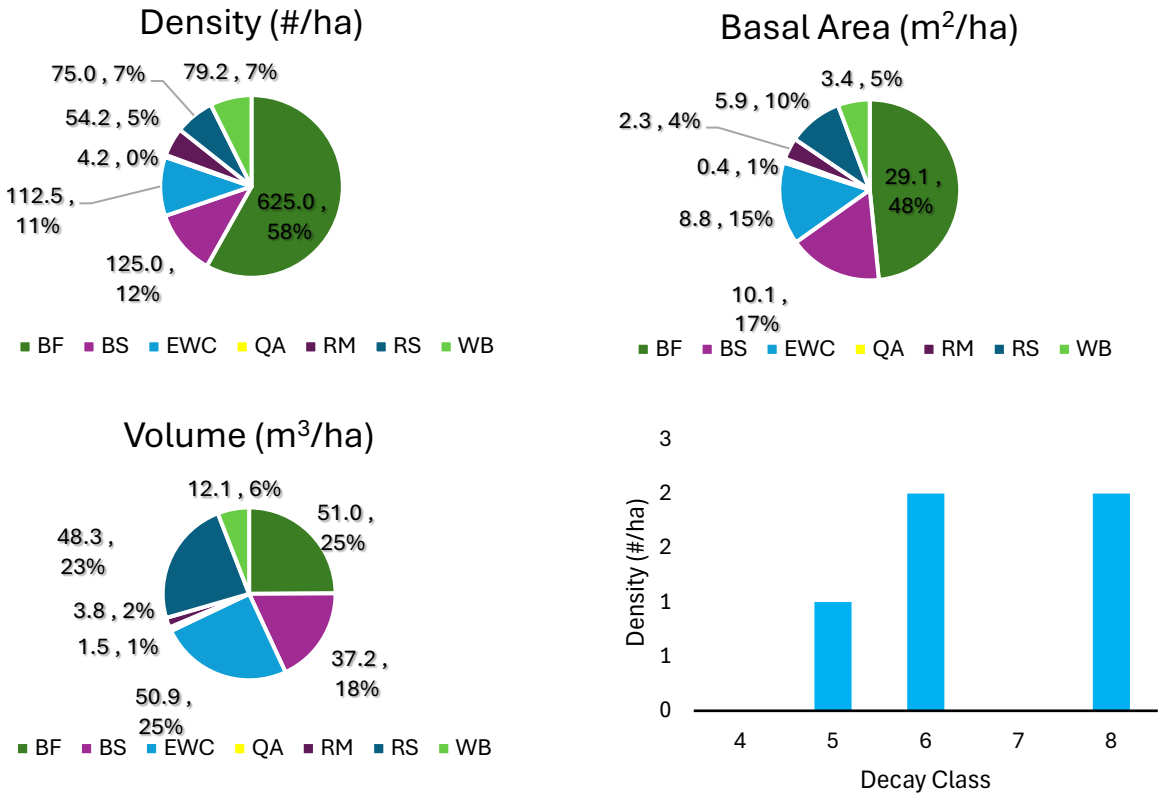
Stand Type: SPMX					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,184 ± 718		63.2 ± 38.1		196.6 ± 64.6	
Top 3 Species					
BF	550 (46.5%)	BF	27 (42.7%)	BF	46.2 (23.5%)
RM	250 (21.1%)	RM	12 (18.9%)	RM	41.7 (21.2%)
YB	150 (12.7%)	EH	6.8 (10.7%)	EWC	37.6 (19.1%)

Spruce

The SPRC stand type is a total of 13.6 ha (Appendix E Figure 19) and had 4 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 19. Map of forest stand of Lonewater Farm highlighting the Spruce stand.



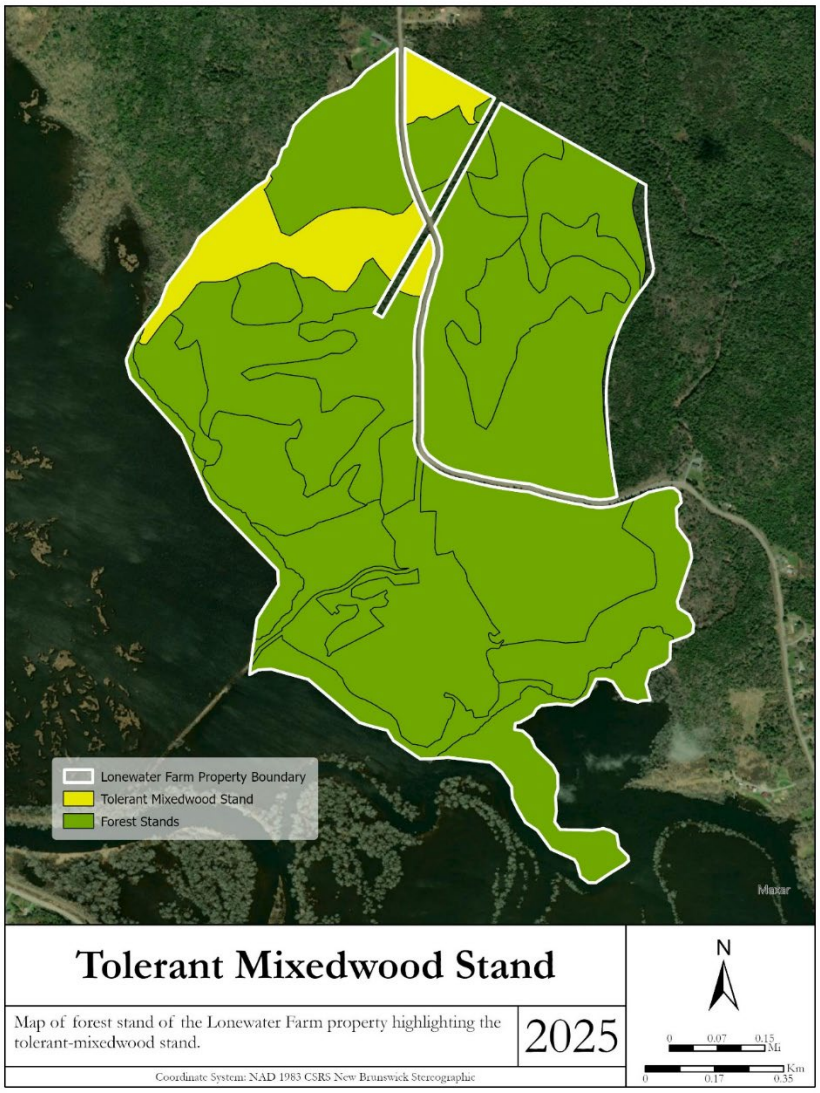
Appendix E Figure 20. Multipaneled showing the density, basal area, volume, and decay class of snags in the SPRC stand type on the LFP.

Appendix E Table 10. Summary of the density, basal area, and volume, with the top three most dominant species for each in the SPRC stand type.

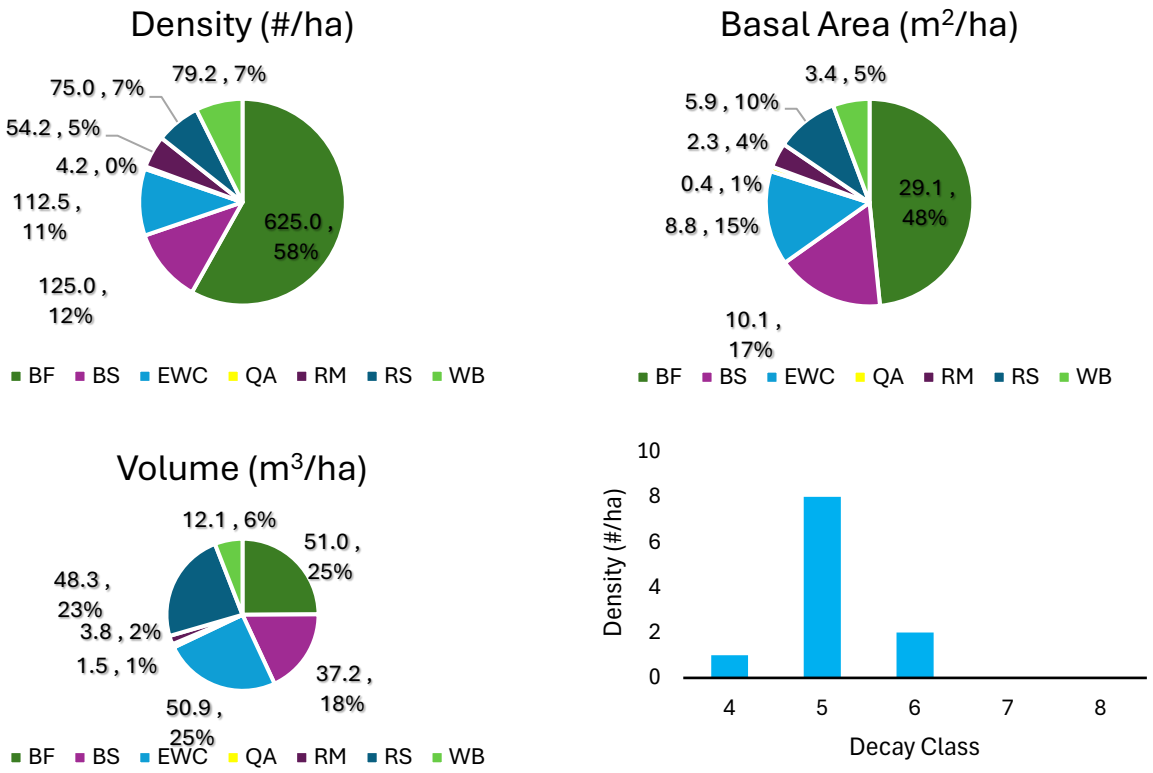
Stand Type: SPRC					
Density (stems/ha)		Basal Area (m²/ha)		Volume (m³/ha)	
1,050 ± 516		60.6 ± 42.6		219.4 ± 230.4	
Top 3 Species					
BF	525 (50%)	BF	22.8 (37.5%)	RS	95.6 (43.6%)
RM	238 (22.6%)	RM	17.8 (29.4%)	RM	57.4 (26.1%)
RS	125 (11.9%)	RS	10.4 (17.2%)	BF	43.5 (19.8%)

Tolerant Mixedwood

The TOMX stand type is a total of 12.8 ha split between 2 stands (Appendix E Figure 21) and had 4 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 21. Map of forest stand of Lonewater Farm highlighting the Tolerant Mixedwood stand.



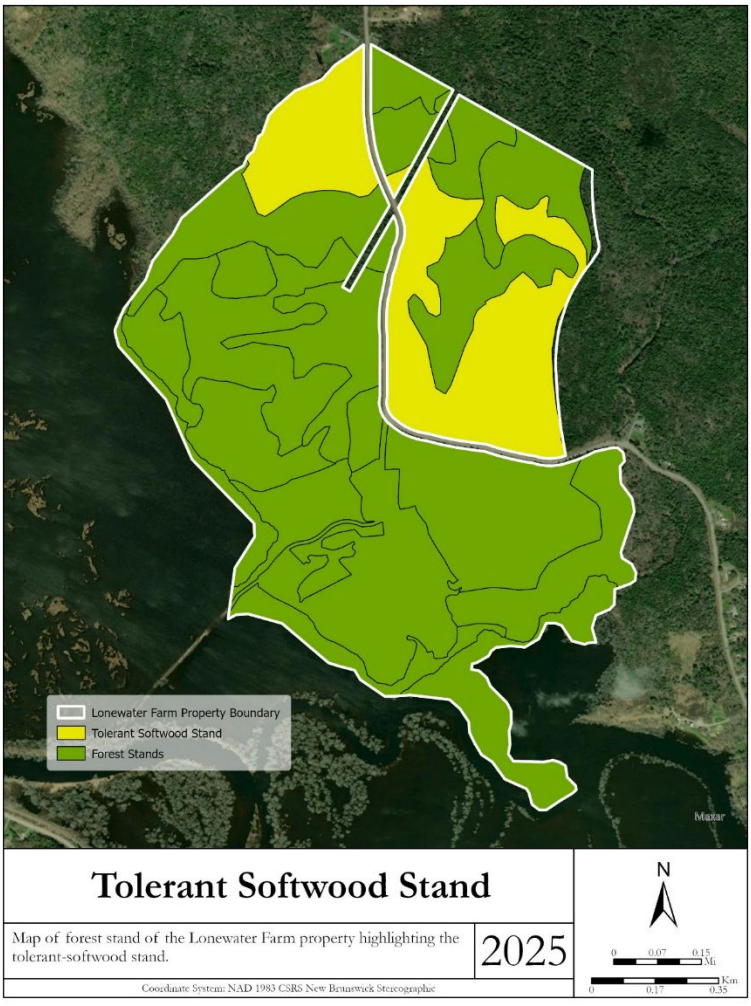
Appendix E Figure 22. Multipaneled showing the density, basal area, volume, and decay class of snags in the TOMX stand type on the LFP.

Appendix E Table. 11Summary of the density, basal area, and volume, with the top three most dominant species for each in the TOMX stand type.

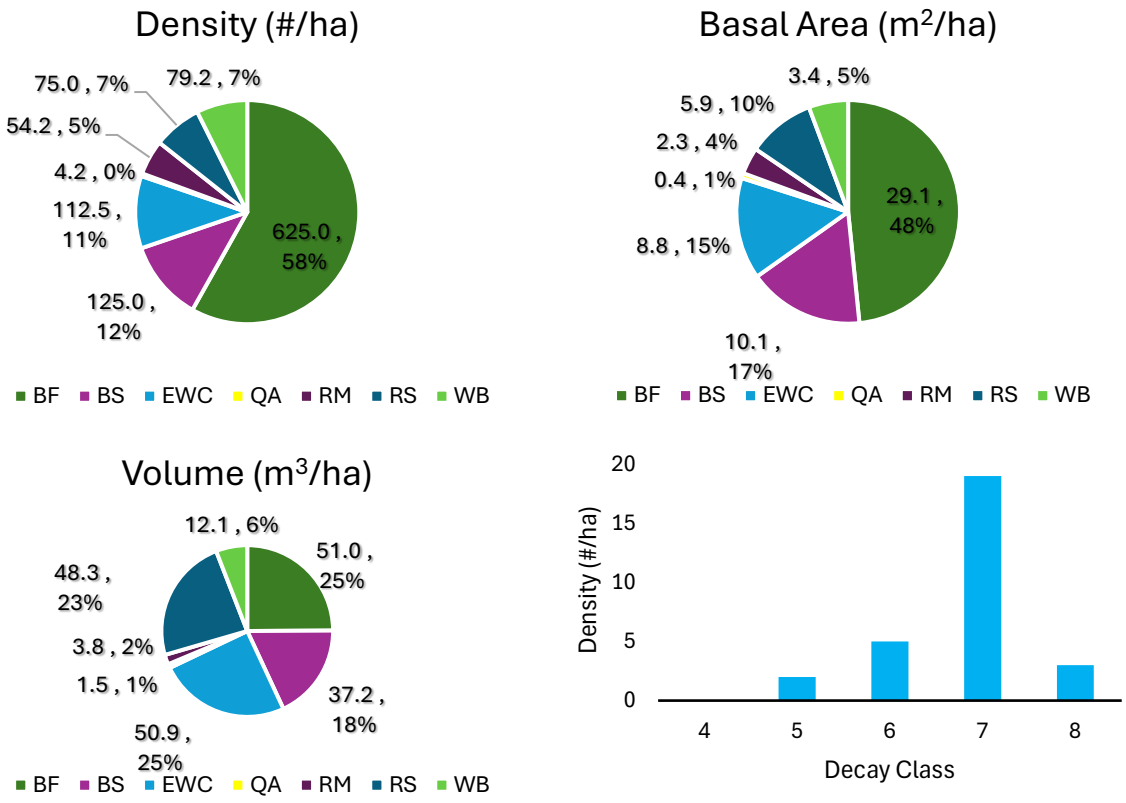
Stand Type: TOMX					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,063 ± 1,299		61.4 ± 68.6		196.7 ± 166.1	
Top 3 Species					
BF	638 (60%)	BF	31.4 (51.2%)	BF	63.9 (32.5%)
WB	138 (12.9%)	WB	9.1 (14.8%)	RS	41.7 (21.2%)
YB	125 (11.8%)	RS	8.4 (13.7%)	WB	39.2 (19.9%)

Tolerant Softwood

The TOSW stand type is a total of 34.1 ha split between 2 stands (Appendix E Figure 23) and had 12 sample locations. The three most dominant species for density, volume, and basal area are listed in the table below, along with the total density, volume and basal area for the stand type. The pie charts display the species composition for density, volume, and basal area, with percentages for each individual species. The chart shows the density of snags in each decay class for this stand type.



Appendix E Figure 23. Map of forest stand of Lonewater Farm highlighting the Tolerant Softwood stand.

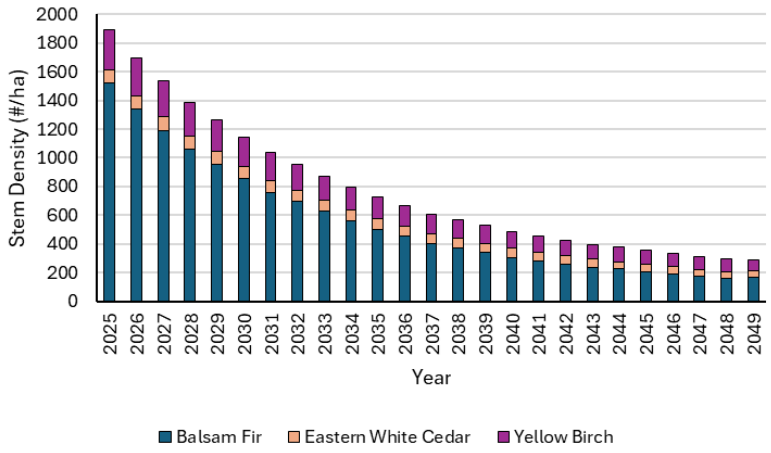


Appendix E Figure 24. Multipaneled showing the density, basal area, volume, and decay class of snags in the TOSW stand type on the LFP.

Appendix E Table 12. Summary of the density, basal area, and volume, with the top three most dominant species for each in the TOSW stand type.

Stand Type: TOSW					
Density (stems/ha)		**Basal Area (m^2/ha)**		**Volume (m^3/ha)**	
1,075 ± 377		60.1 ± 17.9		204.9 ± 48.5	
Top 3 Species					
BF	625 (58.1%)	BF	29.1 (48.4%)	BF	51 (24.9%)
BS	125 (11.6%)	BS	10.1 (16.8%)	EWC	50.9 (24.9%)
EWC	113 (10.5%)	EWC	8.8 (14.7%)	RS	48.3 (23.6%)

Appendix F – Forest Model Outputs



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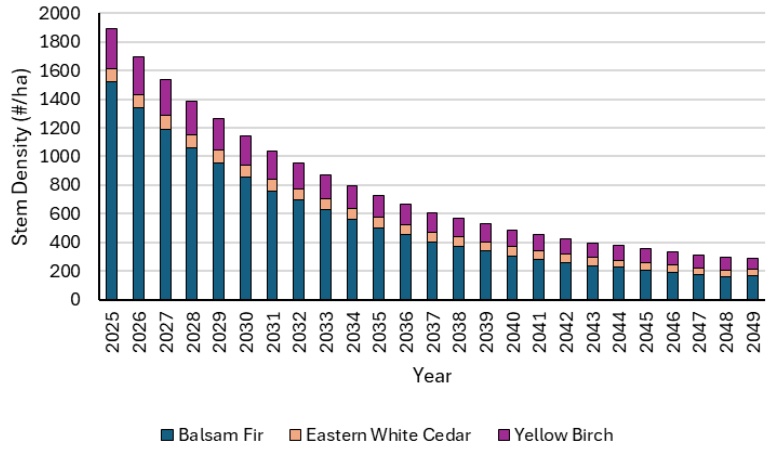

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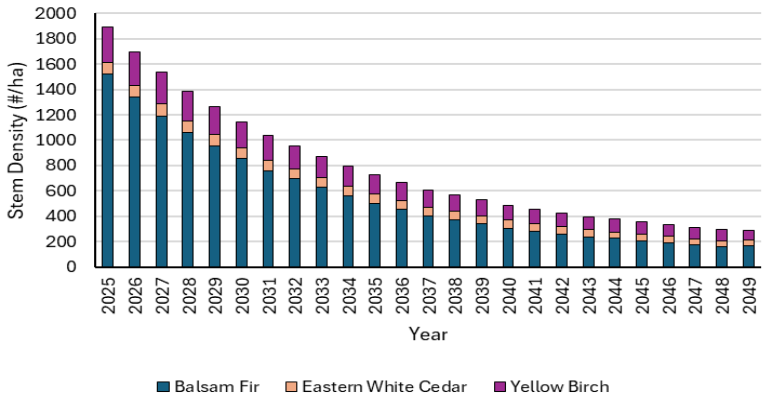
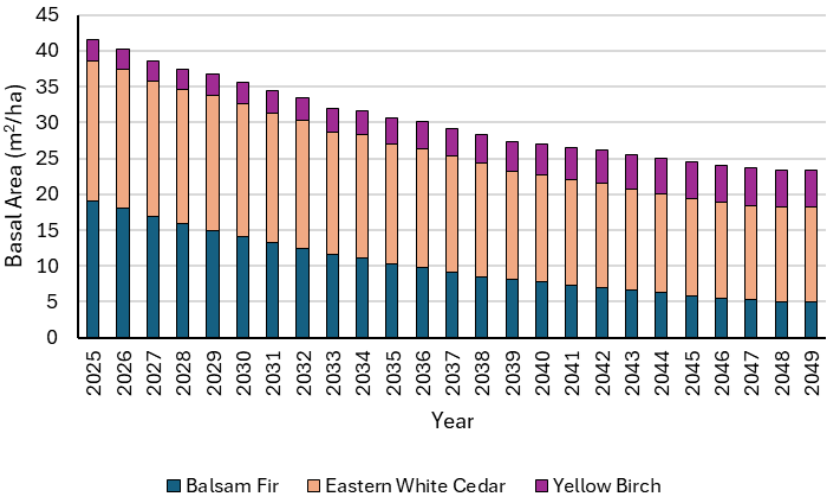


(C)

Appendix F Figure 1. Stem density of the Balsam Fir-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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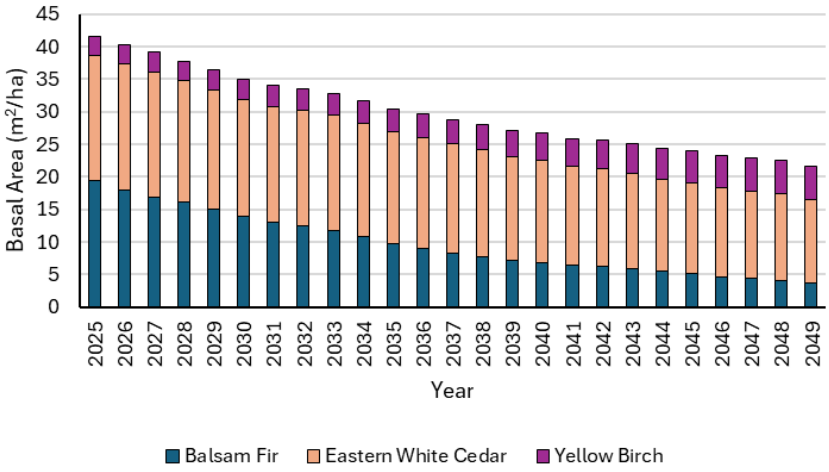

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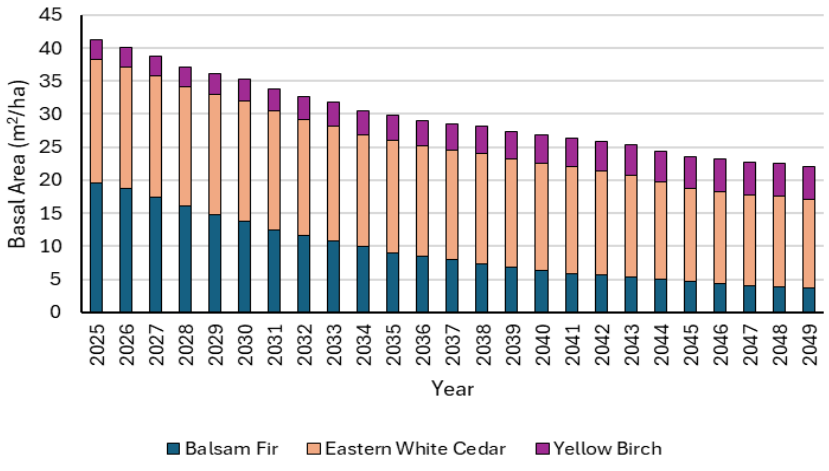
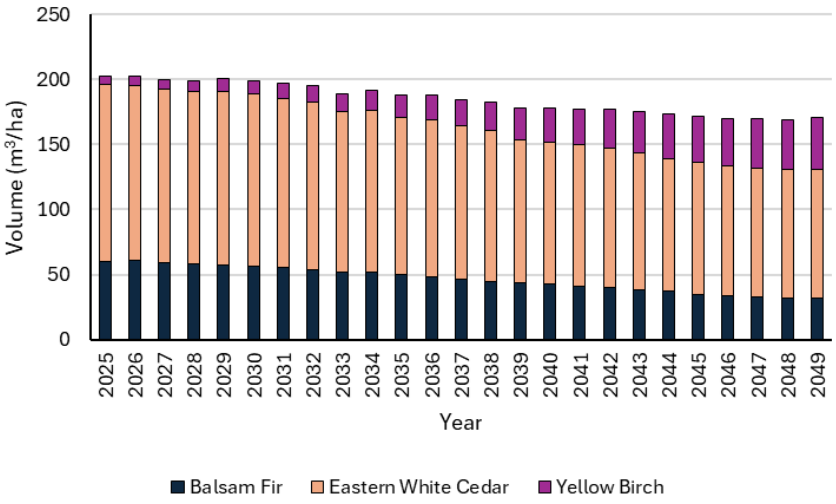


(C)

Appendix F Figure 2. Basal area of the Balsam Fir-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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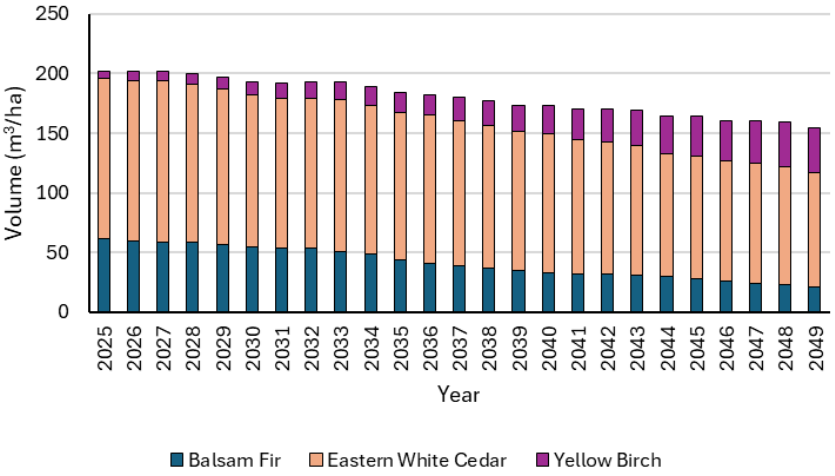

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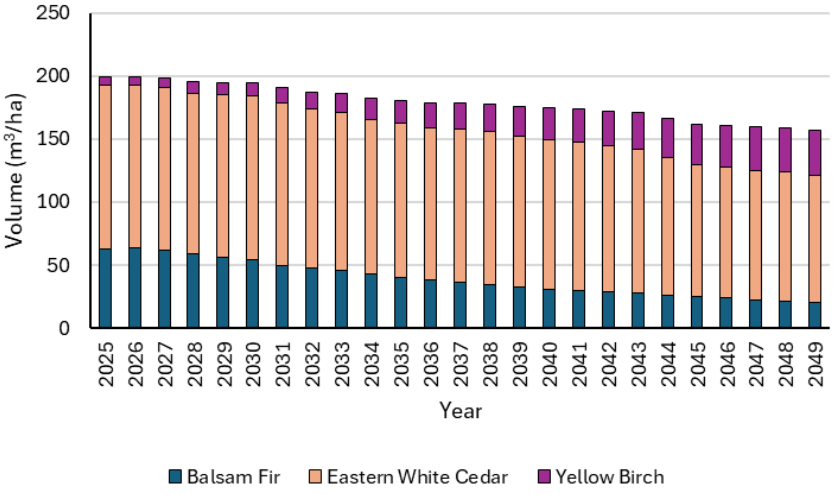
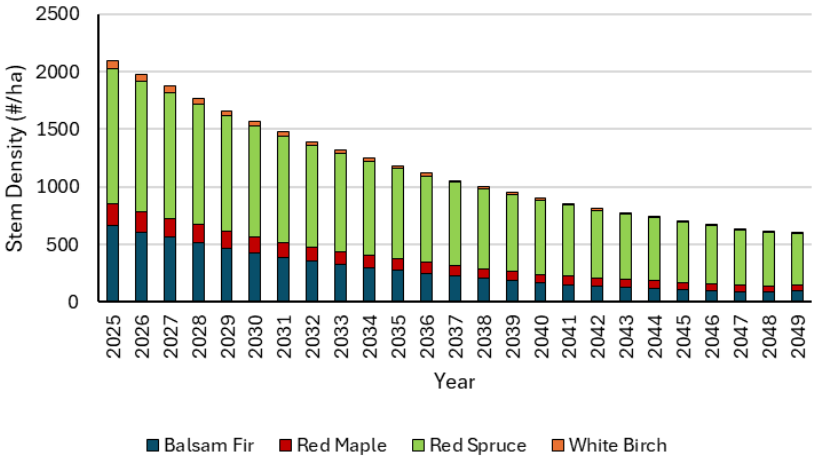


(C)

Appendix F Figure 3. Volume of the Balsam Fir-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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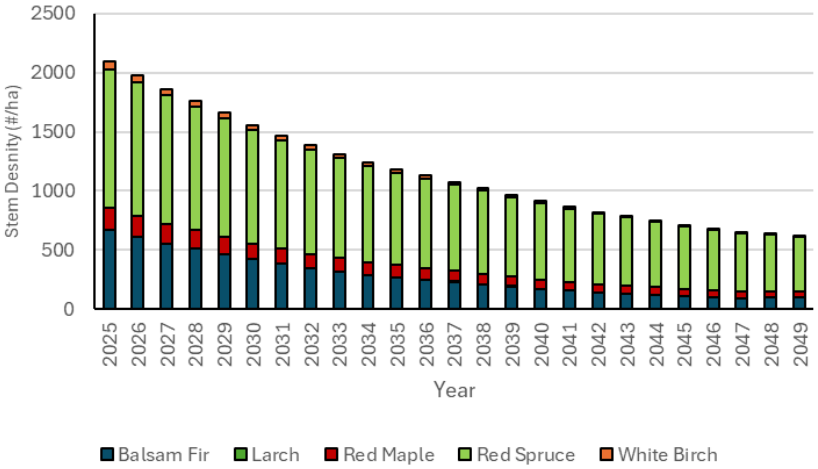

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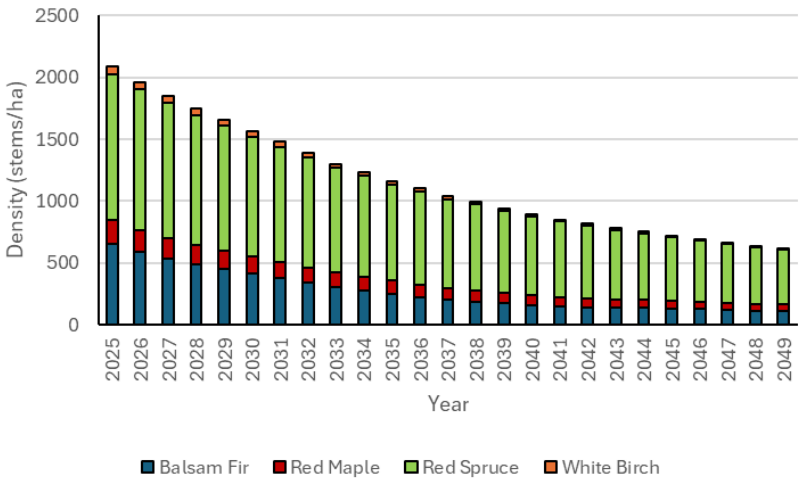
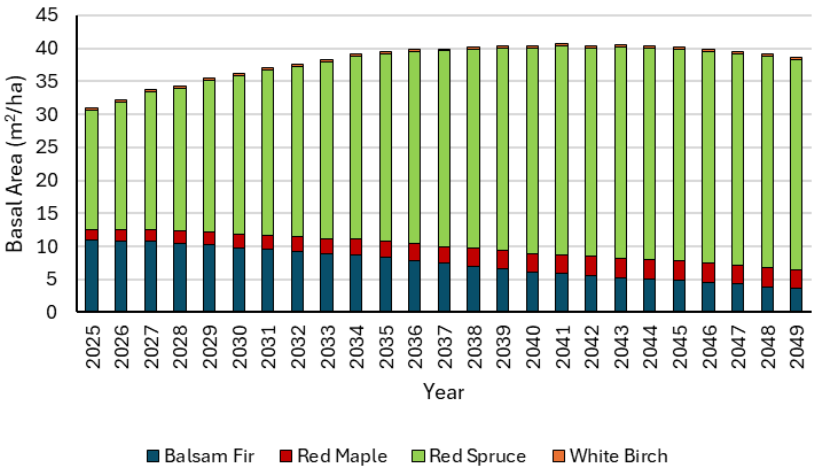


(C)

Appendix F Figure 4. Stem density of the Balsam Fir-Spruce stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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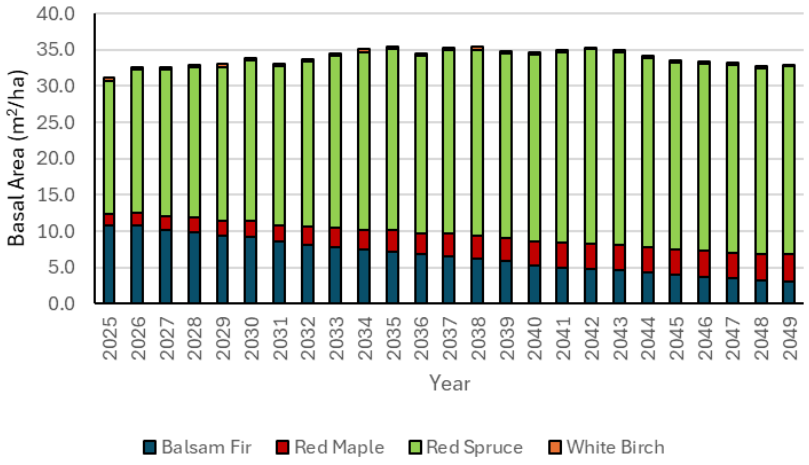

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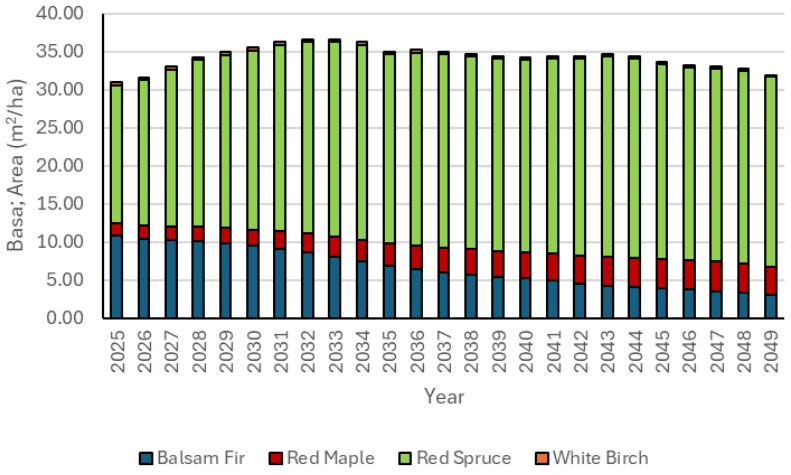

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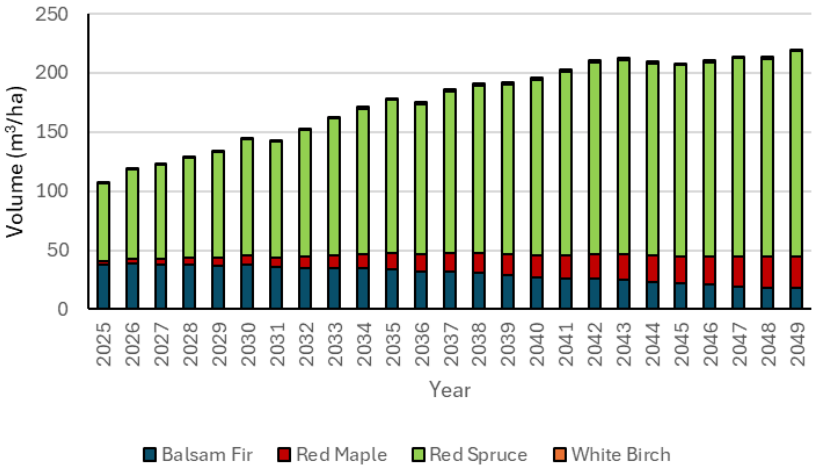
Appendix F Figure 5. Basal area of the Balsam Fir- Spruce stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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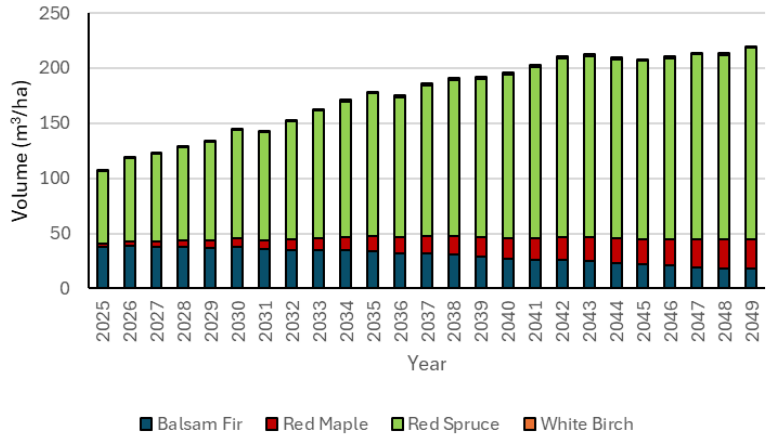

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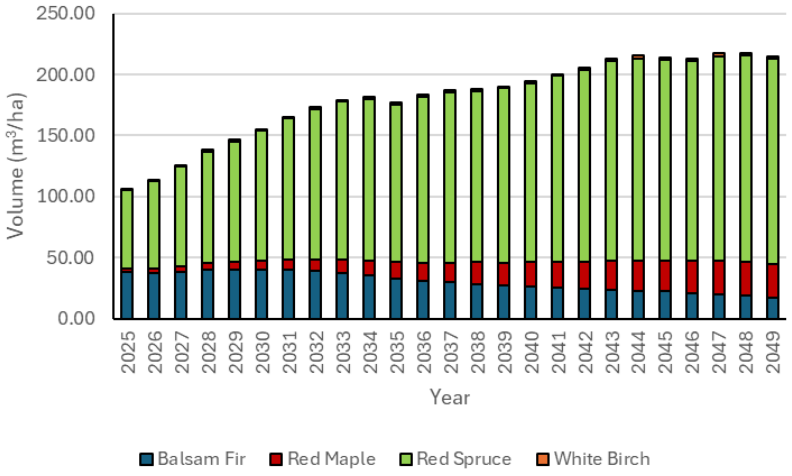
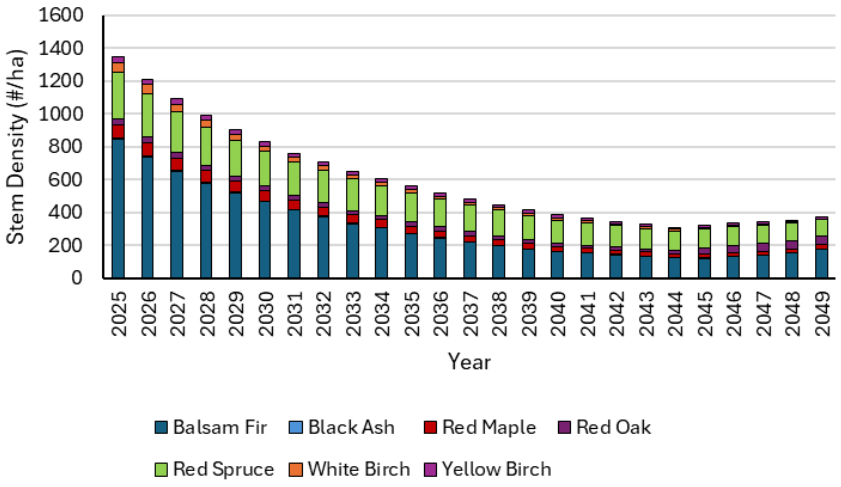


(C)

Appendix F Figure 6. Volume of the Balsam Fir-Spruce stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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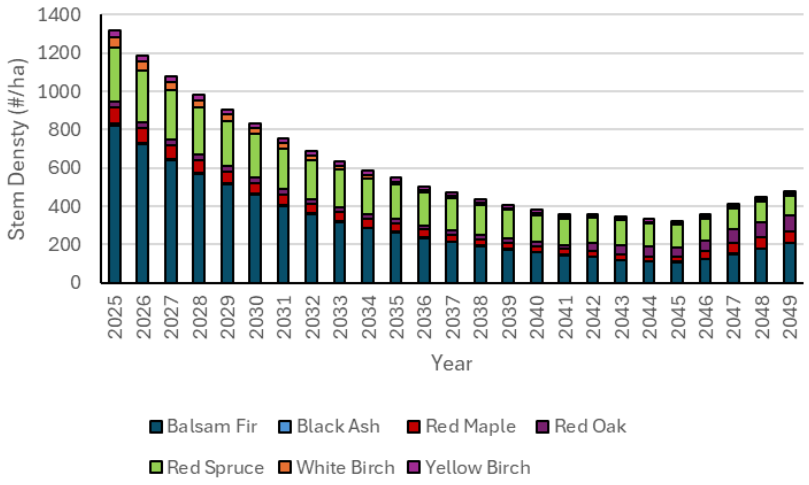

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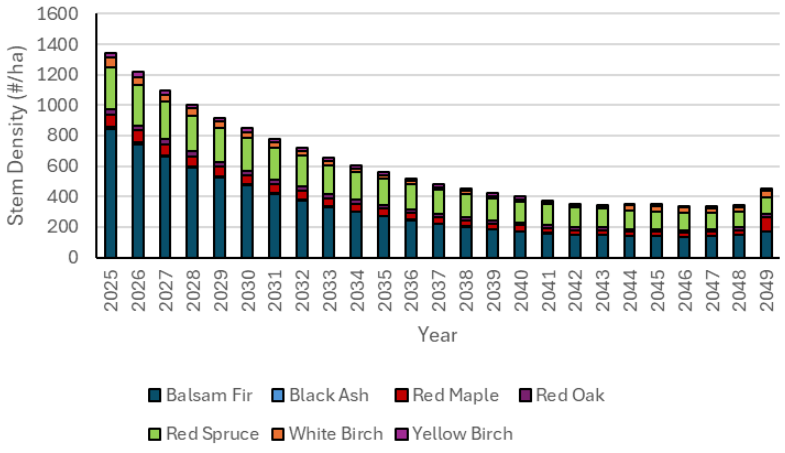
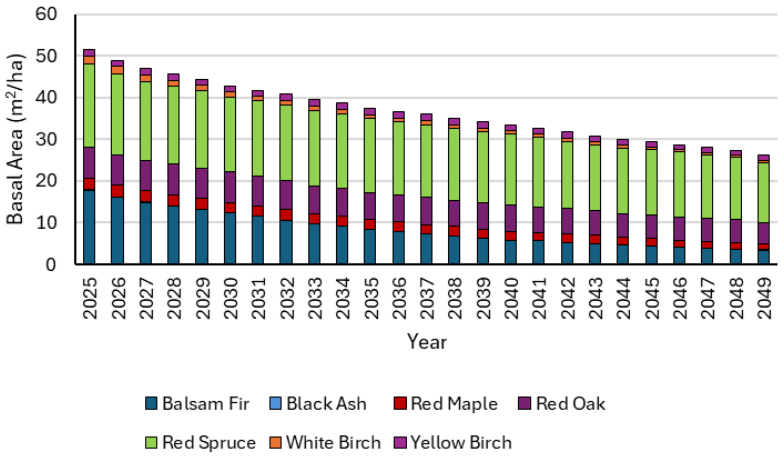


(C)

Appendix F Figure 7. Stem density of the Birch-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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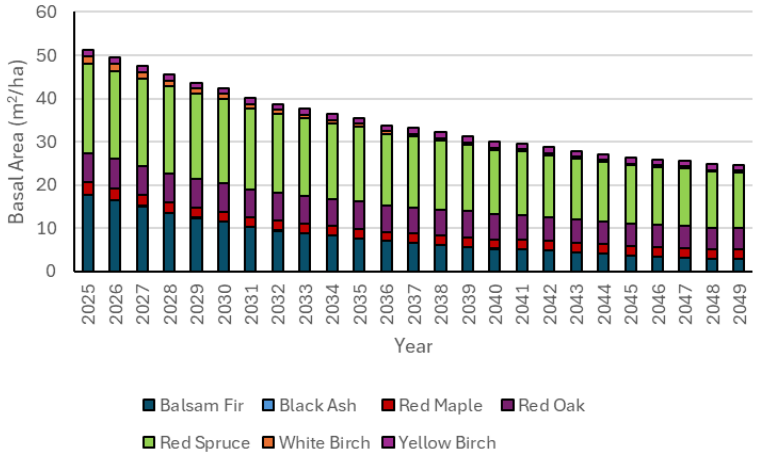

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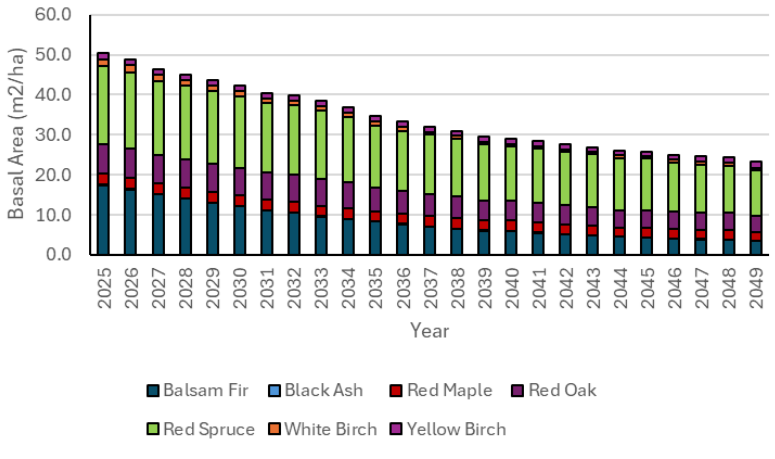

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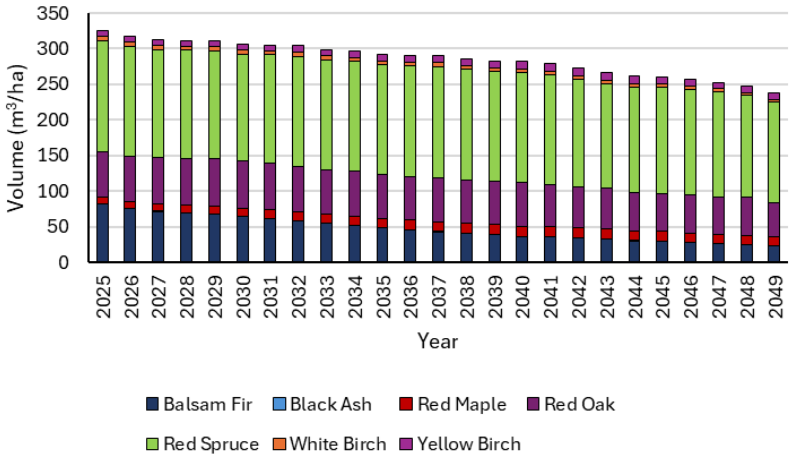
Appendix F Figure 8. Basal area of the Birch-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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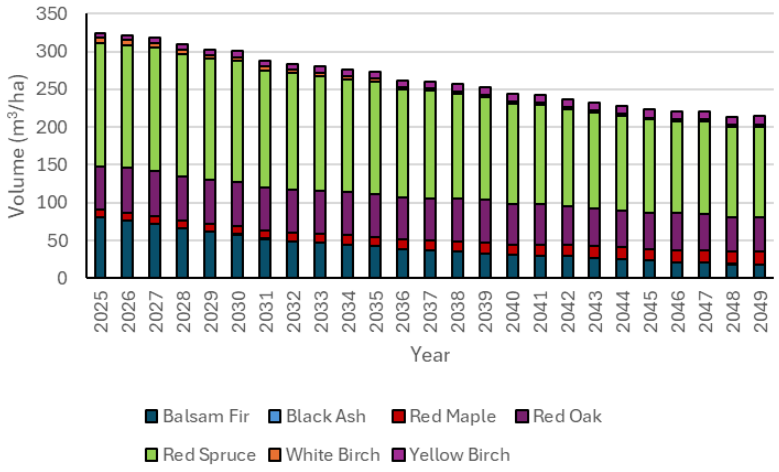

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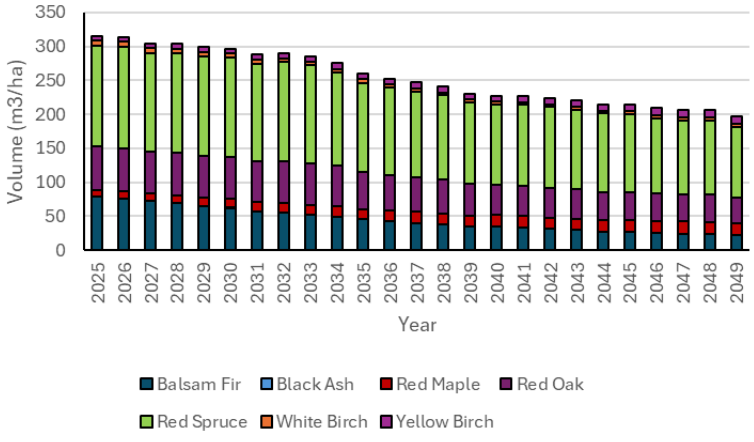

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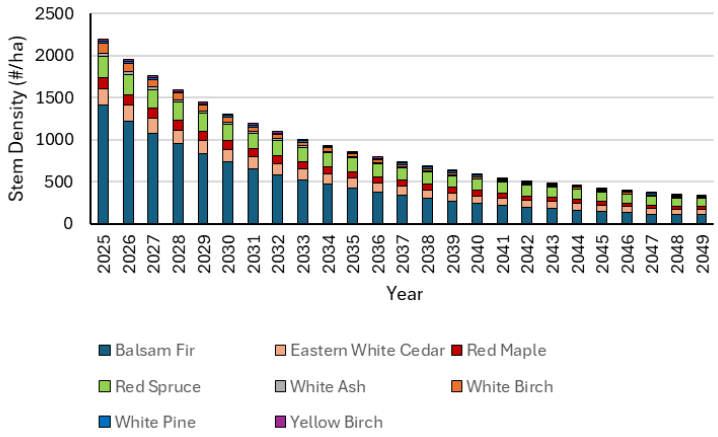
Appendix F Figure 9. Volume of the Birch-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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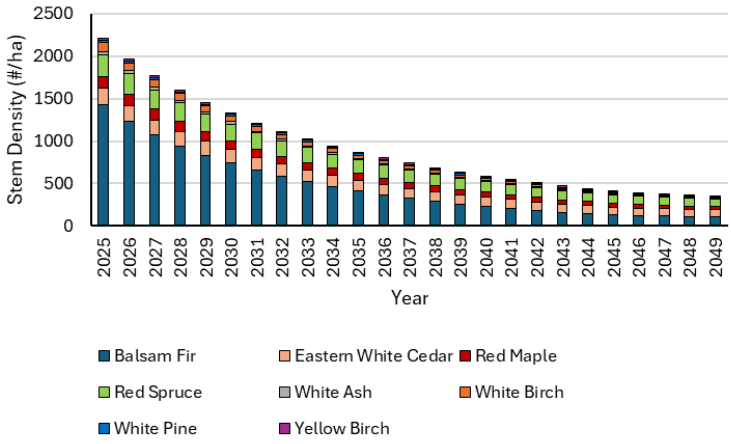

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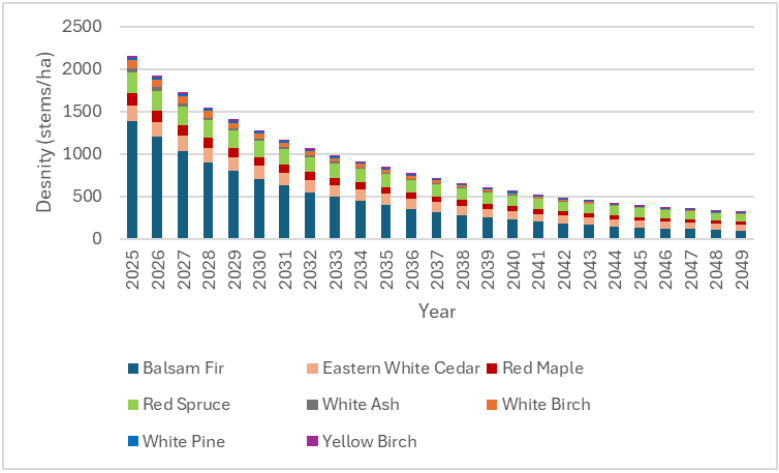
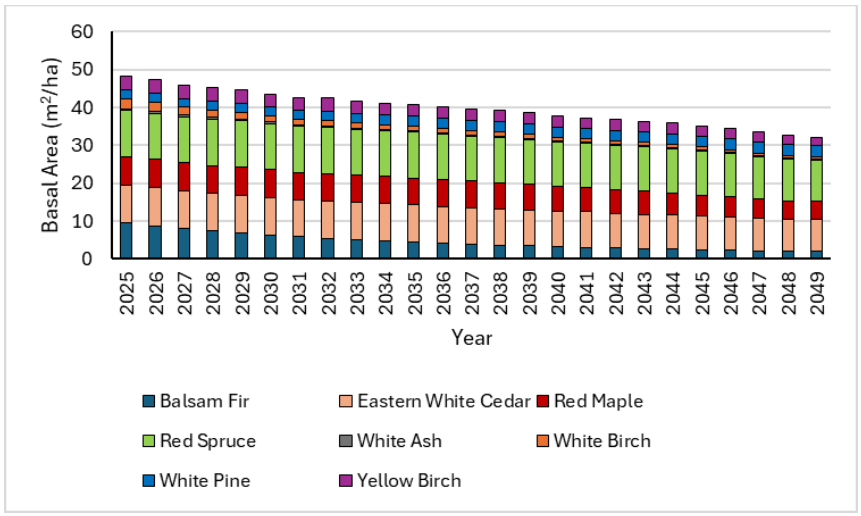


(C)

Appendix F Figure 10. Stem density of the Eastern White Cedar-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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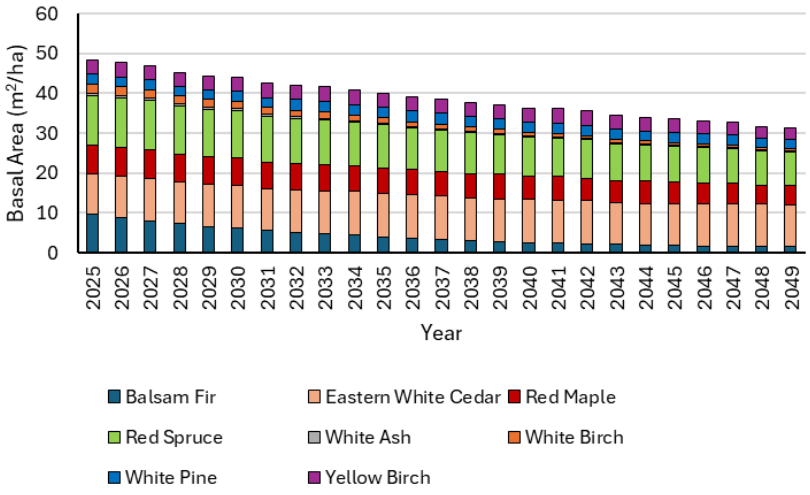

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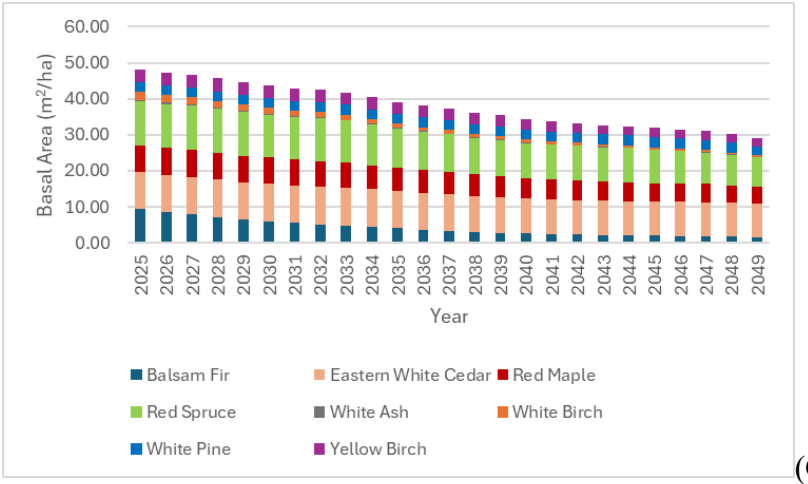
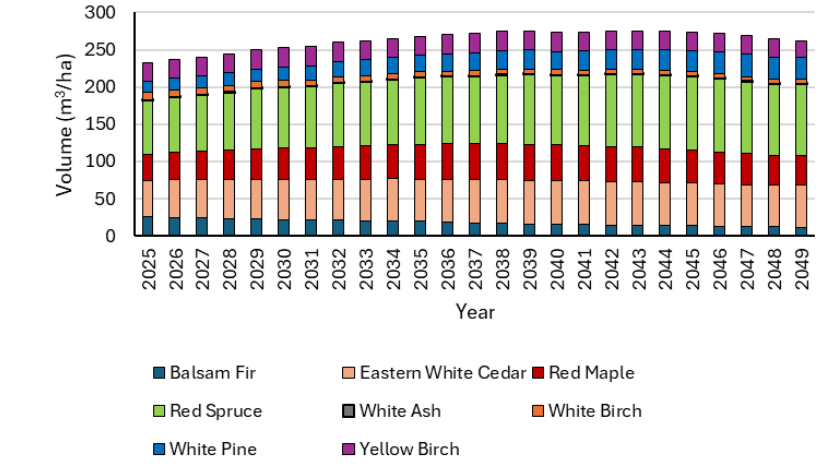


(C)

Appendix F Figure 11. Basal area of the Eastern White Cedar-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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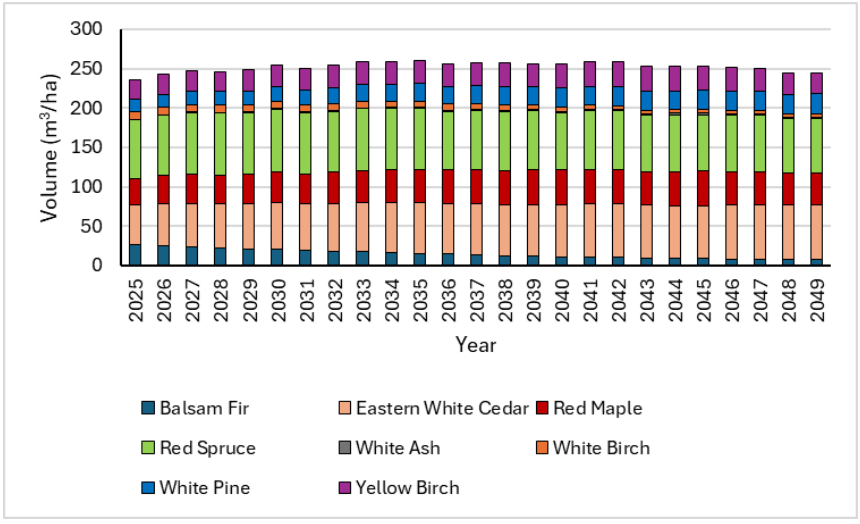

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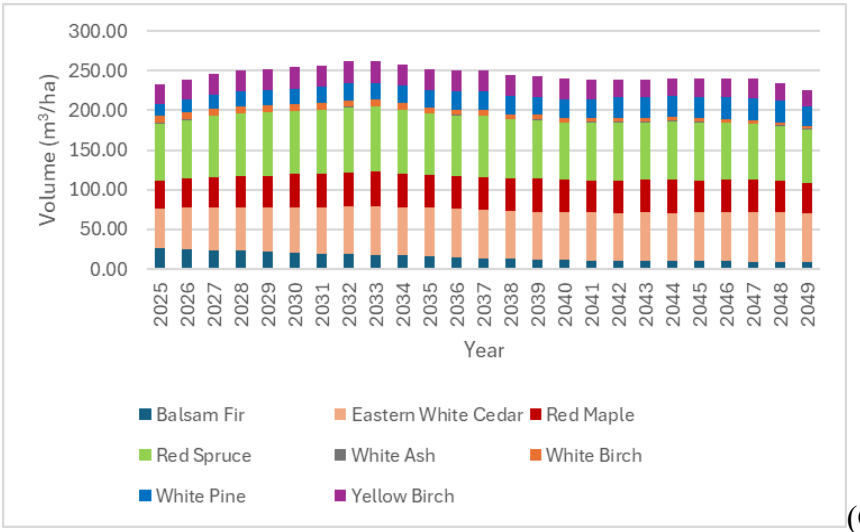
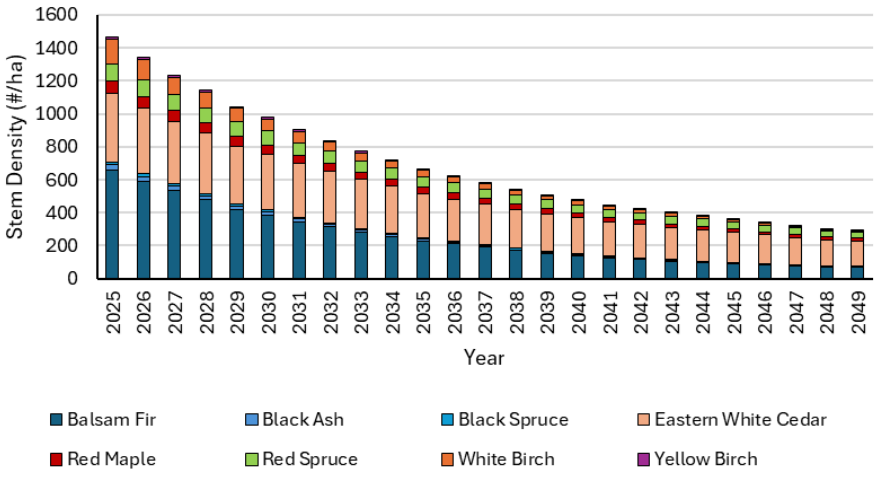


(C)

Appendix F Figure 12. Volume of the Eastern White Cedar-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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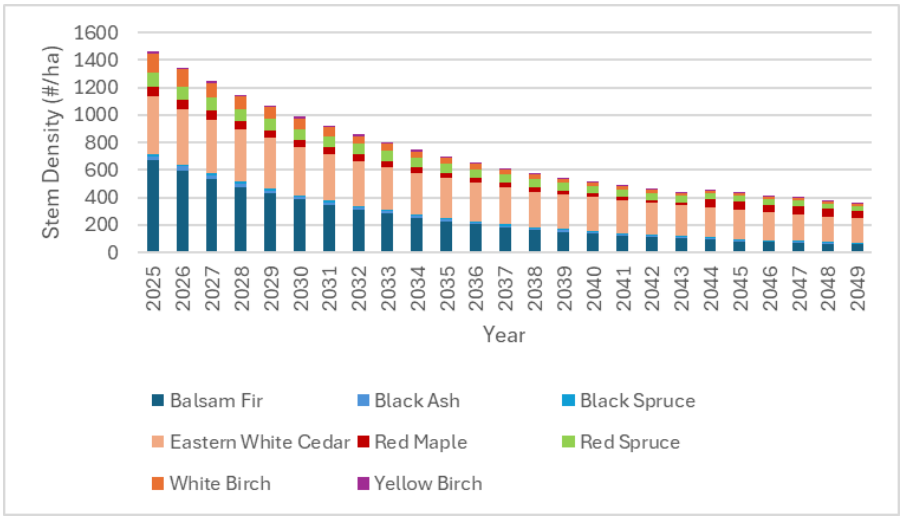

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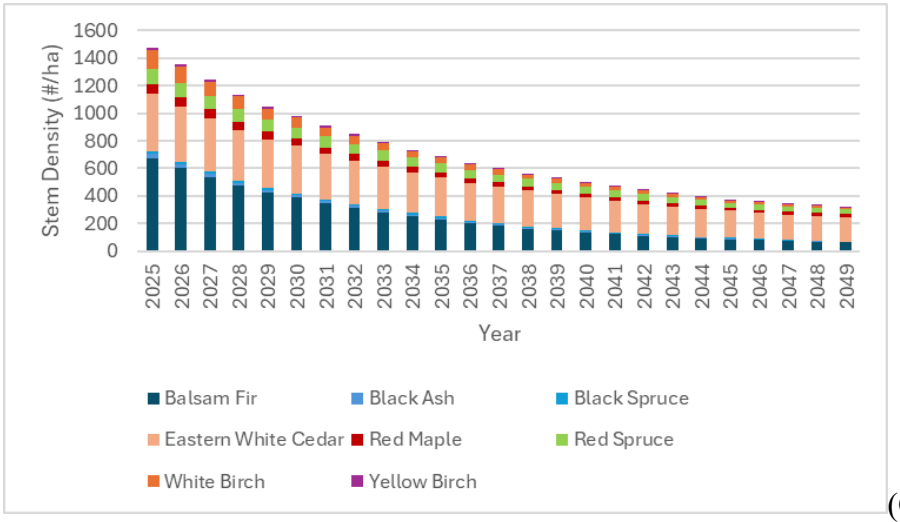
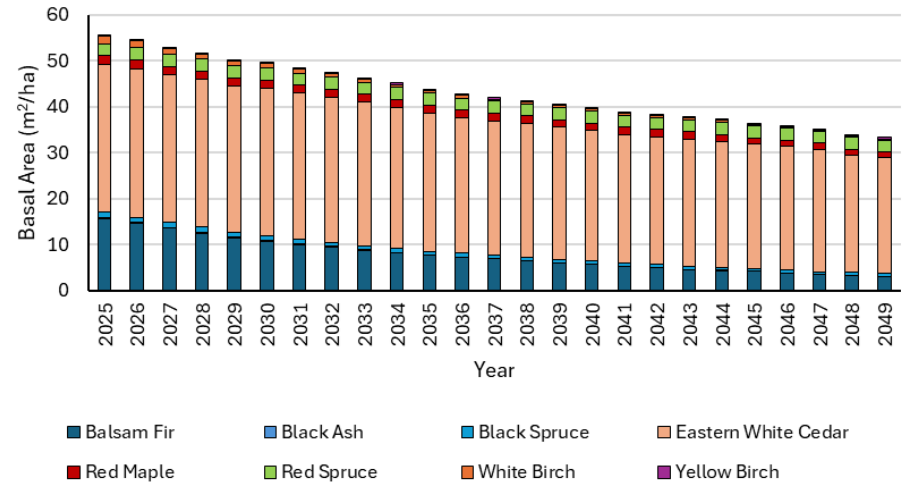


(C)

Appendix F Figure 13. Stem density of the Eastern White Cedar-Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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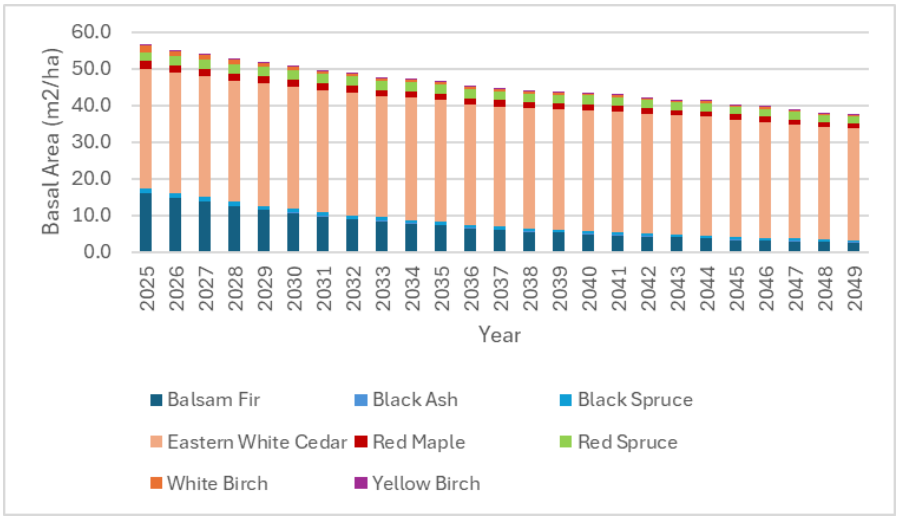

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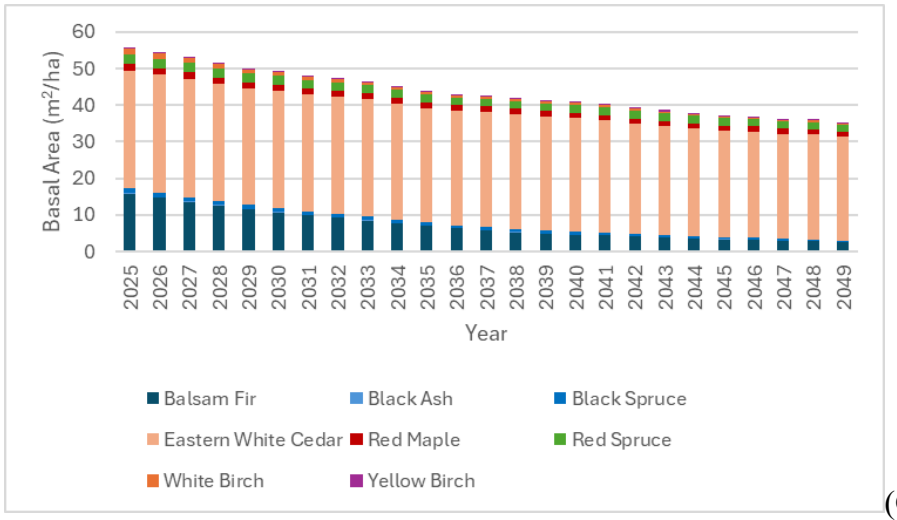

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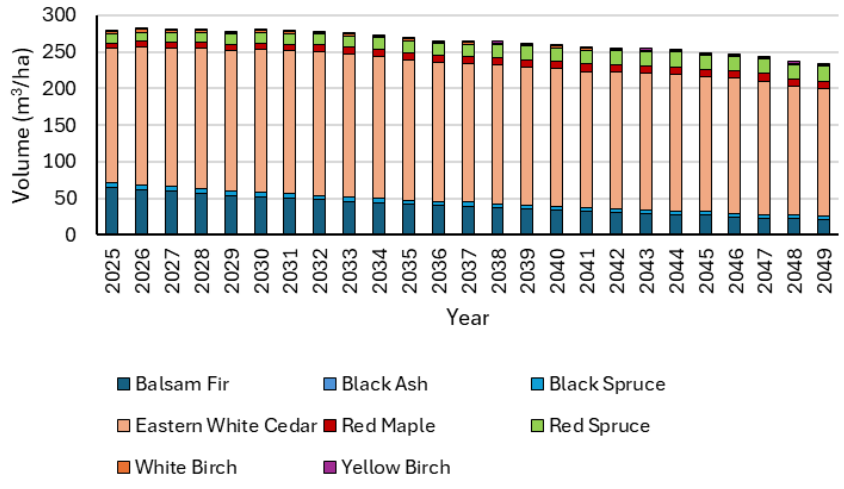
Appendix F Figure 14. Basal area of the Eastern White Cedar-Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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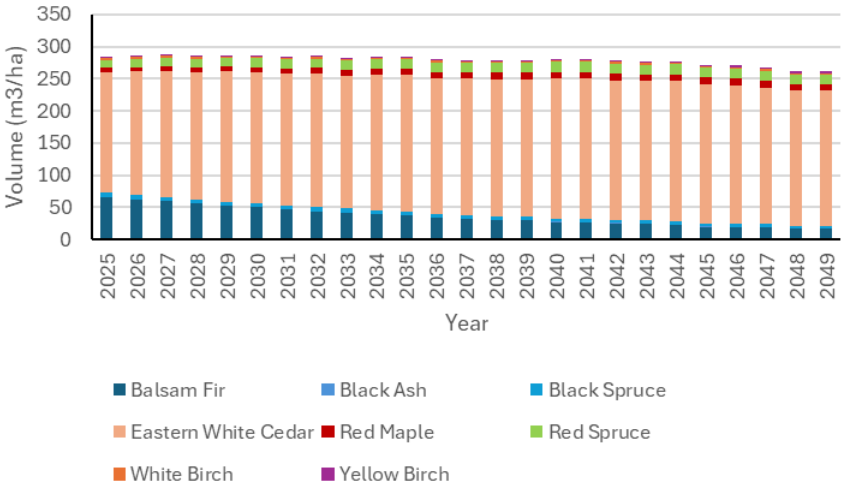

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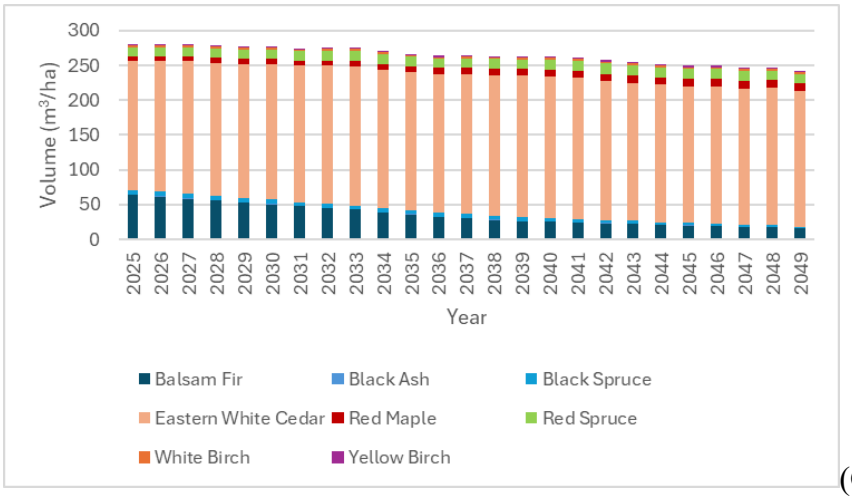
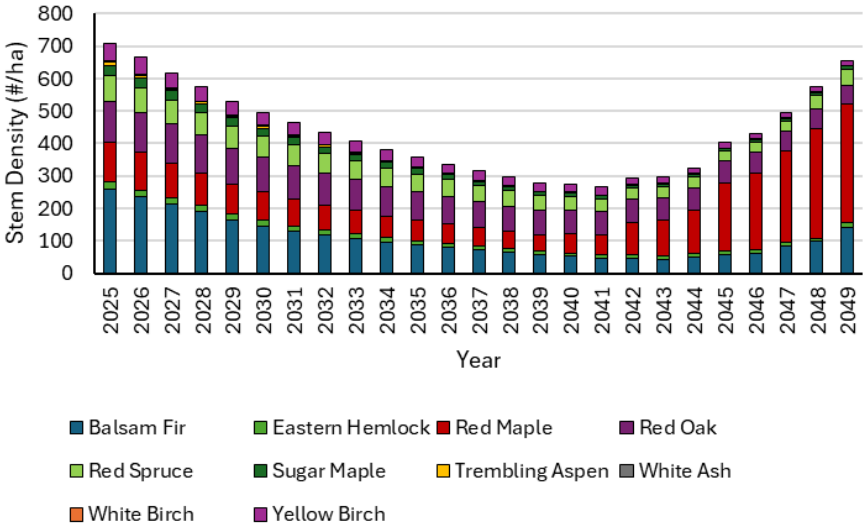


(C)

Appendix F Figure 15. Volume of the Eastern White Cedar-Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



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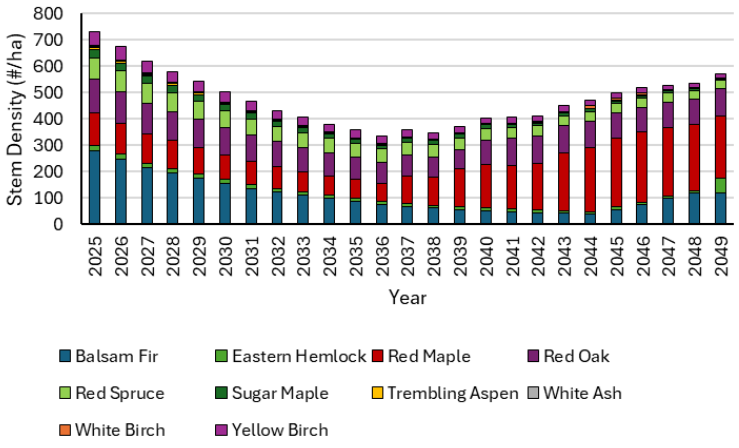

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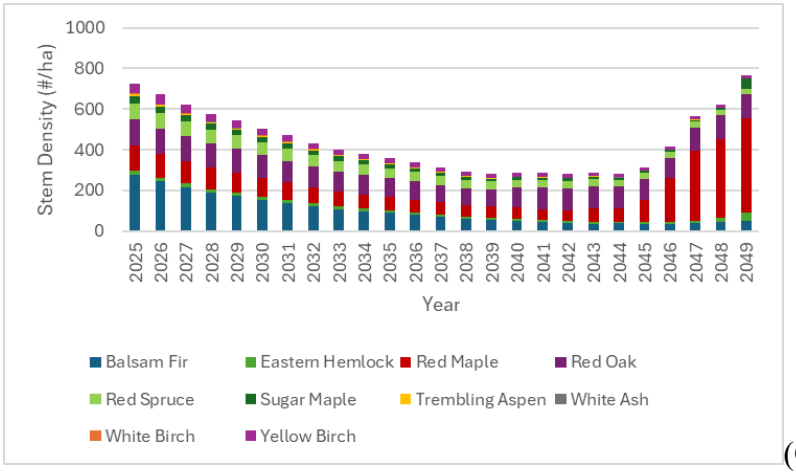
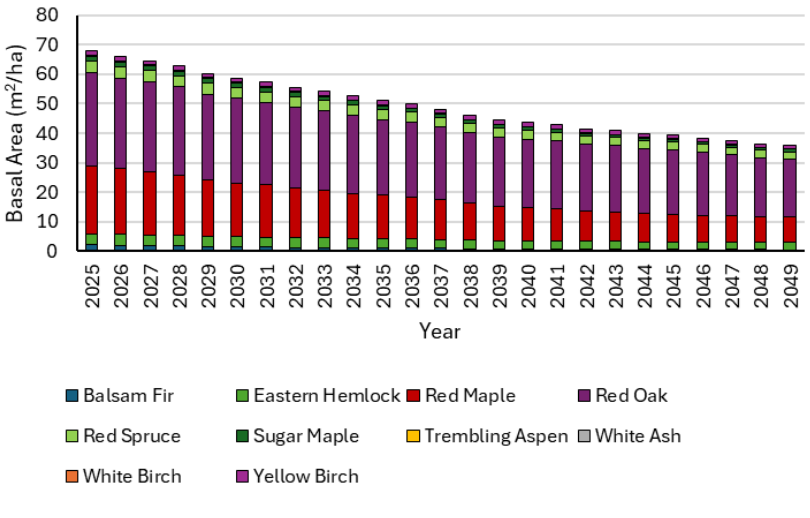
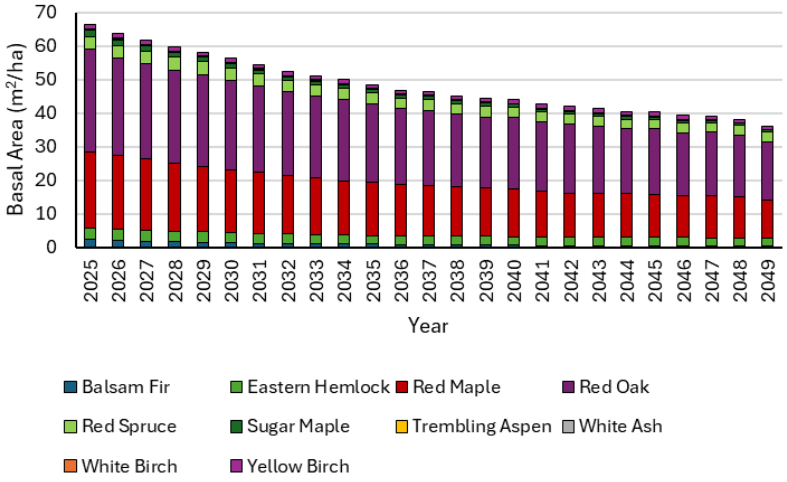


(C)

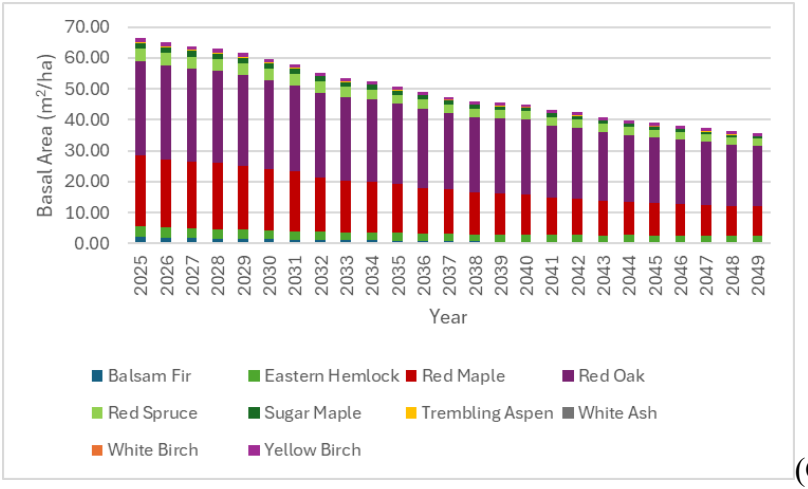
Appendix F Figure 16. Stem density of the Intolerant Hardwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

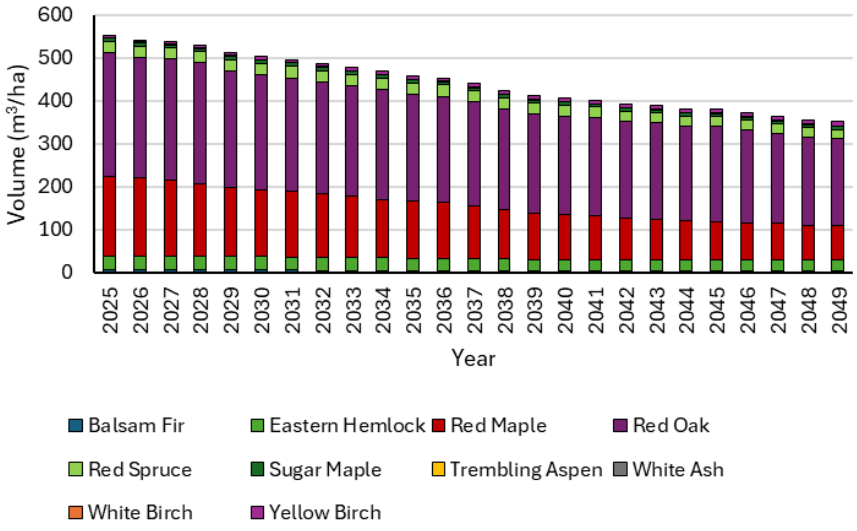


(B)

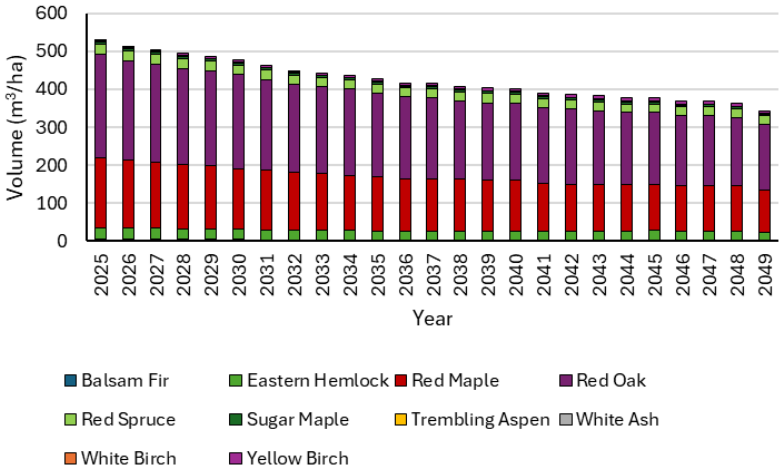


(C)

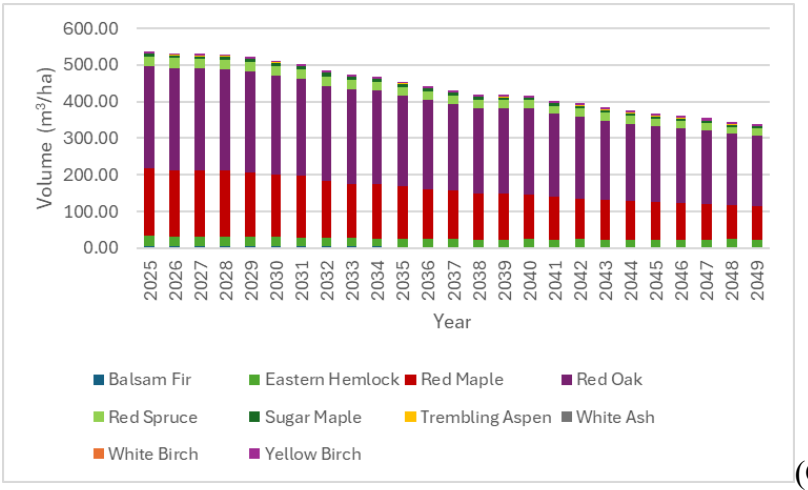
Appendix F Figure 17. Basal area of the Intolerant Hardwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

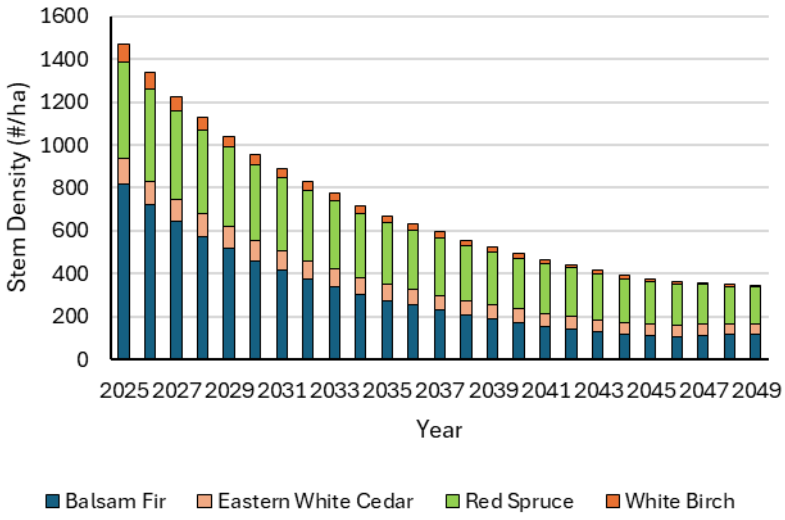


(B)

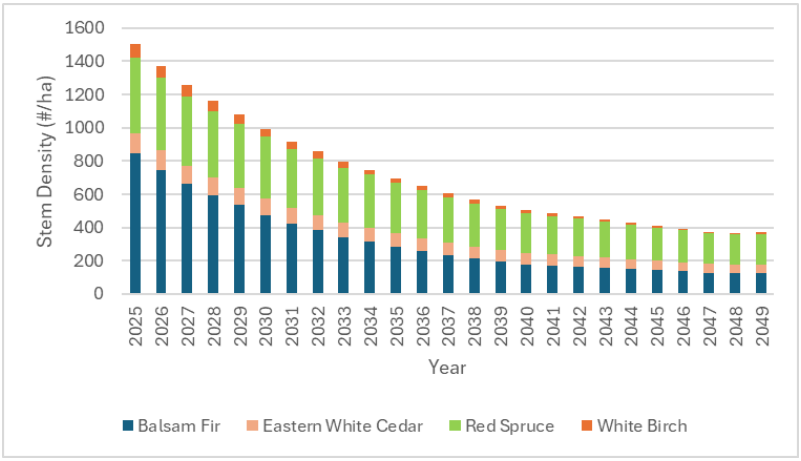


(C)

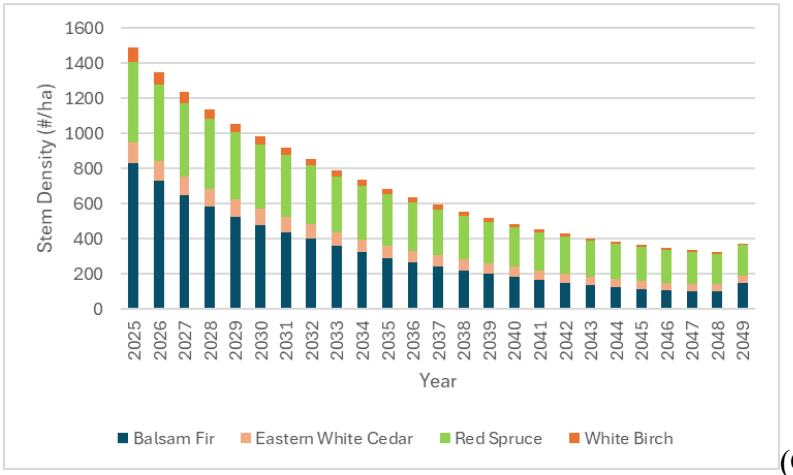
Appendix F Figure 18. Volume of the Intolerant Hardwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

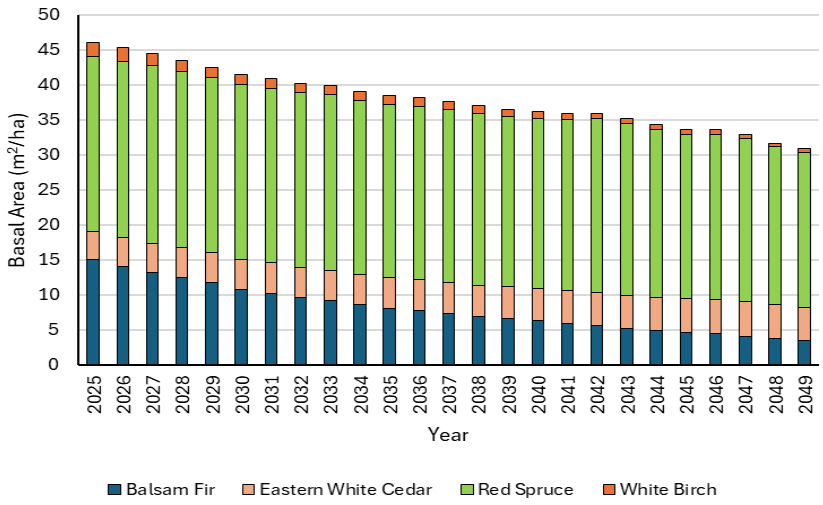


(B)

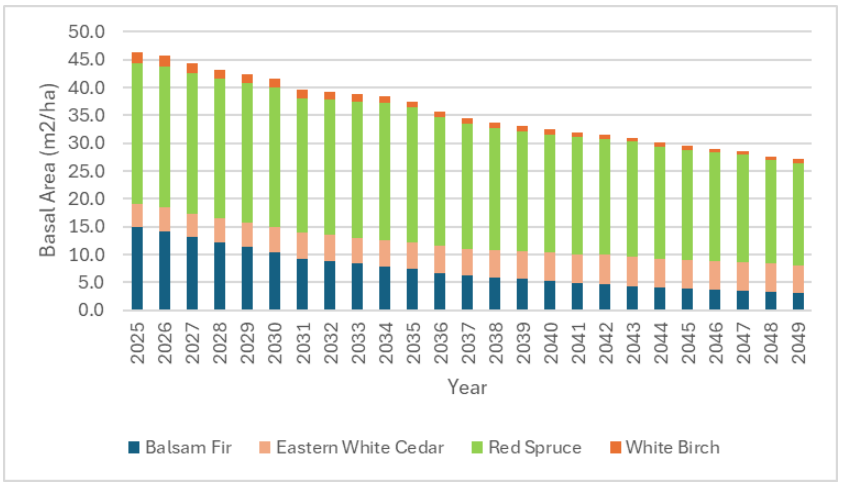


(C)

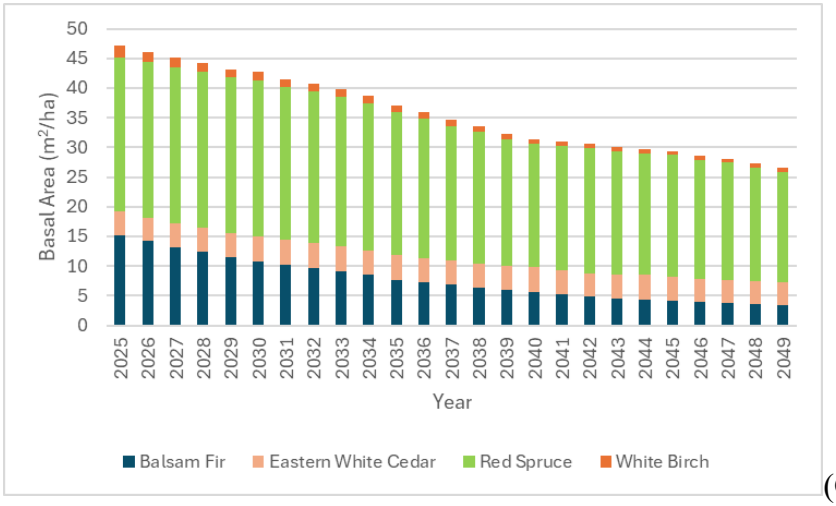
Appendix F Figure 19. Stem density of the Intolerant Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

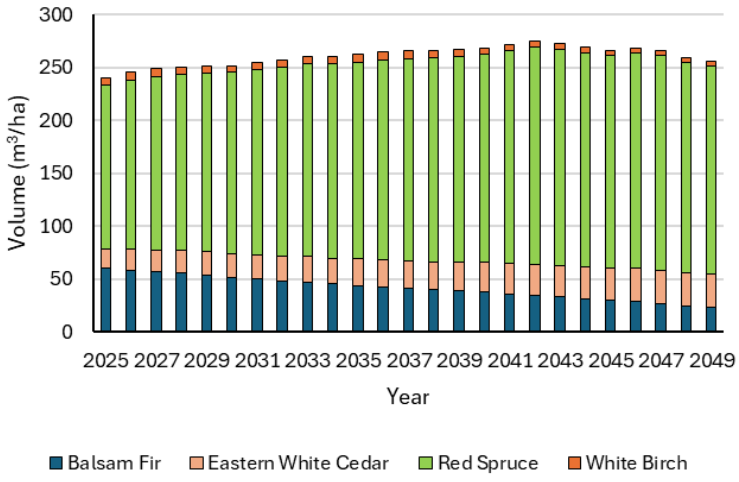


(B)

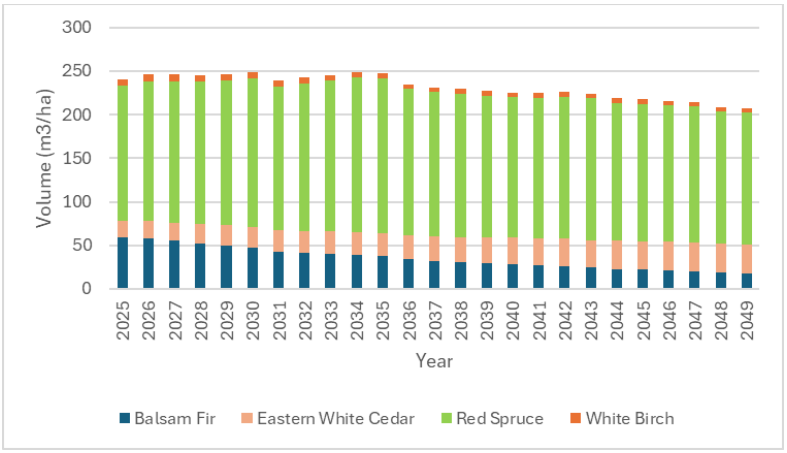


(C)

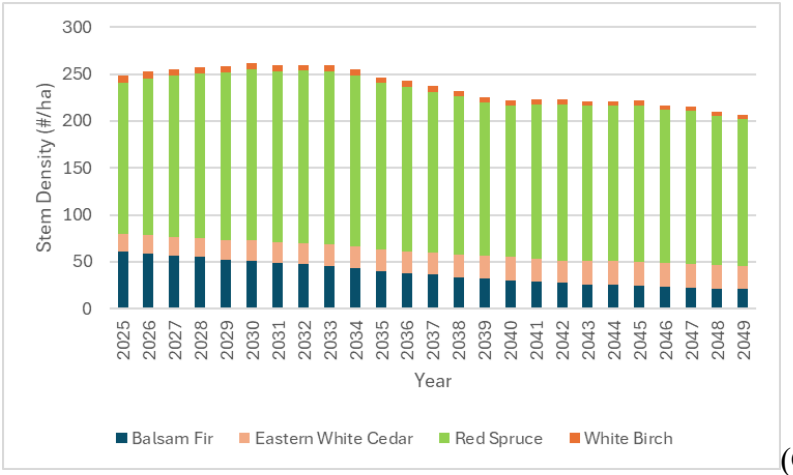
Appendix F Figure 20. Basal area of the Intolerant Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

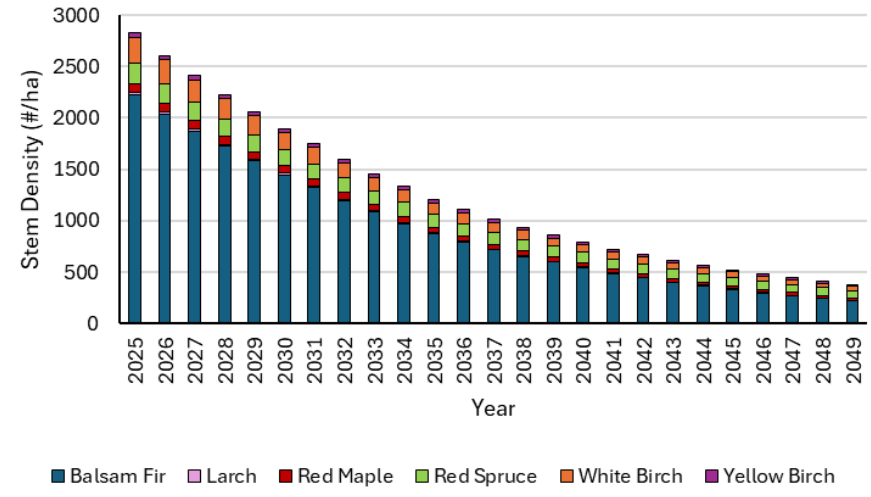


(B)

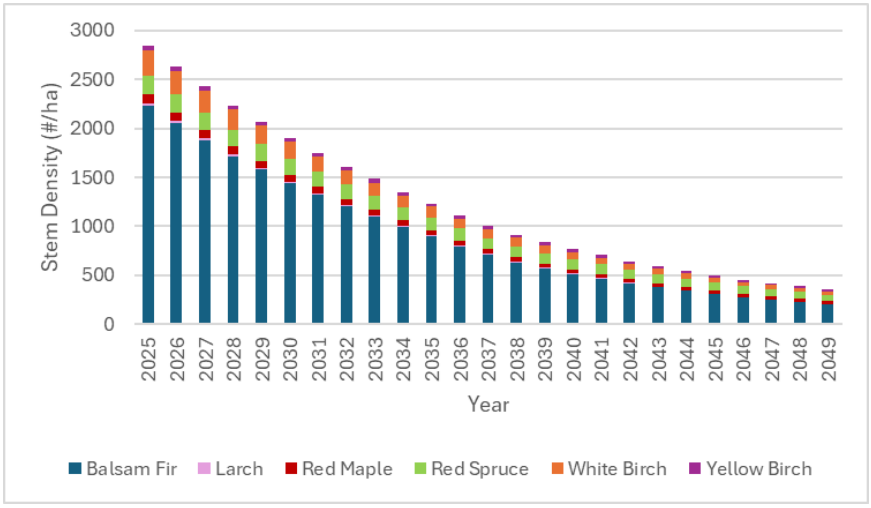


(C)

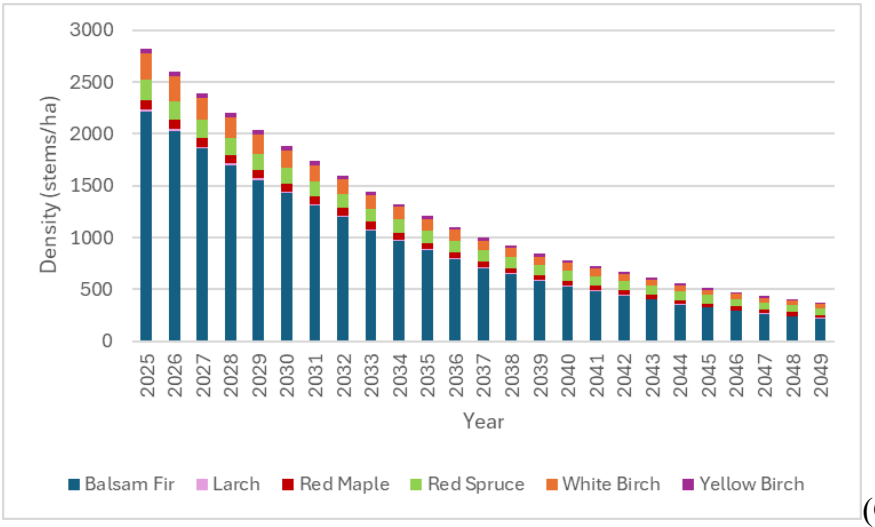
Appendix F Figure 21. Volume of the Intolerant Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

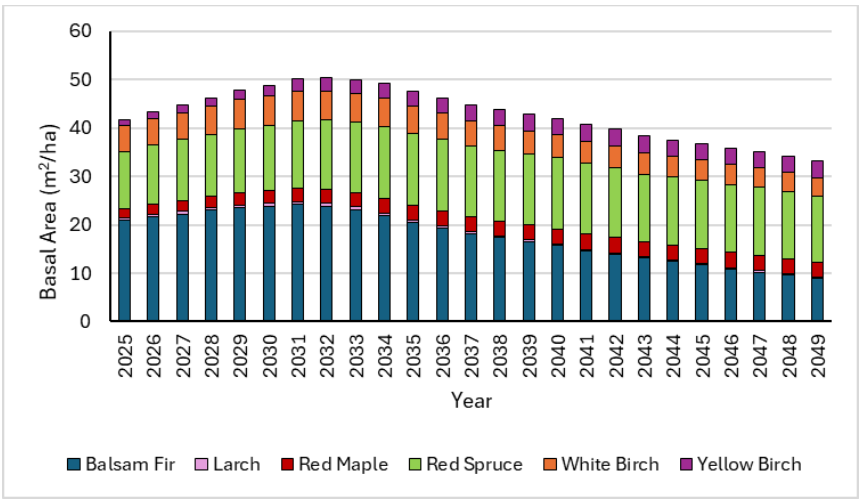


(B)

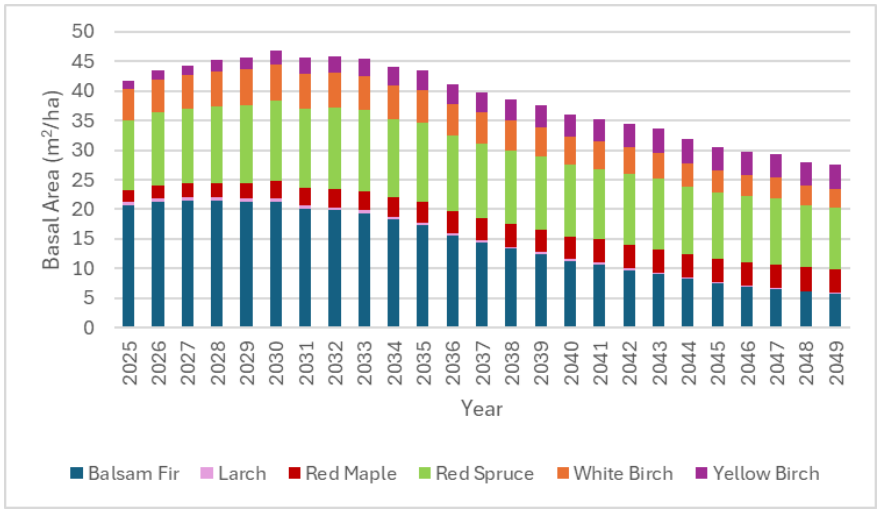


(C)

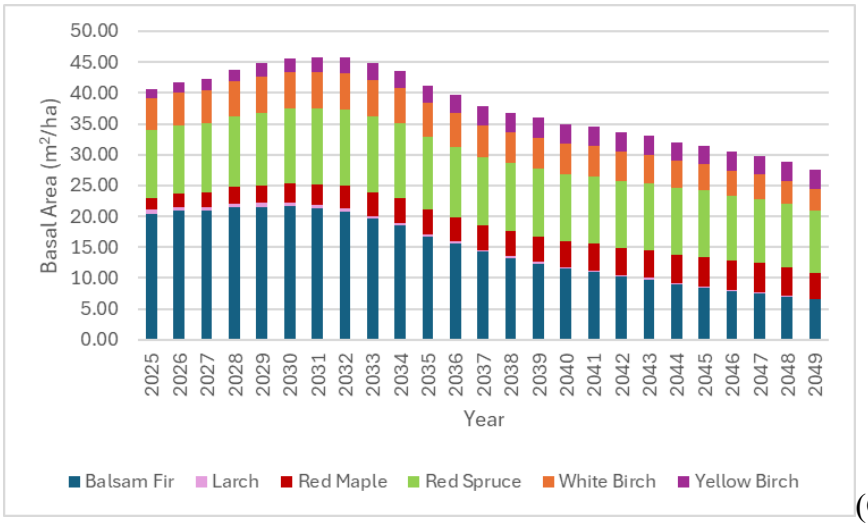
Appendix F Figure 22. Stem density of the Spruce-Fir stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

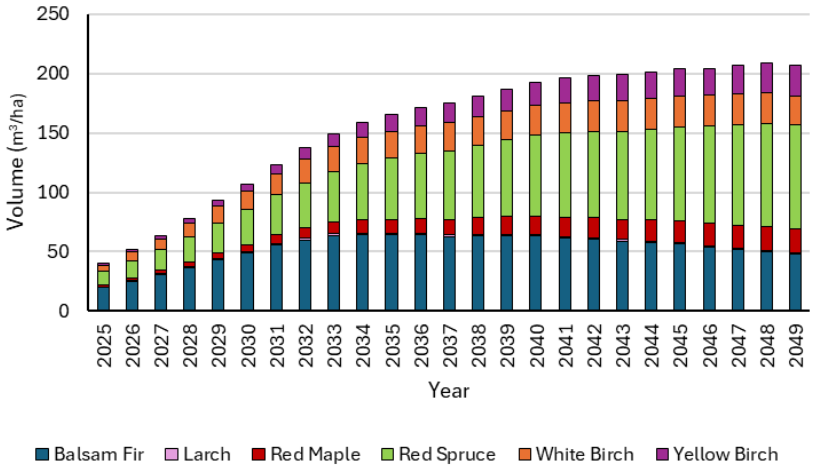


(B)

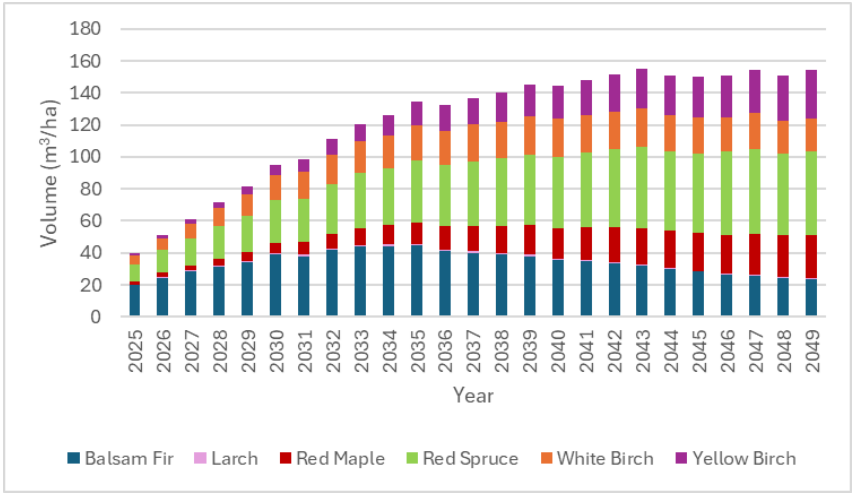


(C)

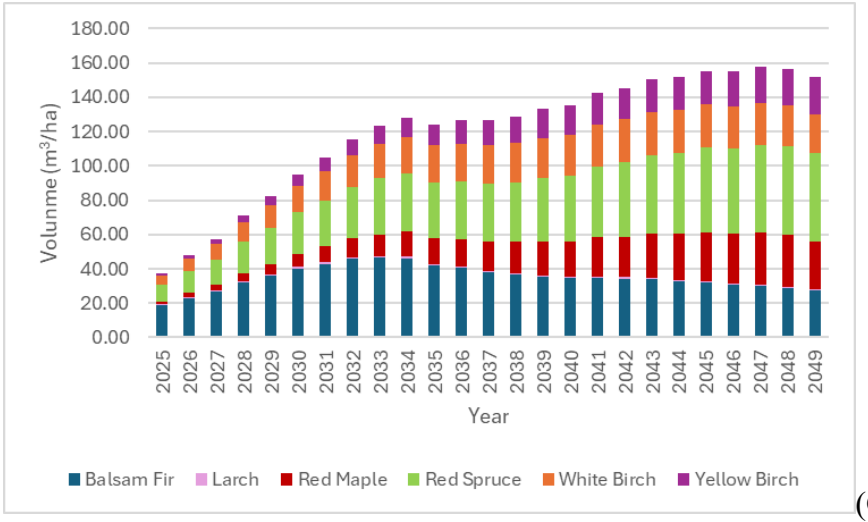
Appendix F Figure 23. Basal area of the Spruce-Fir stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

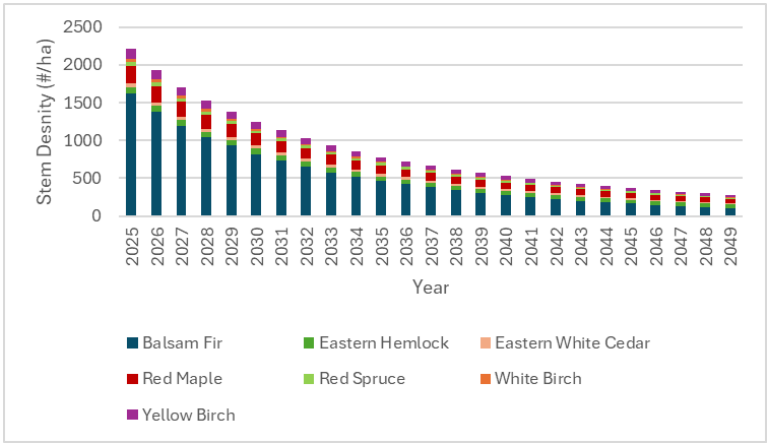


(B)

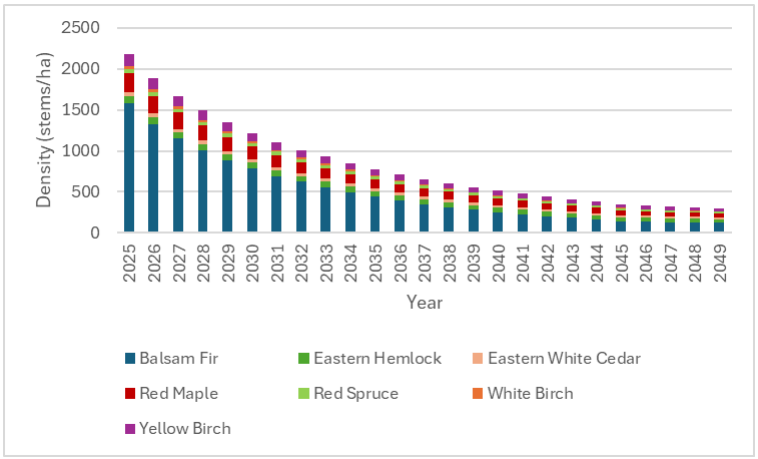


(C)

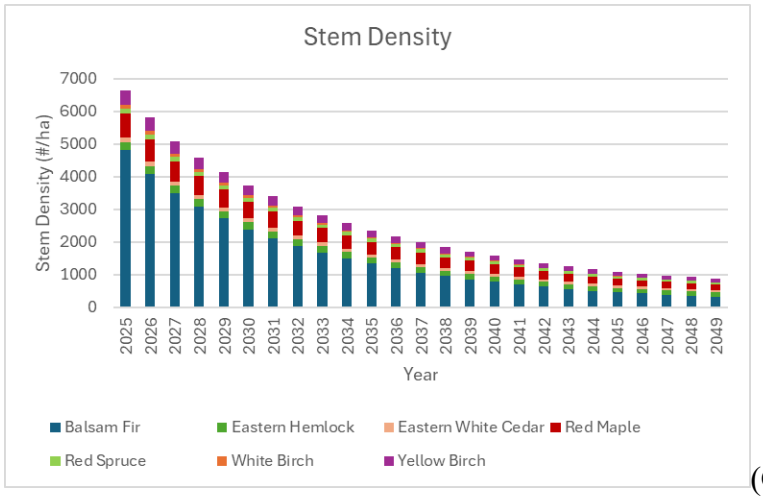
Appendix F Figure 24. Volume of the Spruce-Fir stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

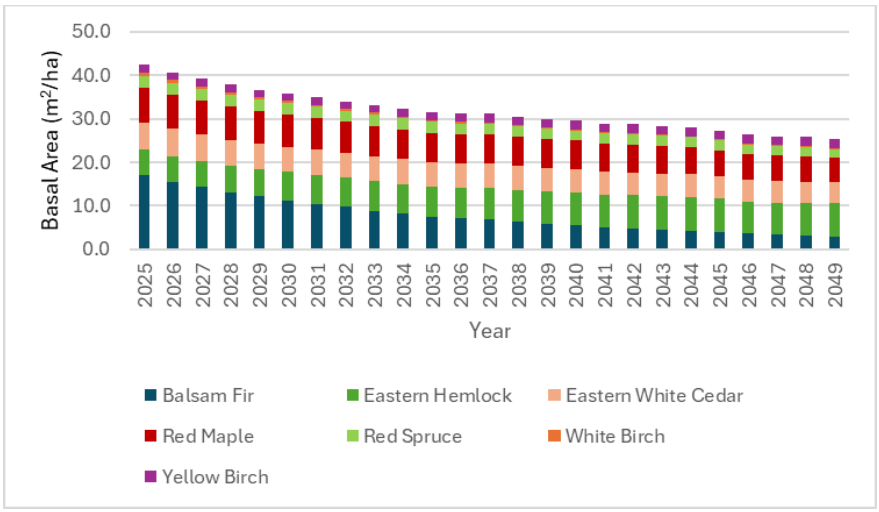


(B)

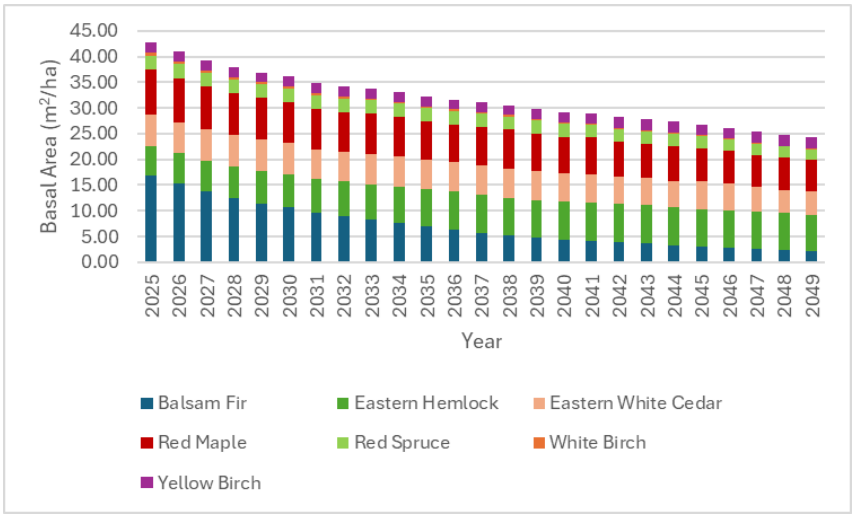


(C)

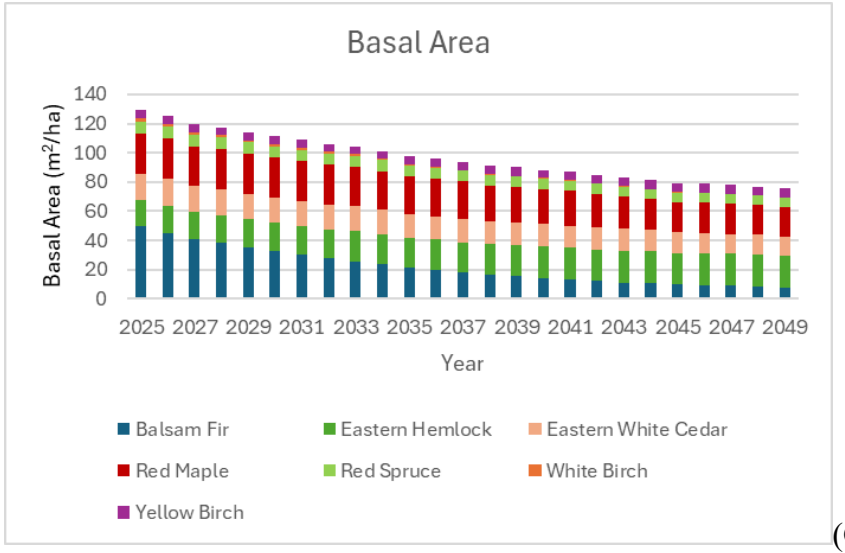
Appendix F Figure 25. Stem density of the Spruce-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

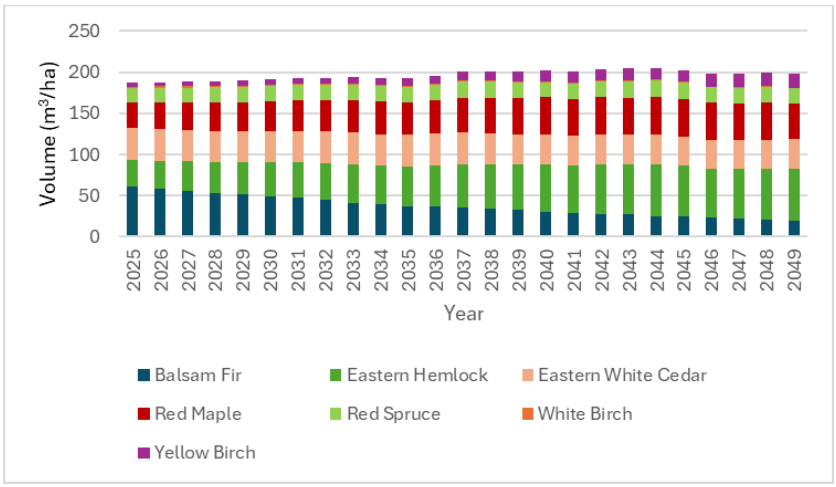


(B)

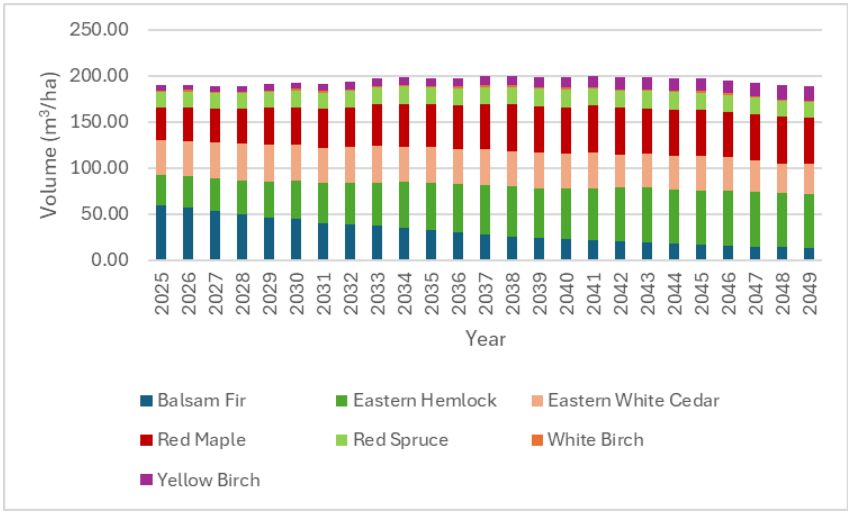


(C)

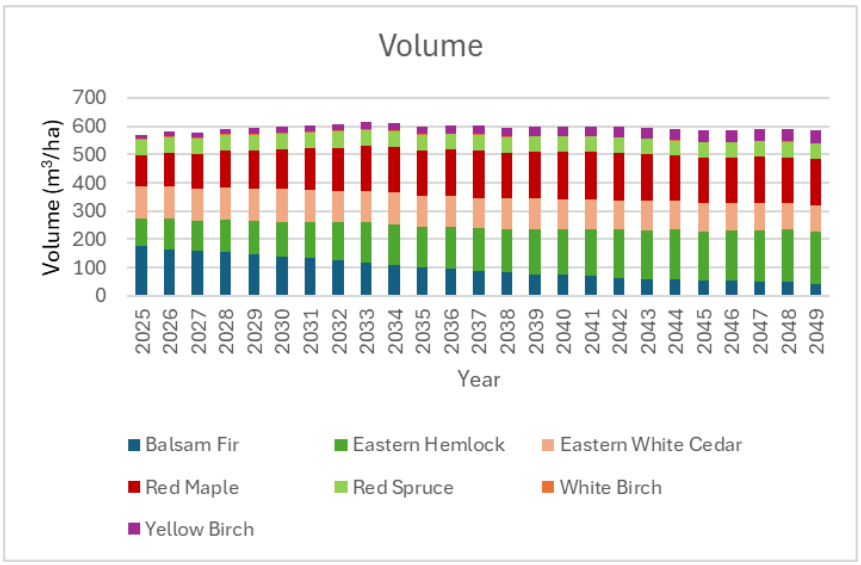
Appendix F Figure 26. Basal area of the Spruce-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

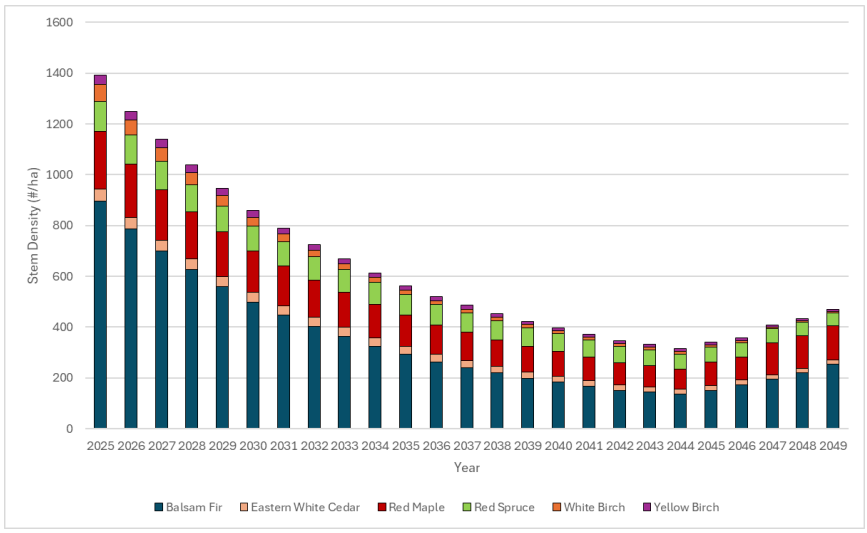


(B)

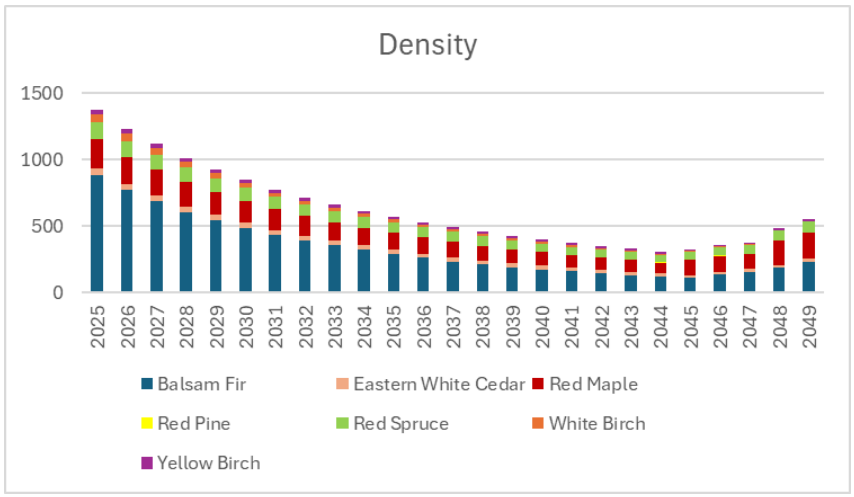


(C)

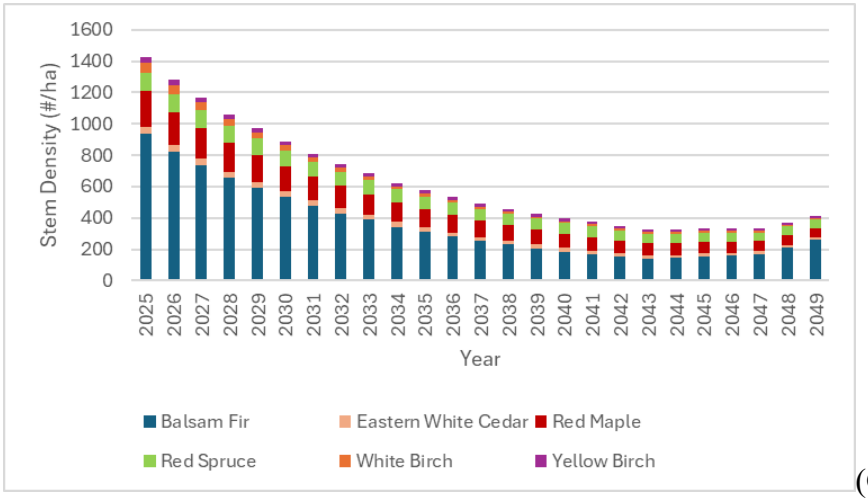
Appendix F Figure 27. Volume of the Spruce-Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

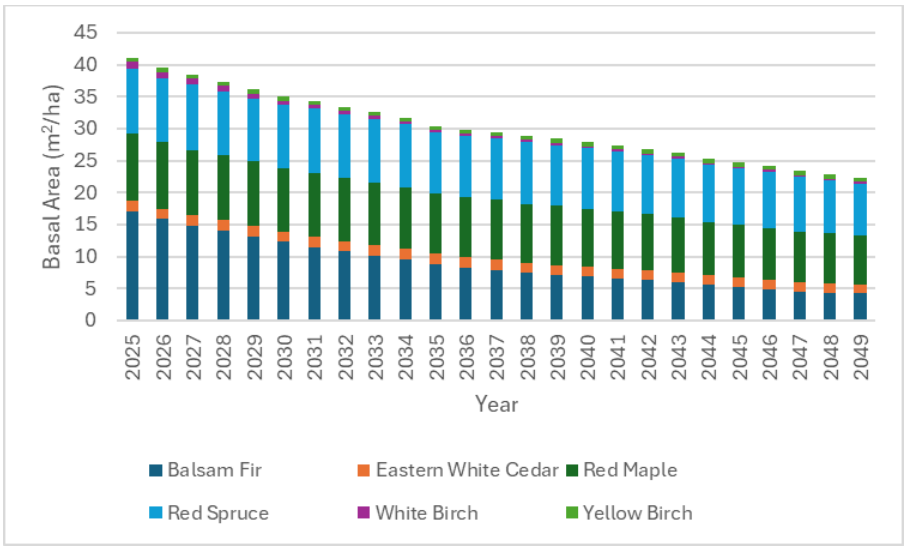


(B)

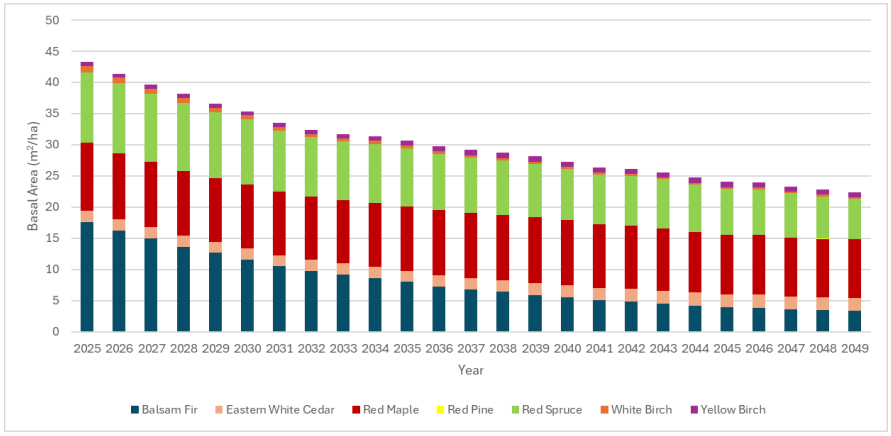


(C)

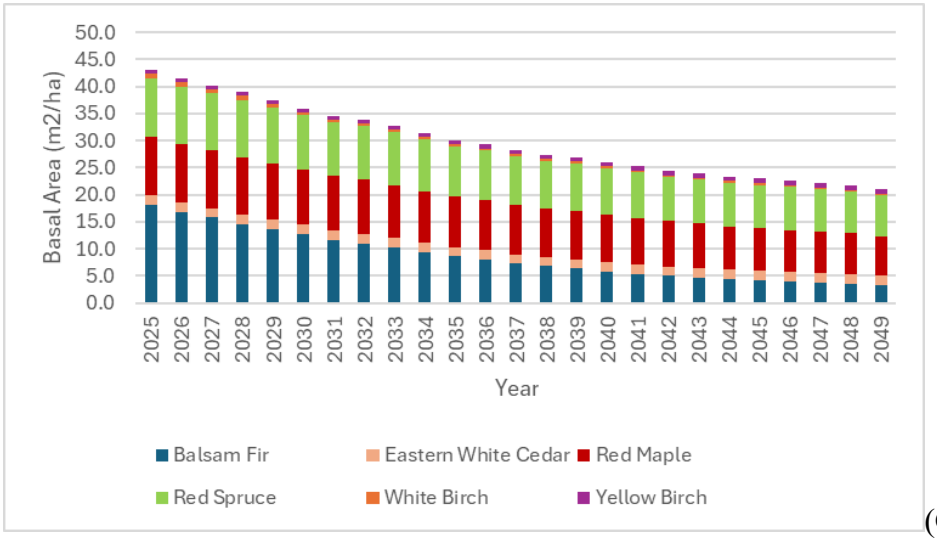
Appendix F Figure 28. Stem density of the Spruce stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

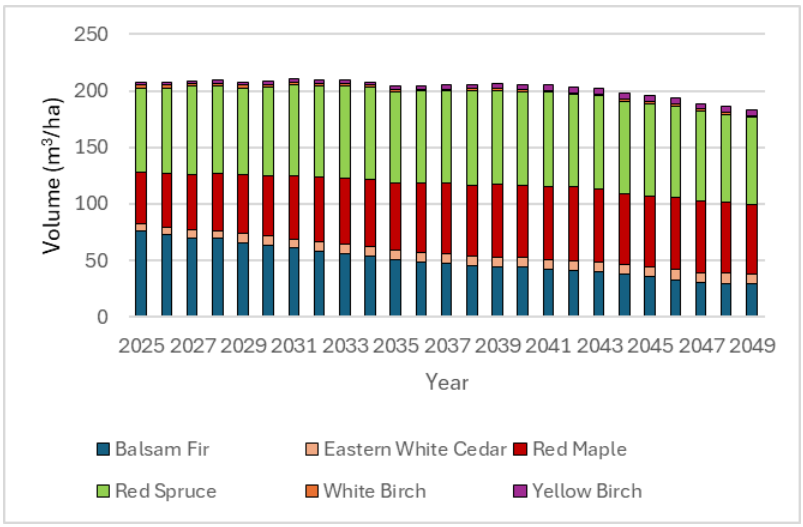


(B)

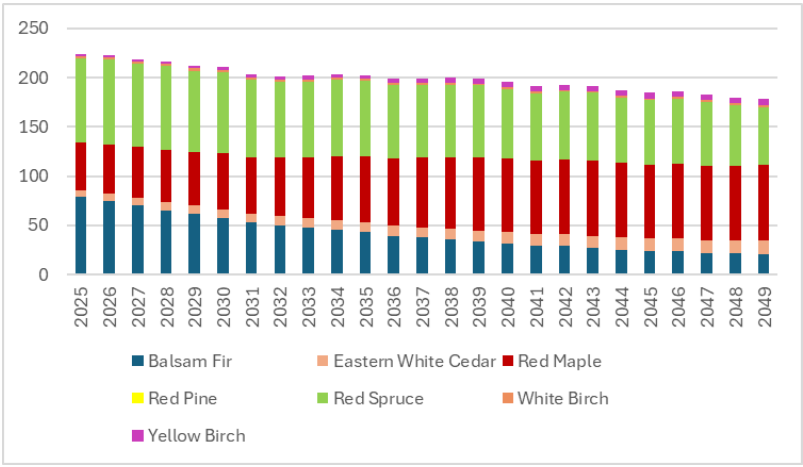


(C)

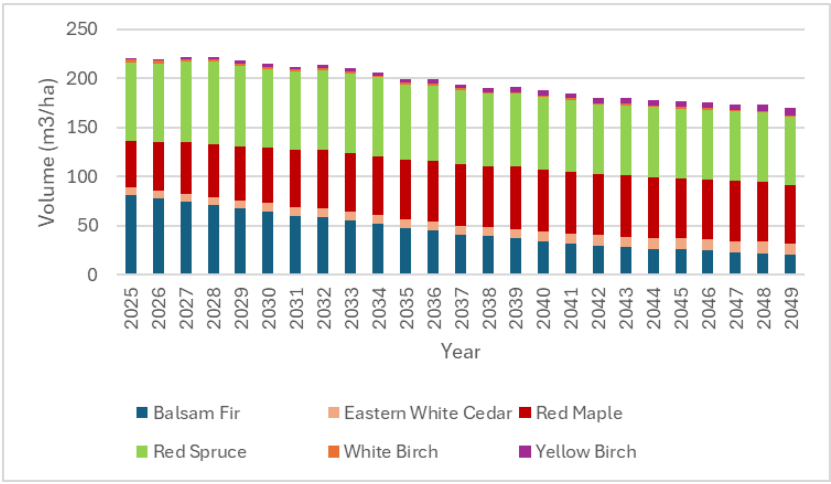
Appendix F Figure 29. Basal area of the Spruce stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

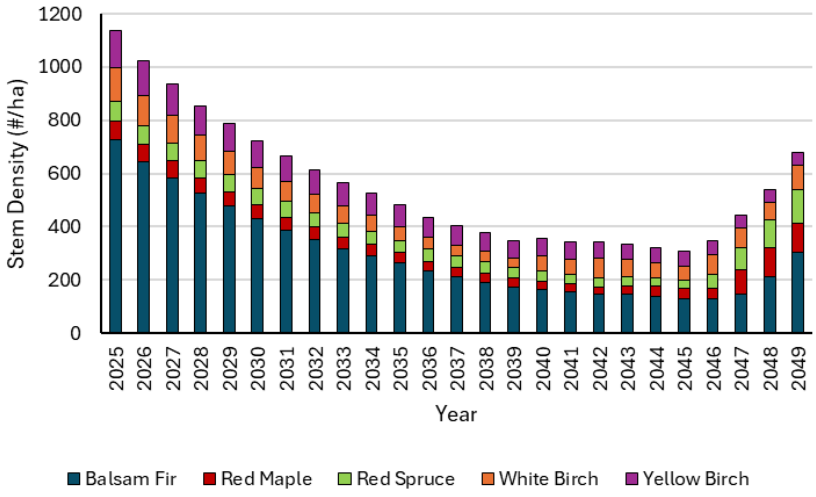


(B)

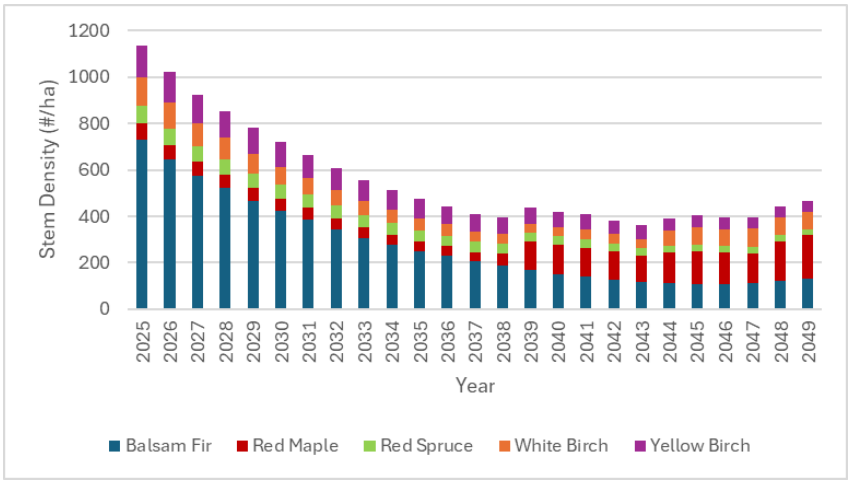


(C)

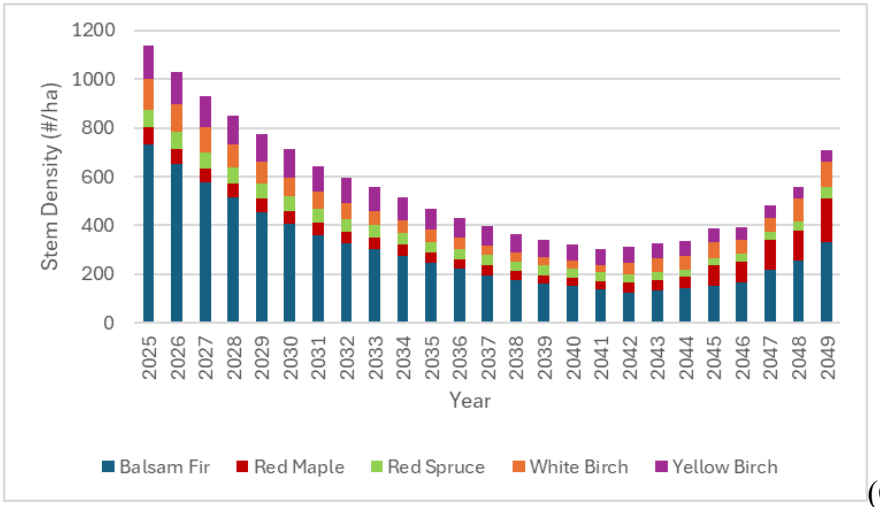
Appendix F Figure 30. Volume of the Spruce stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

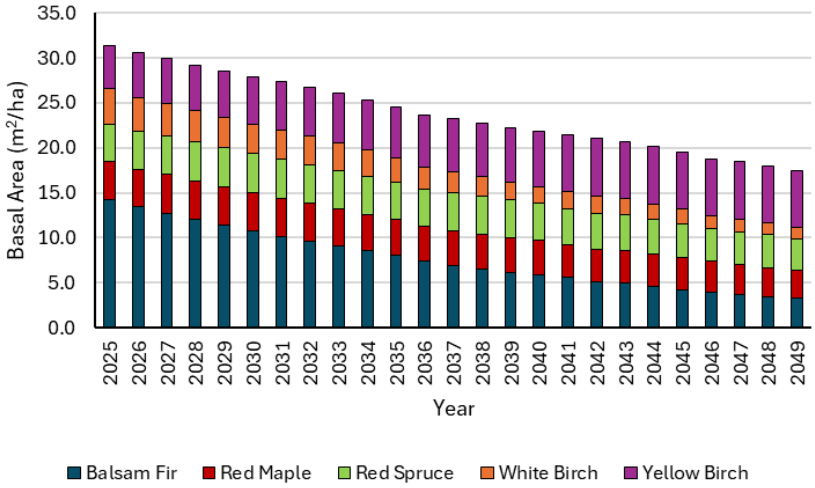


(B)

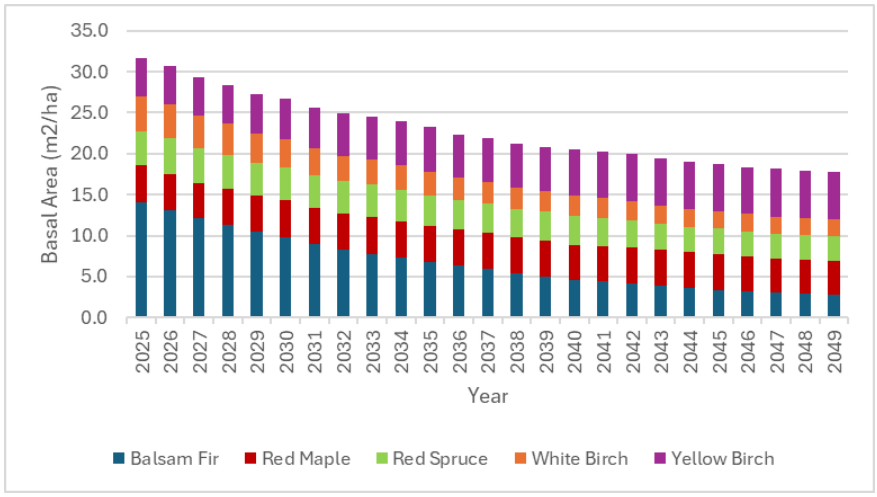


(C)

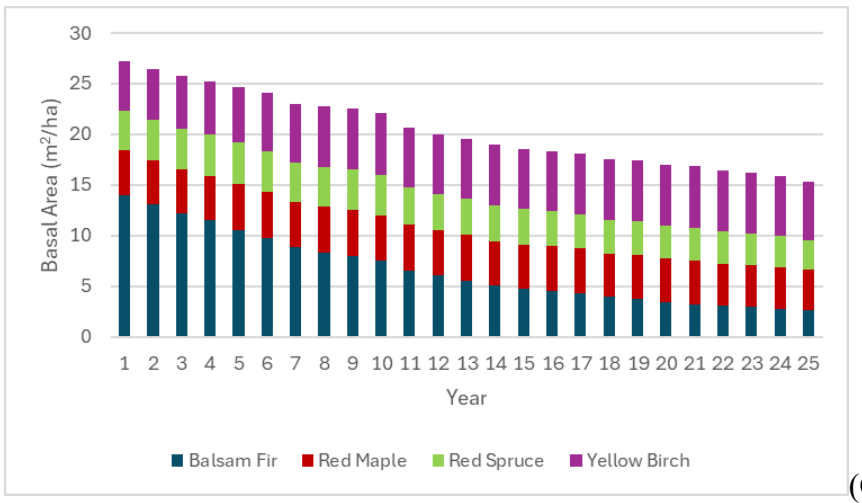
Appendix F Figure 31. Stem density of the Tolerant Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

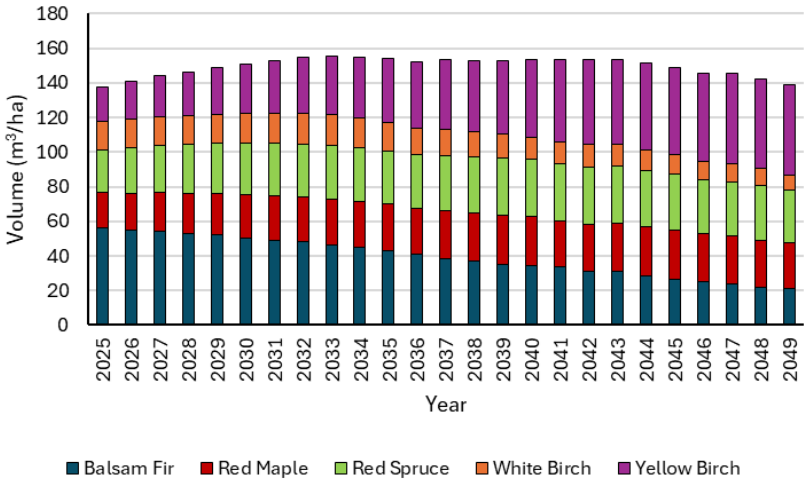


(B)

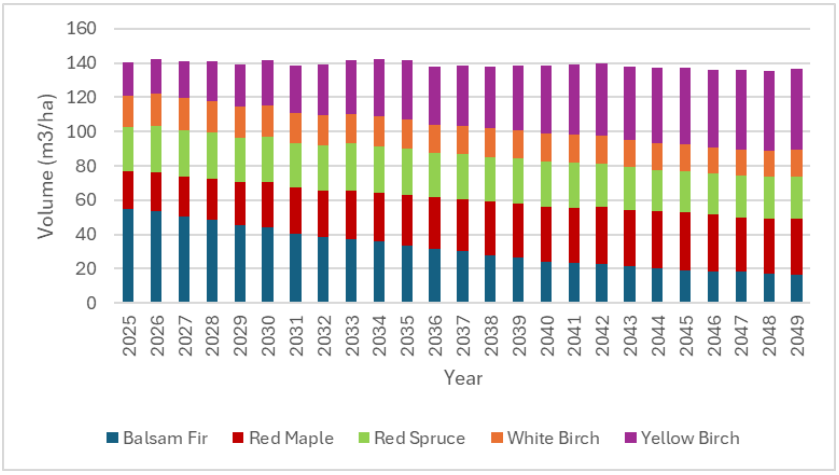


(C)

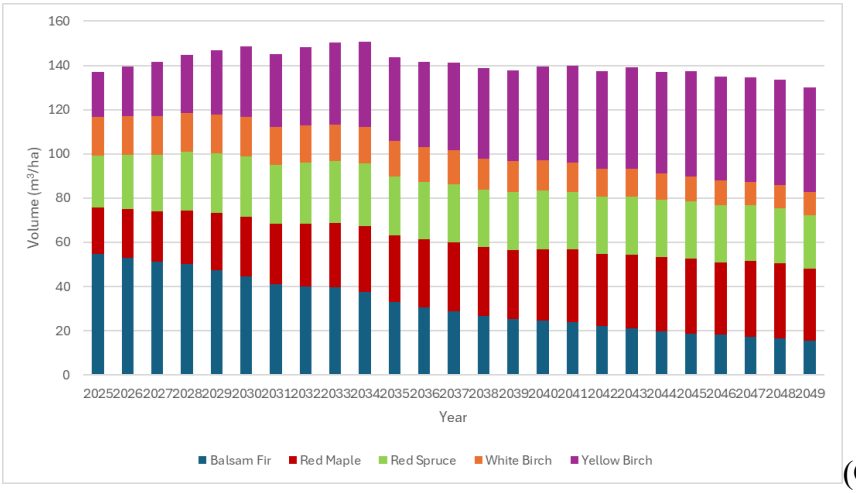
Appendix F Figure 32. Basal area of the Tolerant Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

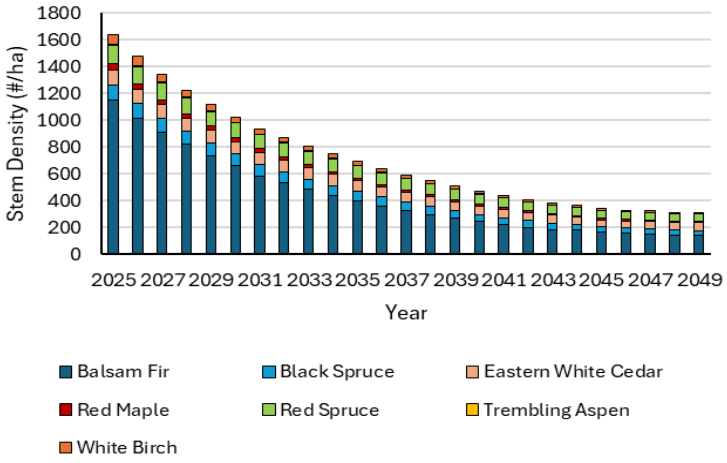


(B)

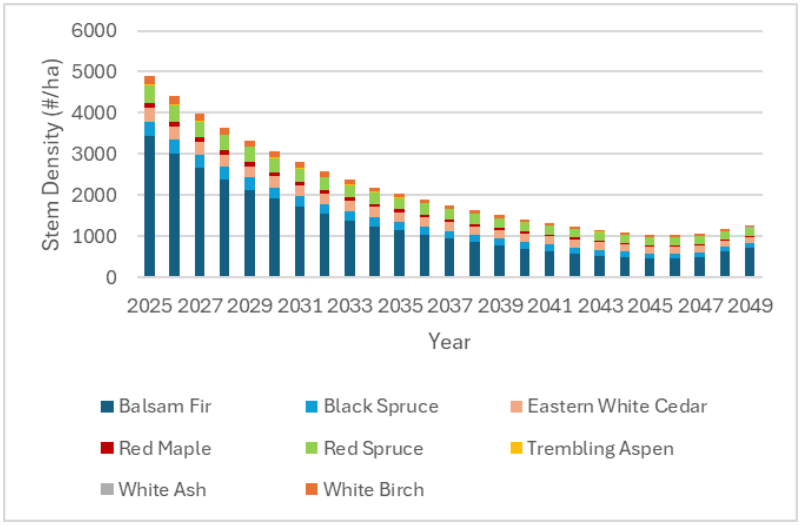


(C)

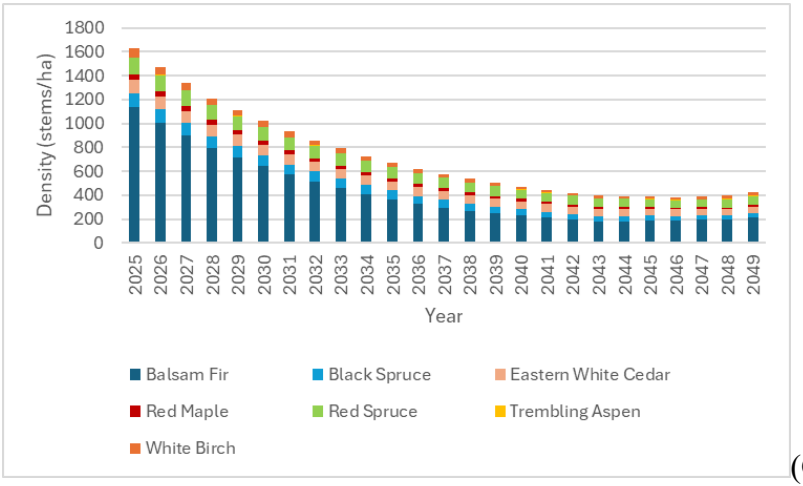
Appendix F Figure 33. Volume of the Tolerant Mixedwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

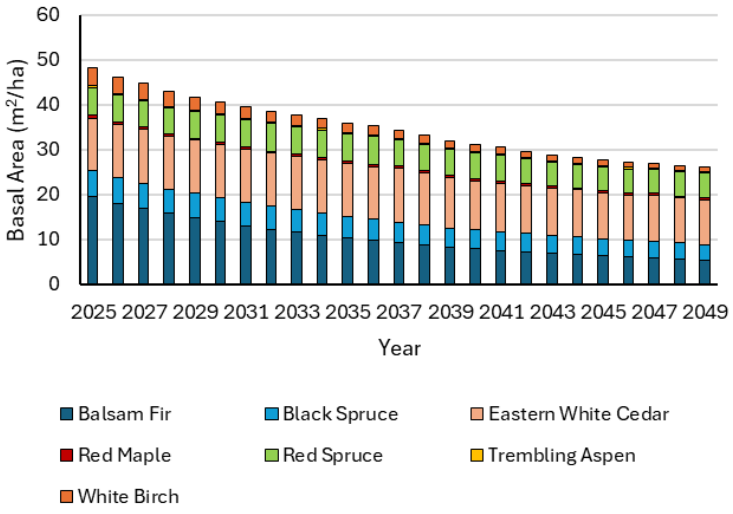


(B)

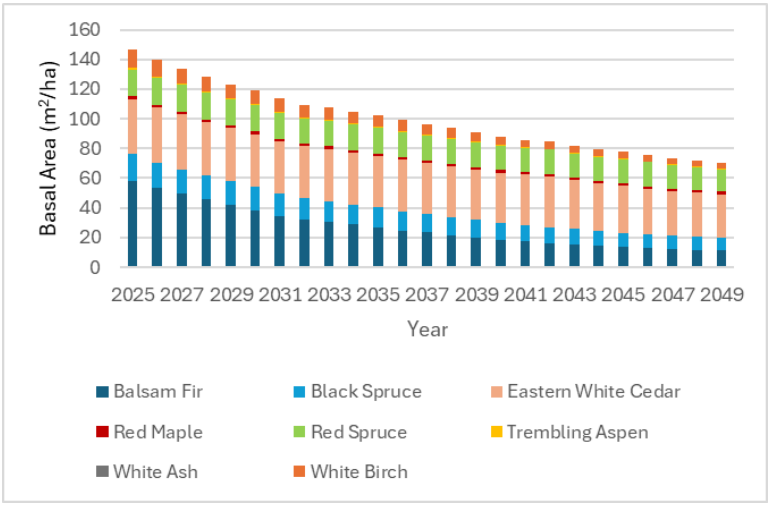


(C)

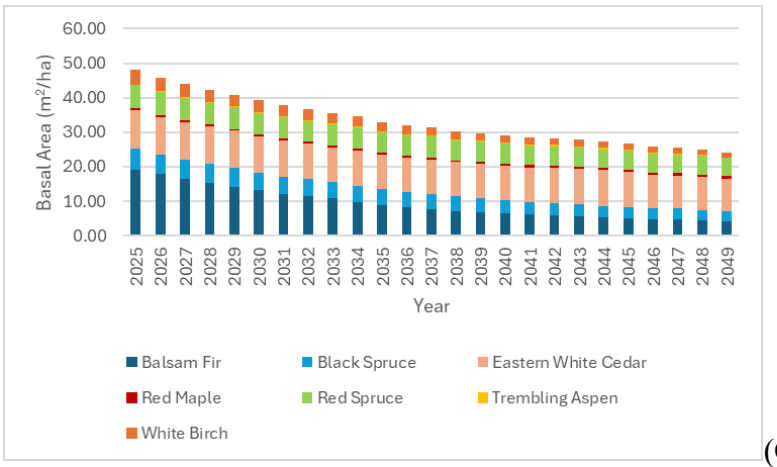
Appendix F Figure 34. Stem density of the Tolerant Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)

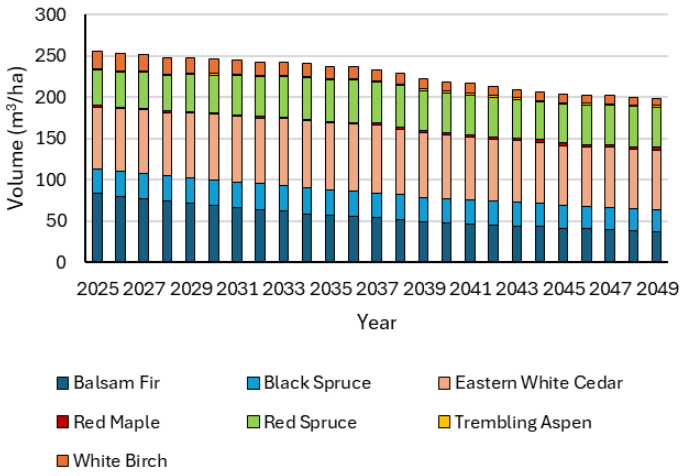


(B)

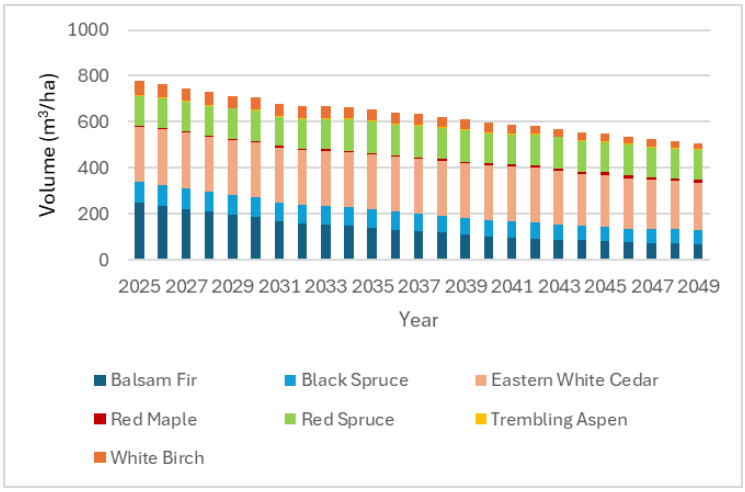


(C)

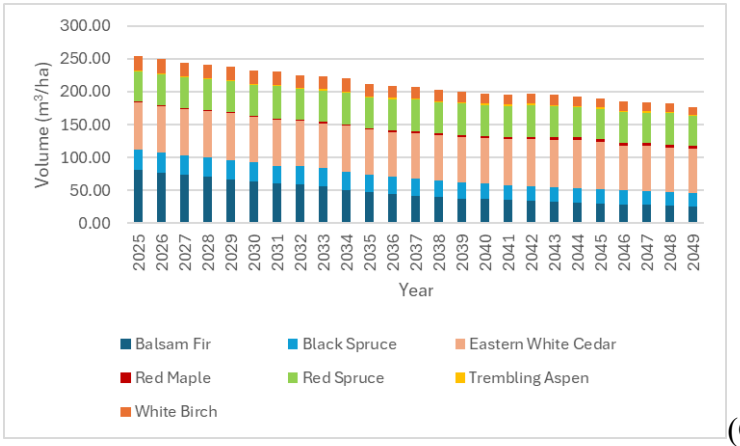
Appendix F Figure 35. Basal area of the Tolerant Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.



(A)



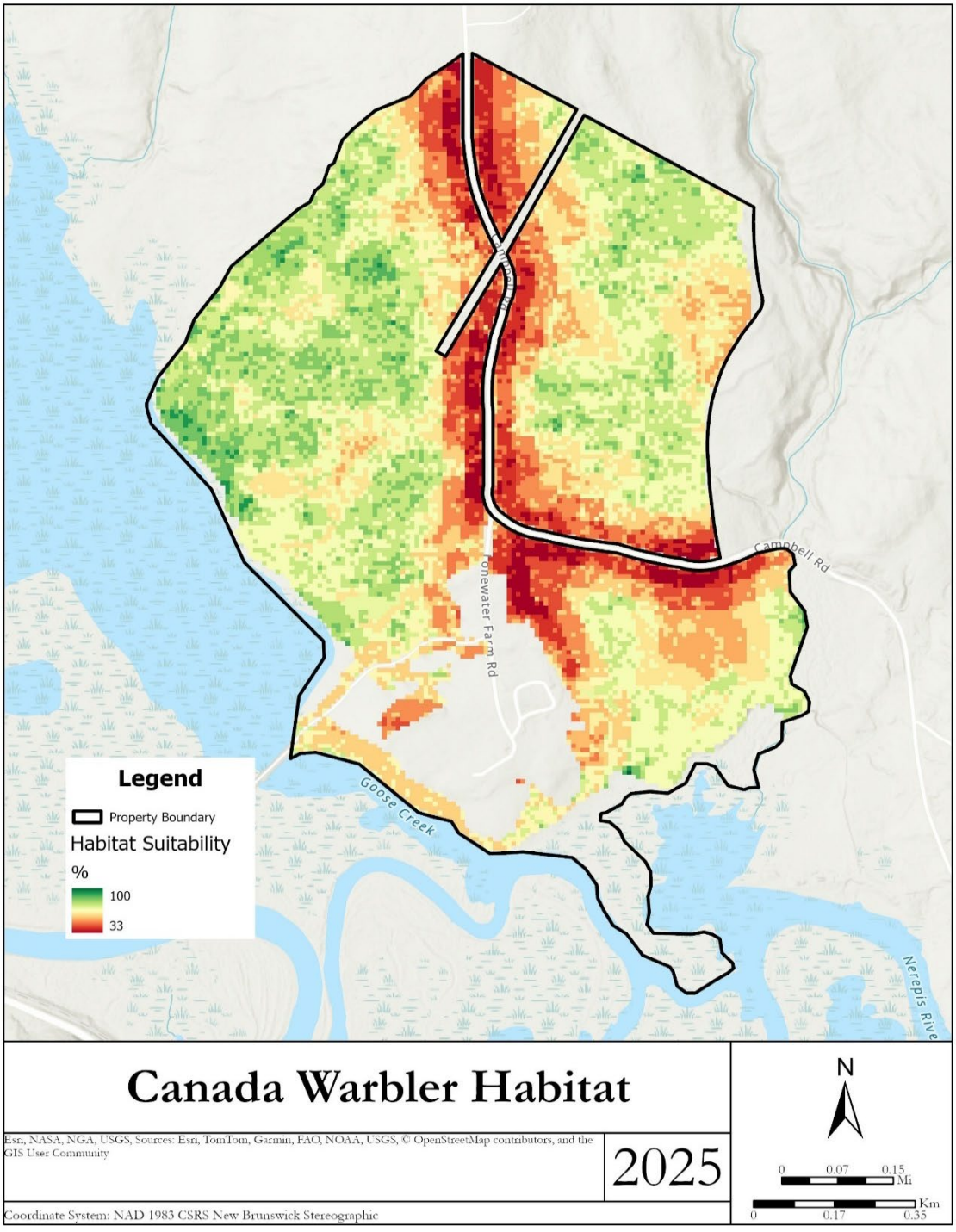
(B)



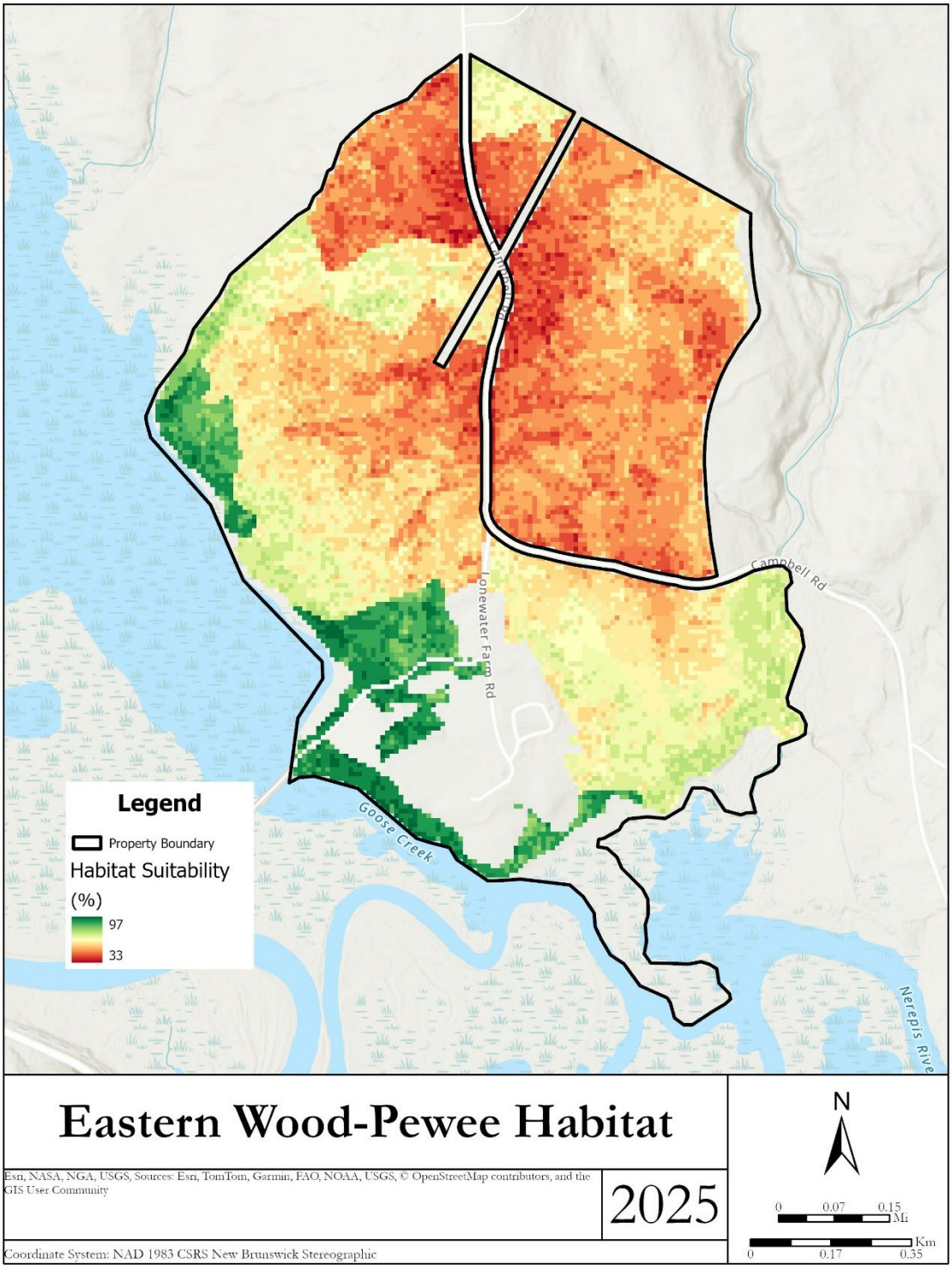
(C)

Appendix F Figure 36. Volume of the Tolerant Softwood stand where (A) is the climate normal scenario, (B) is the RCP 4.5 scenario and (C) is the RCP 8.5 scenario.

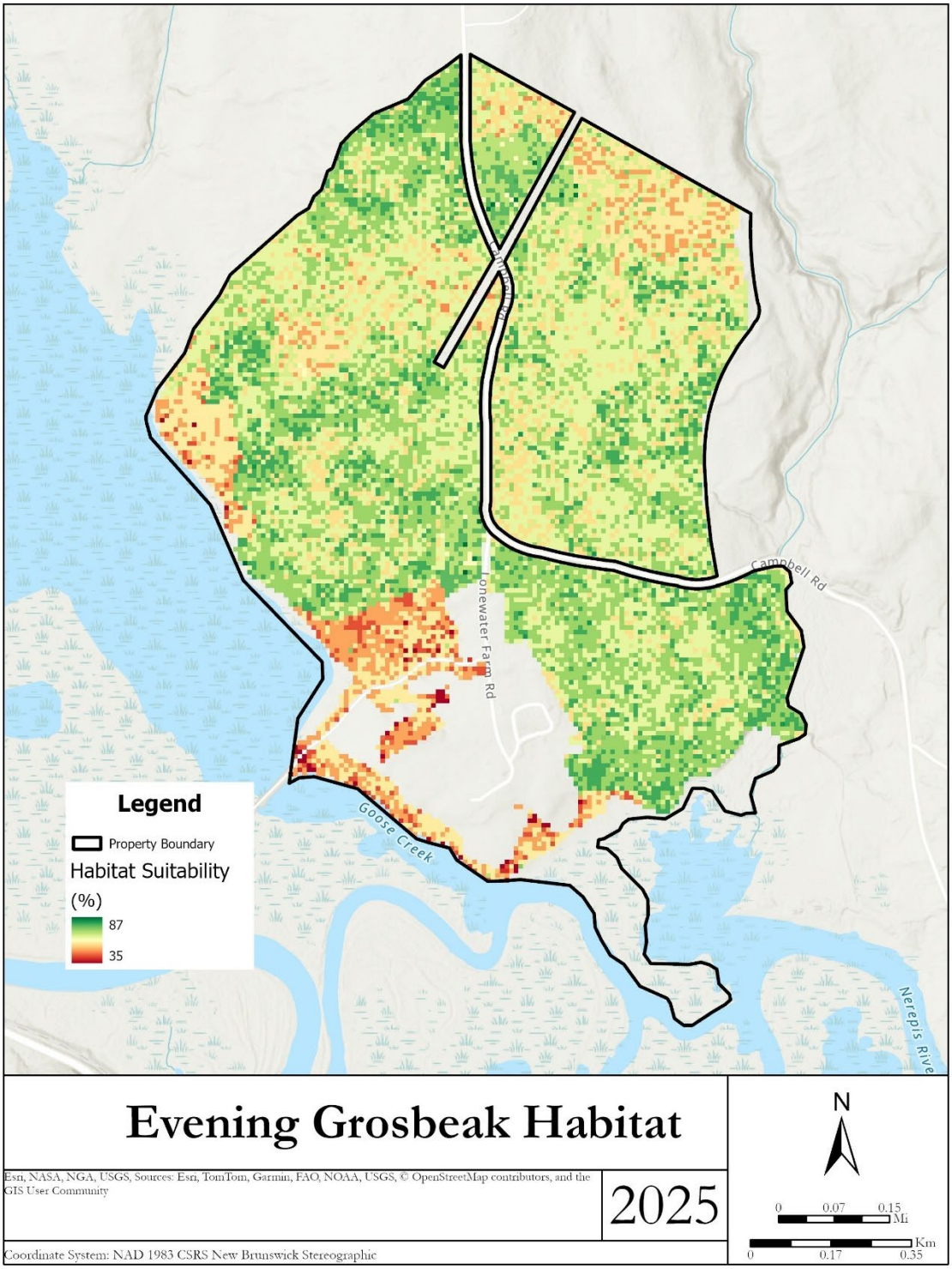
Appendix G - Wildlife Habitat Maps



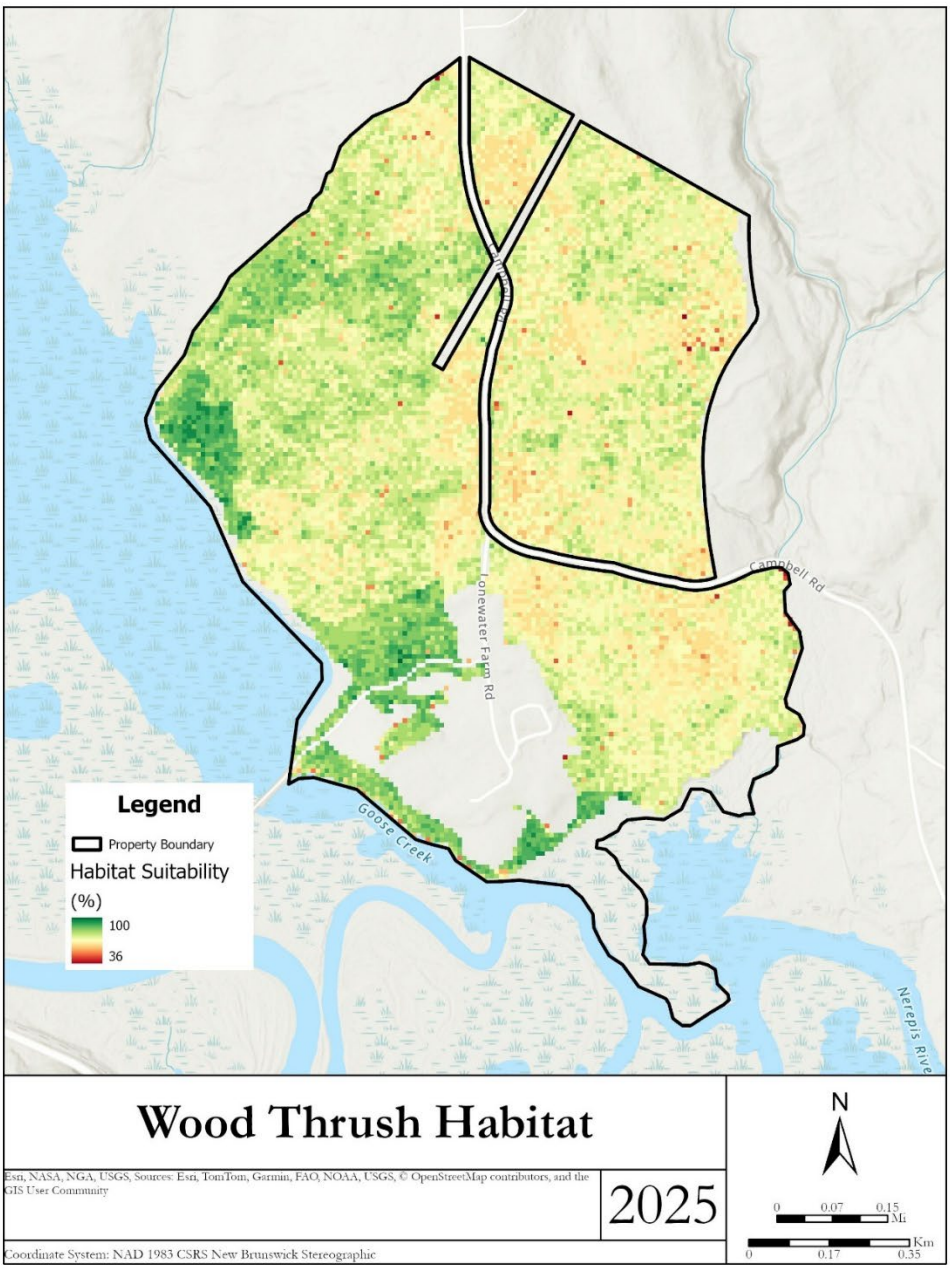
Appendix G Figure 1. Modelled habitat suitability for Canada Warbler, from low (red) to high (green).



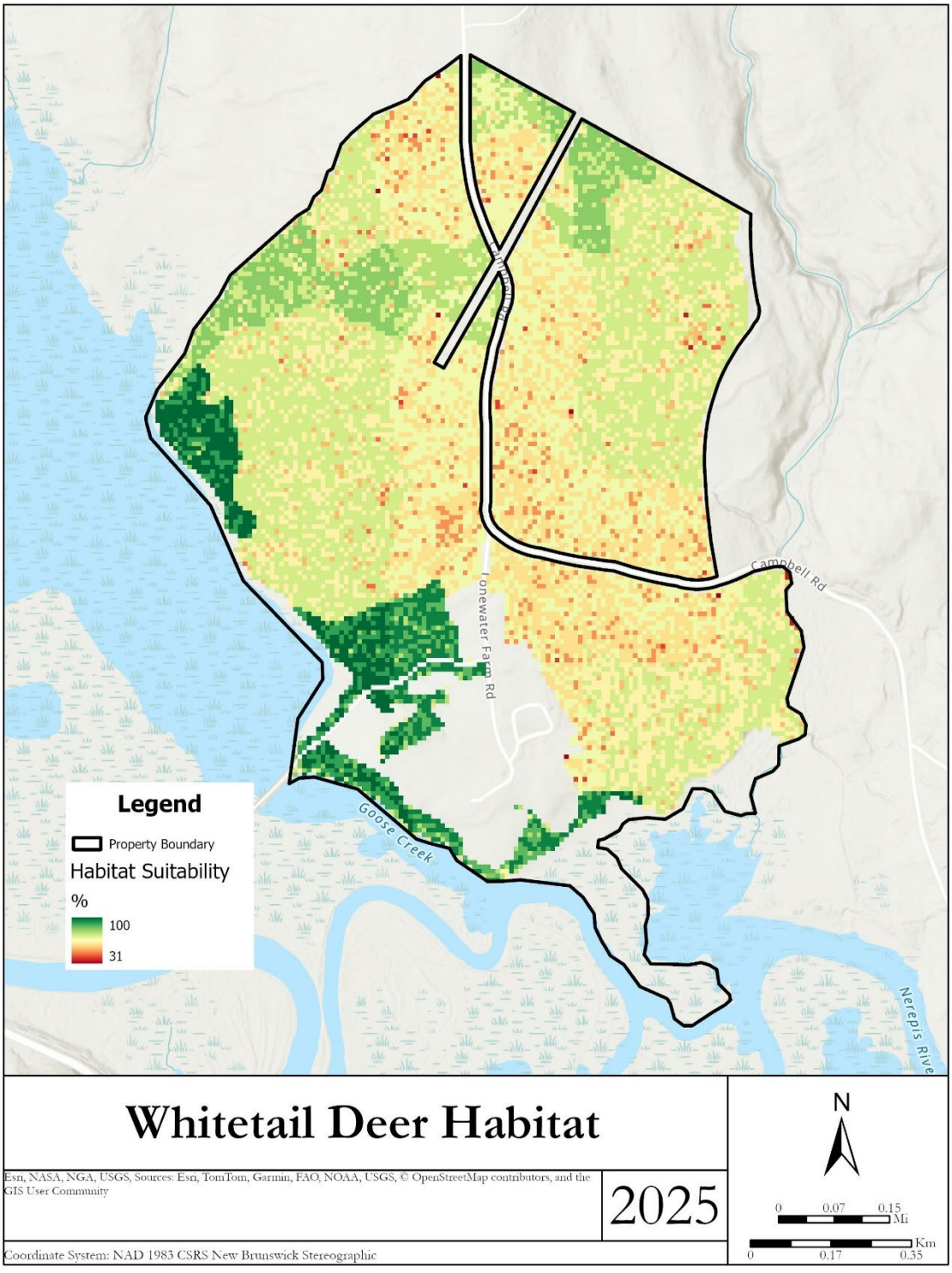
Appendix G Figure 2. Modelled habitat suitability for Eastern Wood-Pewee, from low (red) to high (green).



Appendix G Figure 3. Modelled habitat suitability for Evening Grosbeak, from low (red) to high (green).



Appendix G Figure 4. Modelled habitat suitability for Wood Thrush, from low (red) to high (green).



Appendix G Figure 5. Modelled habitat suitability for Whitetail Deer, from low (red) to high (green).

Appendix H – OECM Screening Criteria

OECM Decision Support Tool – Screening Criteria

Appendix H Table 1. Form 1 of 4 of decision support tool screening criteria for OECM areas.

BASIC INFORMATION	
Name of Site	**Lonewater Farm Property**
Designation	Crown Land
Province/Territory	New Brunswick
Year of Establishment / Securement	Private land until 1968, then designation to government (Department of Health) and became crown land and switched to DNR in 2024
Area (ha)	**167**
Governing Authorities	Department of Natural Resources and Energy Development
Explanation of Governing Authorities *(optional)*	*Only provide description if very complex or not well understood. This is not necessary for most sites.*
Governance Type ***(WDPA type)***	Sub-national Government *If governance is shared, what types of organization are involved?*
Legal Basis / mechanisms	This is where the lease agreement would be presented – Acceptance, Order #, any other information necessary
Explanation of legal basis / mechanisms *(optional)*	*Only provide description if legal basis or mechanism(s) is very complex or not well understood. This is not necessary for most sites* Does mention to Crown Lands Act need to be mentioned here?
Summary of Essential / Relevant natural, social and cultural values	LWF property is located in the town of Grand Bay-Westfield where it is actively used by the public. Recreation activities include: - Hiking / walking - Kayaking / canoeing - Fishing - Photography - Bird watching

	This property is representative of New Brunswick forest types with the dominant species being Balsam Fir, Five Autonomous Recording Units (ARUs) were placed randomly across the property and recorded bird calls for the summer of 2024. These data were compiled and assessed with an interest in bird species at risk. The habitat of four bird species were modelled: - Canada warbler - Eastern Wood-Peewee - Evening Grosbeak - Wood Thrush Habitat modelling show that this property is critical habitat for birds species at risk recorded on ARUs, meaning that there is great value in preserving this landscape. Black Ash is present which is a tree of cultural significance for indigenous communities. As the Rights Holders of the property, Black Ash is a valuable structure on the property.

Appendix H Table 2. Form 2 of 4 of decision support tool screening criteria for OECM areas.

TABLE 1: STANDARDS COMMON TO PROTECTED AREAS AND OECMS				
CRITERIA:	**INTENDED EFFECT OF THE CRITERION**	**SCREENING CHOICE**	**EVIDENCE-BASED RATIONALE Rationale/evaluation of how area meets or does not meet the intended effect of the criterion**	**MEETS INTENDED EFFECT?**
GEOGRAPHICAL SPACE	Demarcates the area to facilitate the in-situ conservation of biodiversity.	A. The geographical space has clearly defined and agreed-upon borders.	There is an established property boundary with a PID assigned by Service New Brunswick.	Yes
EFFECTIVE MEANS – 1	Activities incompatible with the in-situ conservation of biodiversity do not occur and compatible activities are effectively managed.	A. The mechanism(s) provide(s) the ability to prevent incompatible activities and manage all other activities within the area, such that the in-situ conservation of biodiversity can be achieved	Trails and outdoor classroom will be restricted to areas away from critical wildlife habitat. Trails are limited to 5 km Outdoor classroom within a limited area Dock access will be altered to prevent trailer launch as that is usually for motorized vehicles.	Choose outcome
EFFECTIVE MEANS – 2		B. The mechanism(s) does/do not compel the authority(ies) to prohibit activities incompatible with the in-situ conservation of biodiversity but incompatible activities are not likely to occur.	The property is easily accessible by the public, and although the aim is to keep individuals on trails, there will not be any active and/or daily monitoring that people do stay on them. Signage will be placed to encourage people to stay on trails and reduce their impact as much as possible.	Choose outcome

TABLE 1: STANDARDS COMMON TO PROTECTED AREAS AND OECMS				
CRITERIA:	**INTENDED EFFECT OF THE CRITERION**	**SCREENING CHOICE**	**EVIDENCE-BASED RATIONALE Rationale/evaluation of how area meets or does not meet the intended effect of the criterion**	**MEETS INTENDED EFFECT?**
LONG TERM	The area is permanently protected or conserved and not easily reversed.	B. The mechanism(s) is/are expected to be in effect for the long term and not easily reversed.	The property owners are in the process of placing an easement. This will place a primary goal of conservation and maintain that goal even if property ownership changes in the future.	Choose outcome
TIMING	Biodiversity is protected or conserved year-round.	C. The mechanism(s) is/are not in effect year-round	There are no seasonal components to this designation.	Yes

Appendix H Table 1. Form 3 of 4 of decision support tool screening criteria for OECM areas.

TABLE 2: STANDARDS THAT FURTHER DEFINE AND DISTINGUISH BETWEEN PROTECTED AREAS AND OECMS				
CRITERIA:	**INTENDED EFFECT OF THE CRITERION**	**SCREENING CHOICE**	**EVIDENCE-BASED RATIONALE: Rationale/evaluation of how area meets or does not meet the intended effect of the criterion**	**OUTCOME**
SCOPE OF OBJECTIVES	Objectives have sufficient scope to result in the in-situ conservation of biodiversity.	A. The objectives are for the in-situ conservation of biodiversity as a whole, or for indigenous values accomplished through the in-situ conservation of biodiversity.	Objectives include: - Protecting wildlife habitat - Establishing standard trail system - Limit dock access to non-motorized vessels only Trails would be placed away from critical habitat and limited to a total of 5 km. There is unofficial trails in place that people will continue to use, we just have to be sure that recreation is limited to areas not considered critical habitat.	Yes - OECM
PRIMACY OF OBJECTIVES	Objectives are such that they result in the in-situ conservation of biodiversity.	B. Based on evident intent (e.g., management intent, stated or implied conservation objectives, allowable and prohibited activities), conservation objectives are primary and overriding, or are given priority when there is conflict among objectives.	. Under the outlined project objectives, defined rules and standards are in place to Preserve critical wildlife habitat for species at risk and or avoid/mitigate potential negative effects on biodiversity/sensitive areas via encouraging low impact activities and prohibiting the use of motorized vehicles within the define boundaries of the property. The prioritization and implementation of allowable activities are low impact in nature and do not include heavy-impact activities which result in fragmentation and or habitat disruption.	Yes - OECM

TABLE 2: STANDARDS THAT FURTHER DEFINE AND DISTINGUISH BETWEEN PROTECTED AREAS AND OECMS				
CRITERIA:	**INTENDED EFFECT OF THE CRITERION**	**SCREENING CHOICE**	**EVIDENCE-BASED RATIONALE: Rationale/evaluation of how area meets or does not meet the intended effect of the criterion**	**OUTCOME**
GOVERNING AUTHORITIES	The in-situ conservation of biodiversity is not jeopardized by relevant governing authorities.	A. All relevant governing authorities acknowledge and abide by the conservation objectives of the area.	In the case of the current land use agreement under the authority of the Government of New Brunswick's department of energy and natural resource development, the land use within spatial boundaries of PID# 00215269 is not allocated as a provincial park or protected natural area. However, the responsible parties will adhere to the prioritization of conservation values and uphold integrity in regard to the objectives pertaining to maintaining biodiversity and or the protection of species at risk. Conflicting activities which do not align with overarching goals such as extractive processes would reduce overall land use availability and impact public safety and recreational values. Strategically managed low impact operations are permissible provided that biodiversity, conservation and recreation are not undermined.	Yes - OECM
BIODIVERSITY CONSERVATION OUTCOMES	Biodiversity is conserved in-situ.	C. The area is being managed in a way that delivers the in-situ conservation of biodiversity.	Lonewater Farms has documented 4 species of risk during the data collection phase. Evening grosbeak, Eastern wood peewee, Wood Trush, and Canada warbler. Habitat suitability maps have identified critical deer over wintering areas and optimal breeding habitat for the identified species at risk. Species of interest included milk patches within the southern portion of the previously disturbed area. Recreational use planning of the disturbed area will utilize milkweed as a means for monarch butterfly habitat restoration along with facilitating ecological education. Continual monitor throughout project lifespan is encouraged to ensure conservation efforts are being met.	Yes - OECM

Appendix H Table 2. Form 4 of 4 of decision support tool screening criteria for OECM areas.

SUMMARY OF ASSESSMENT	
OUTCOME / EVALUATION	**Screening Outcome:** Choose an item. Is this an Interim Target 1 area: Choose an item. Is this a candidate Target 1 area: Choose an item. **Currently reported to CPCAD/CARTS?** Choose an item. **Total Area (ha) to be reported to CPCAD/CARTS:**
Identify deficiencies that could be overcome in order to report as PA or OECM	*What, if any, actions could be undertaken to meet the Pan-Canadian criteria and standards for reporting?*
Lead evaluator / assessor	*Lead evaluator / assessor* *Assistance from*
Communications / Engagement	*Names of governing authorities and others consulted, including names and positions of contact people and dates*
Approvals	*Names of governing authorities (including government, private or Indigenous landowners, right holders and the responsible jurisdiction) that have approved the content and results of this screening as being accurate and complete to the best of their knowledge and agree to reporting of data. Agreement for data sharing with the land owner/manager.*