Meduxnekeag Valley Nature Preserve

2025 Woodlot Survey and Climate Resiliency Planting Report

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Report Submitted: July 14, 2025

Executive Summary

This report outlines the results of a forest condition assessment and silvicultural recommendations for four properties within the Meduxnekeag Valley Nature Preserve (MVNP) in western New Brunswick. Conducted in the summer of 2025 by Devon Noel Bustard in partnership with the Meduxnekeag River Association (MRA), this work supports a broader ecological restoration project funded in part by the New Brunswick Environmental Trust Fund (NB ETF). The goal of this project is to increase the extent and resilience of Appalachian Hardwood Forest (AHF) across the preserve through targeted enrichment planting and gradual stand conversion. Across the Bell Flats, Wilson Mountain, Leonard Woods, and Vandine Falls properties, 96 fixed-radius plots were surveyed per site, totalling over 800 trees sampled and analyzed for species composition, diameter at breast height (DBH), and height. Stands were delineated using a combination of satellite imagery, forest inventory data, and GIS-based stand mapping in QGIS. The properties ranged from mature mixed wood stands to pure conifer plantations, with species compositions varying widely between sites. A total of 17 forest stands were identified and evaluated using a 1–4 priority ranking system based on their existing species composition, resilience under climate change, and potential for restoration to AHF conditions. High-priority stands (Rank 1) were typically softwood plantations dominated by balsam fir, black spruce, or red pine with little structural diversity or ecological resilience. These stands are recommended for gradual conversion to hardwood-dominated systems using a shelterwood silvicultural system and enrichment planting of shade-tolerant native hardwoods. Mid-priority stands include immature mixed woods that can be incrementally improved through gap planting. Low-priority stands, such as natural hemlock slopes and cedar wetlands, are recommended for protection without active intervention. Species selected for planting include AHF indicator species such as white ash (*Fraxinus americana*), basswood (*Tilia americana*), butternut (*Juglans cinerea*), and ironwood (*Ostrya virginiana*), as well as associated tolerant hardwoods such as sugar maple and yellow birch. Red oak (*Quercus rubra*) has also been included for its projected climate resilience and mast-producing potential as a replacement for declining American beech. The proposed implementation plan spans 2025 to 2029, with shelterwood prep work and planting occurring in the first two years, followed by monitoring, maintenance, and possible thinning in later years. Acknowledging the MRA's non-profit capacity, the plan also includes recommendations for flexibility based on funding and resource availability. This report provides a science-based framework for ecological restoration and climate adaptation across the MVNP. It is intended to guide both immediate planting operations and longer-term forest management decisions that promote biodiversity, community engagement, and the recovery of a rare and ecologically valuable forest type in New Brunswick.

Contents

Introduction:

Climate change is expected to significantly impact the forested landscape of New Brunswick, where the southernmost range of the Boreal Forest interacts with the temperate deciduous forest to form the Acadian Forest type. It is within this range where boreal species exhibit their southernmost tolerances to heat and moisture regimes, and where the more southern broadleaf forest displays its most hardy specimens. Within this forest matrix, a unique forest community exists known as the Appalachian Hardwood Forest (AHF); a tolerant hardwood forest most notably containing white ash (*Fraxinus americana*), basswood (*Tilia americana*), butternut (*Juglans cinera*) and ironwood (*Ostrya virginiana*). While this forest community once covered a significant portion of the calcareous soils of Western New Brunswick, approximately 1% of AHF remains, with 50% of remaining forest being found along the Meduxnekeag River. Historically, much of this forest type has been converted into potato farmland, the main economic activity of the region, while other sections have become "borealized" woodlots managed for timber or Christmas trees. Today, AHF exists mostly in small pockets, with a lack of contiguous woodland.

This report outlines work undertaken in the summer of 2025 to assess the tree species composition of four properties of the Meduxnekeag Valley Nature Preserve (MVNP), and silvicultural recommendations for the future of these properties under climate change whilst maintaining the AHF forest type. Properties include the Bell Flats, Leonard Woods and Vandine Falls (Figure 1). The properties assessed are areas that currently facilitate recreational trails for use by the public, allowing for educational opportunities in forest management and climate change mitigation. While initially suggested as sites in a project proposal, the site adjacent to Rosevear Cliff and the Bell Forest were left out of this report since the Rosevear Cliff site received planting in spring of 2025, and the Bell Forest was found to be excellent quality AHF in a 2024 University of New Brunswick survey (Akmens et al., 2024).

Site conditions of surveyed properties range from softwood plantations to stands tolerant hardwoods, all formed on calcareous soils typical of the region. In partnership with the New Brunswick Environmental Trust Fund, the Meduxnekeag River Association (MRA) has procured funding for the enrichment planting of these properties to encourage native tolerant hardwood growth, and potential silvicultural interventions to shift forest dynamics towards AHF and away from boreal-like succession. In aspect to the ETF project undertaken by the MRA, this report may be used as part of the framework for the implementation of the project.

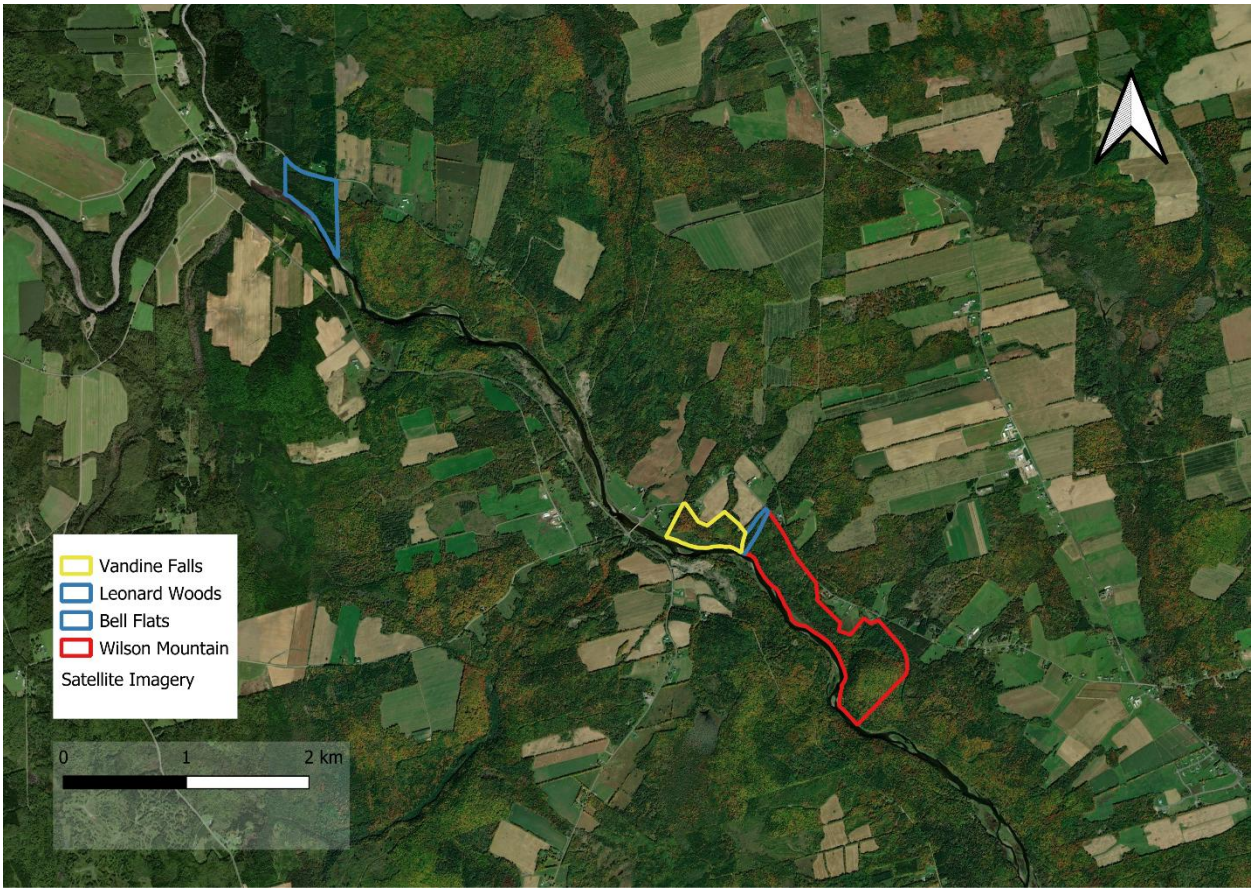

Figure 1: Map of surveyed properties of 2025 forest inventory project, located on the Meduxnekeag River in Red Bridge and Belleville, New Brunswick. Map created by Devon Noel Bustard.

Tree Species

The MRA identified 6 tree species slated to perform well under RCP 4.5 projection of climate change: red oak (*Quercus rubra*), ironwood, white ash, eastern hemlock (*Tsuga canadensis*), butternut, and basswood (de Graaf, n.d.). This selection of trees includes AHF indicator species as well as associated trees that commonly form AHF forest cover, with an exception to red oak. While red oak exists adjacent to MVNP properties in select pockets, it is not commonly found within current AHF stands at a noticeable level. The decision to include red oak as a planted species stems from the fact that it is a nearby tree species that is expected to proliferate under climate change scenarios and should replace American beech (*Fagus americana*) as a mast tree.

While not mentioned in the initial proposal of this project, the decision to include other tolerant hardwood species such as sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*) in management decisions is because these tree species form the typical cover of

AHF and will be useful in rewilding softwood plantations. Due to the nature of non-profits such as the MRA and the likely fact that most seeds and saplings will come as donations, planting operations may potentially disregard prescribed species for similar alternatives because of difficulties to acquire specific species.

Methodology:

To create a more comprehensive understanding of current stand compositions on MVNP properties, a rapid ecological assessment was completed using standard forest inventory methods. On four of the properties assessed, a systematic grid sampling approach was conducted at a density of 1plot/ha to stay within time restraints of summer students, while still allowing for a complete overview of the properties (Appendix 4).

Forest Inventory Methods

Forest inventory plots were created using QGIS software, using open-source data from GeoNB for property lines. Plots were created at a 1plot/ha density and then loosely arranged in a grid style format for complete coverage of the property. Each plot was conducted using a fixed radius of 5m, which was deemed sufficient for a species composition analysis where metrics such as volume or carbon storage may not be as important. Fixed radius plots were also regarded to be quicker for an individual surveyor to complete in comparison to variable radius plots.

Within the fixed radius plots, individual tree species and metrics of diameter at breast height (DBH) and heights (m) were recorded with a diameter tape and clinometer for both plot/stand level assessment as well as property level scaling. At each plot, information such as latitude and longitude, slope (%), aspect and ground cover were recorded alongside individual tree metrics for consideration in future planting operations. To record slope and aspect, a clinometer and compass were used for exact measurements. Plot information was recorded on designed forest inventory field sheets and then input into excel sheets for each individual property for analysis.

For navigation, the cloud feature of QGIS was utilized with the QField application on mobile devices. This allowed staff to reliably navigate to plots without internet access, and ease of data transfer between mobile devices and office computers.

Data Analysis

Forest inventory data was analysed using Microsoft Excel; data such as DBH and heights were used to form loose approximations of potential forest stands. Next, using excel and QGIS

concurrently, inventory data of each plot and satellite imagery were used to fully delineate stands based on visible species shifts on the basemap followed by confirmation using inventory species composition data. Where tree species were not present, or had low abundance, ground cover species were also used for stand delineation. Following delineation of stands, average DBH, heights as well as overall stand and property species composition were calculated and used to create figures for use by the MRA staff.

Existing Conditions

Bell Flats

The Bell Flats property is a 15.5-hectare property situated adjacent to the MVNP Bell Forest property in Belleville, New Brunswick. This property was surveyed on June 17, 2025, and contained 16 forest inventory plots. The property was delineated into four types of stands during inventory analysis: balsam fir, black spruce, red pine and mixed wood (Figure 2). The three softwood stand types are plantations from the previous owner of the woodlot that were not harvested before the MRA took over ownership and represents 9 of the total 15.5ha (58%). The largest single stand is mixed wood which represents 7ha of the property.

The forest inventory survey of the Bell Flats property surveyed a total of 0.1257ha (0.79% of total property) and collected data on 225 individual trees. The most common tree species was balsam fir (38.22%), and the most common type of tree species was softwood (75.55%). The most common deciduous tree species was trembling aspen (9.78%) (Figure 3).

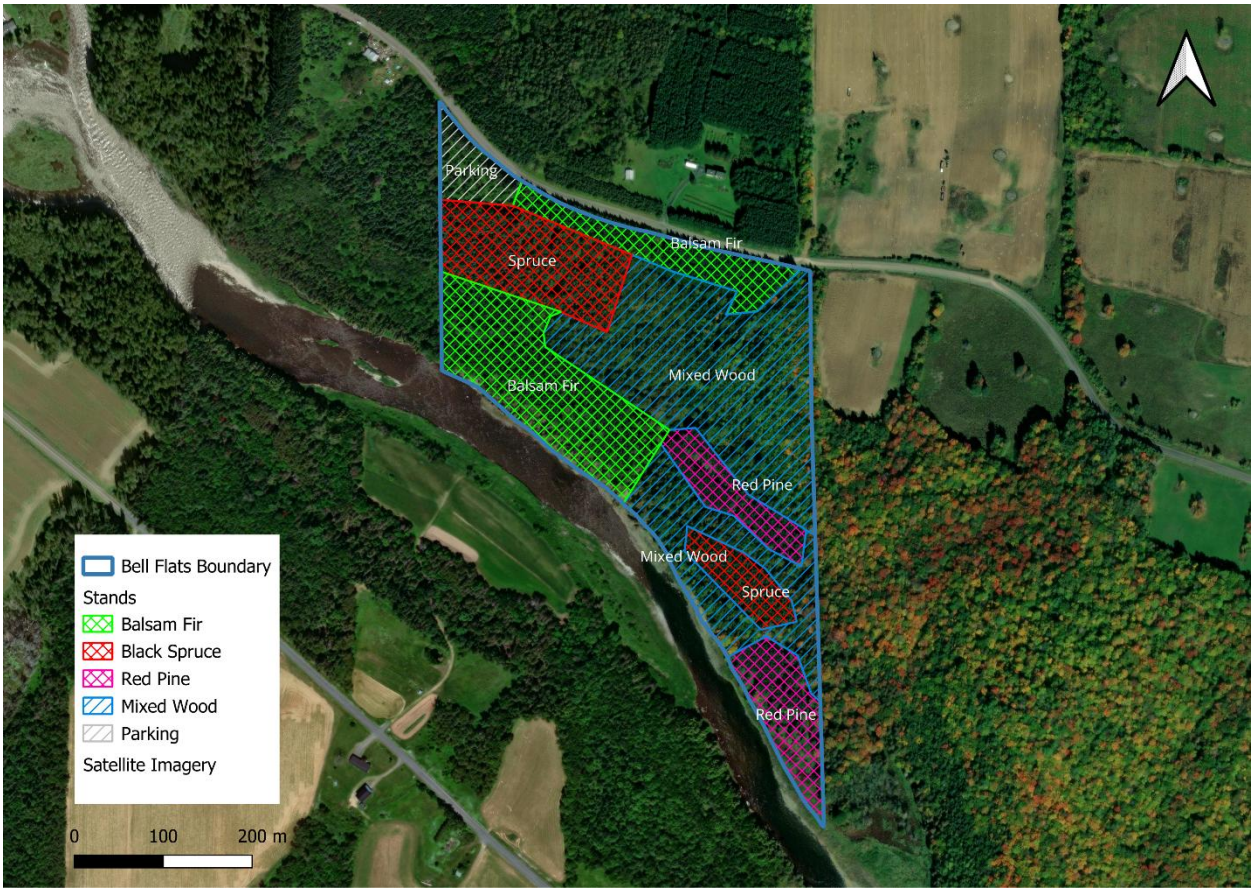

Figure 2: Delineated stands of the Bell Flats using inventory data and satellite imagery. Cross hatched polygons represent plantations, and single hatched polygons represent natural forest stands. Figure created July 9, 2025 by Devon Noel Bustard.

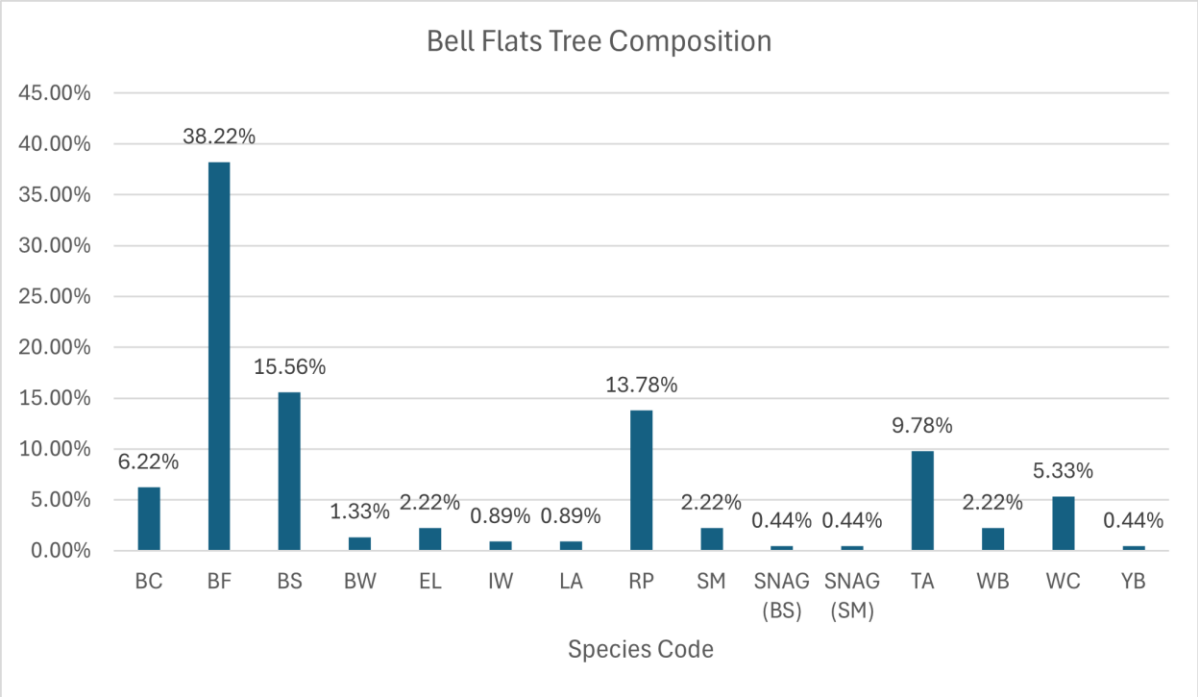

Figure 3: Chart of tree species composition of the Bell Flats, using forest inventory data from 2025 survey. Trees are represented as percentages of grand total and named using tree species code chart from the MRA. Chart created by Devon Noel Bustard.

Stand Summaries

Balsam Fir

Pure balsam fir stands cover 4ha of the Bell Flats property and exist as two separate stands, one on the north end of the property and the other on the south end of the property. The northernmost balsam fir stand had an average DBH of 20.1cm and an average height of 17.4m. The tree cover of this stand was 94% balsam fir and 6% trembling aspen (Appendix 2). The southern stand had an average DBH of 17.6cm and an average height of 15.9m. The tree cover of this stand was 78.38% balsam fir and then 8.11% Eastern White Cedar (Appendix 2).

Black Spruce

Pure black spruce stands cover 3ha of the Bell Flats property and exist as two separate stands, one on the northwest end of the property and the other on the southeast end of the property. The northernmost black spruce stand had an average DBH of 21.97cm and an average height of 18.02m. The tree cover of this stand was 74.07% black spruce and then 18.52% black cherry (Appendix 2). The southern stand had an average DBH of 18.86cm and an average height of 18.45m. The tree cover of this stand was 100% black spruce (Appendix 2).

Red Pine

Pure red pine stands cover 2ha of the Bell Flats property and exist as two separate stands, one on the center of the property and the other on the southeast tip of the property in the riparian zone. The northern most red pine stand had an average DBH of 18.98cm and an average height of 19.37m. The southern stand had an average DBH of 23.01cm and an average height of 19.58m. The tree cover of these stands was 100% red pine (Appendix 3).

Mixed Wood

A mixed wood stand exists on the eastern side of the property, with red pine and spruce stands existing within it. This stand covers 7ha of the Bell Flats property. The mixed wood stand had an average DBH of 17.25cm and an average height of 15.85m. The tree cover of this stand was 30.95% balsam fir and then 21.43% trembling aspen (Appendix 3).

Wilson Mountain – Leonard Woods

For the purposes of this report, the Wilson Mountain property will be combined with the Leonard Woods to form a single larger management zone (Figure 4). The combined properties will be referred to as Wilson Mountain. The combined properties are 60ha in area and contains 8 separate stands. This management zone was surveyed from June 18-27, with 64 total plots.

The forest inventory survey of the Wilson Mountain property surveyed a total of 0.5027ha (0.79% of total property) and collected data on 502 individual trees. The most common tree species was balsam fir (38.22%), and the most common type of tree species was softwood (75.55%) (Figure 5). The most common deciduous tree species was trembling aspen (9.78%).

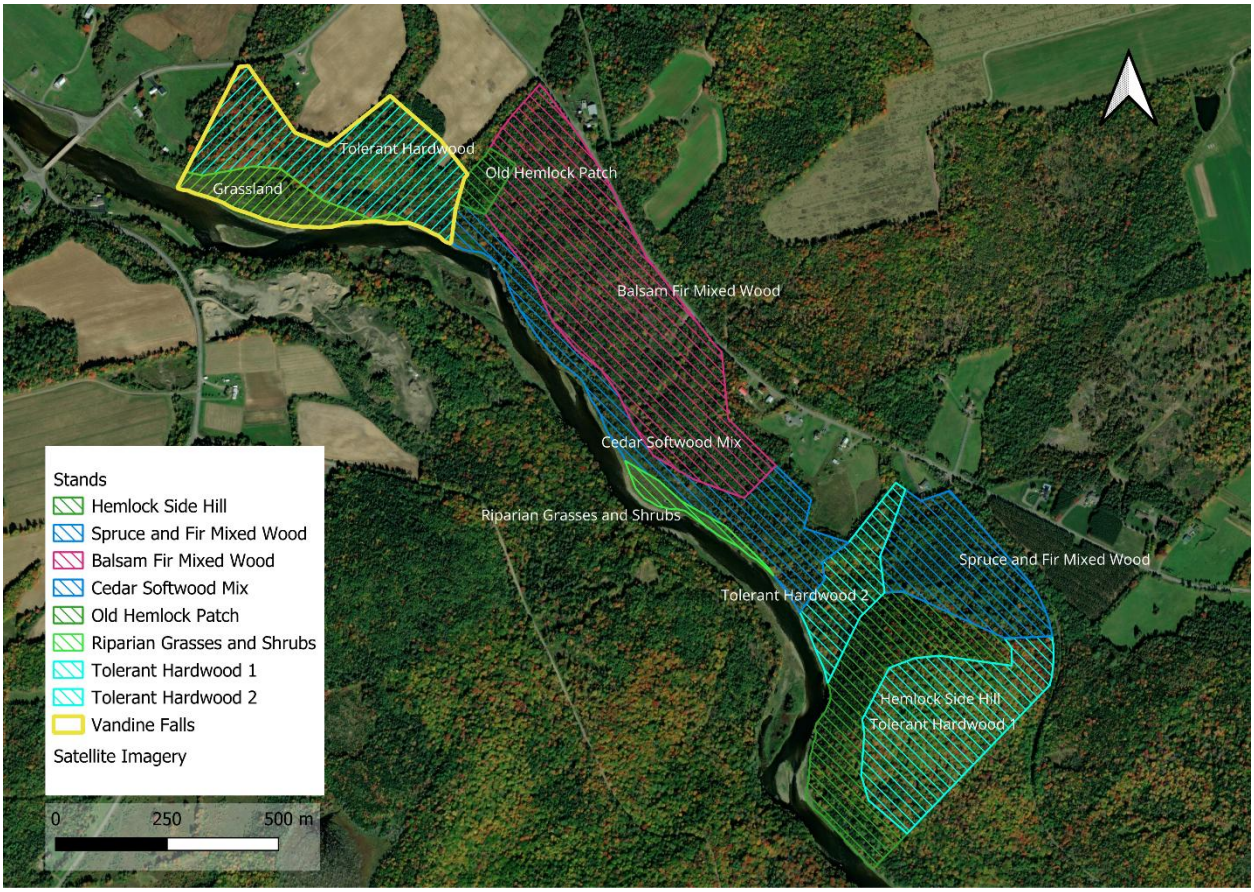

Figure 4: Delineated stands of the Bell Flats using inventory data and satellite imagery. Wilson Mountain and Leonard Woods properties are combined to form one larger property, with stands overlapping. Polygons within yellow boundaries are located on the adjacent Vandine Falls property. Map created by Devon Noel Bustard.

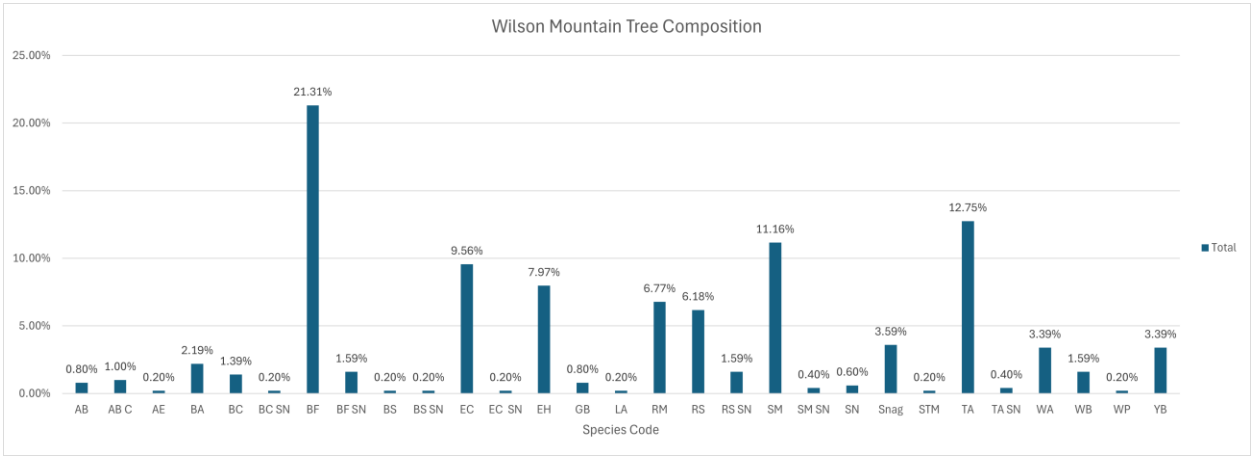

Figure 5: Chart of tree species composition of Wilson Mountain, using forest inventory data from 2025 survey. Trees are represented as percentages of grand total and named using tree species code chart from the MRA. Chart created by Devon Noel Bustard.

Stand Summaries

Balsam Fir Mixed Wood

The Balsam Fir Mixed Wood stand was found to have an average DBH of 17.38cm and an average height of 17.14m. The tree cover in this stand was 34.31% balsam fir and then 22.55% trembling aspen (Appendix 5).

Cedar Softwood Mix

The Cedar Softwood Mixed Wood stand was found to have an average DBH of 24.58cm and an average height of 17.9m. The tree cover in this stand was 40% eastern white cedar and then 15.38% balsam fir (Appendix 5).

Tolerant Hardwood 1

The Tolerant Hardwood 1 stand was found to have an average DBH of 22.6cm and an average height of 17.8. The tree cover in this stand was 34.88% sugar maple and then 17.44% balsam fir (Appendix 6).

Tolerant Hardwood 2

The Tolerant Hardwood stand was found to have an average DBH of 23.48cm and an average height of 19.74m. The tree cover in this stand was 26.92% sugar maple and then 19.23% trembling aspen (Appendix 6).

Hemlock Side Hill

The Hemlock Side Hill stand was found to have an average DBH of 27.24cm and an average height of 18.9m. The tree cover in this stand was 36.76% eastern hemlock and then 14.71% red spruce (*Picea rubens*) (Appendix 5).

Old Hemlock Patch

The Hemlock Side Hill stand was found to have an average DBH of 33cm and an average height of 19.4m. The tree cover in this stand was 75% eastern hemlock and then 14.71% red spruce (Appendix 5).

Spruce-Fir Mixed Wood

The Spruce-Fir Mixed Wood stand was found to have an average DBH of 21.8cm and an average height of 18.3. The tree cover in this stand was 32.65% red spruce and then 18.37% balsam fir (Appendix 6).

Riparian Grasses and Shrubs

This stand did not contain any stems greater than 10cm and was representative of typical riparian grasses in the ice scour zone of the Meduxnekeag River. Common species included ferns, sedges and grasses in the scour zone and bloodroot, cow parsnip and ferns in the transitional area between ice scouring and forest.

Vandine Falls

The Vandine Falls property is located adjacent to the Wilson Mountain property and is 14ha in area. This property contained two stands, one forested, and one grassland cover type (Figure 6). This property was surveyed on June 18-19.

The forest inventory survey of the Vandine Falls property surveyed a total of 0.11ha (0.79% of total property) and collected data on 77 individual trees. The most common tree species was sugar maple (27.27%), and the most common type of tree species was hardwood (76.63%) (Figure 7). The most common softwood tree species was eastern white cedar (9.09%). The average DBH of the forested stand was 21.31cm and the average height was 17.96m.

Figure 6: Delineated stands of the Vandine Falls using inventory data and satellite imagery. Map created by Devon Noel Bustard.

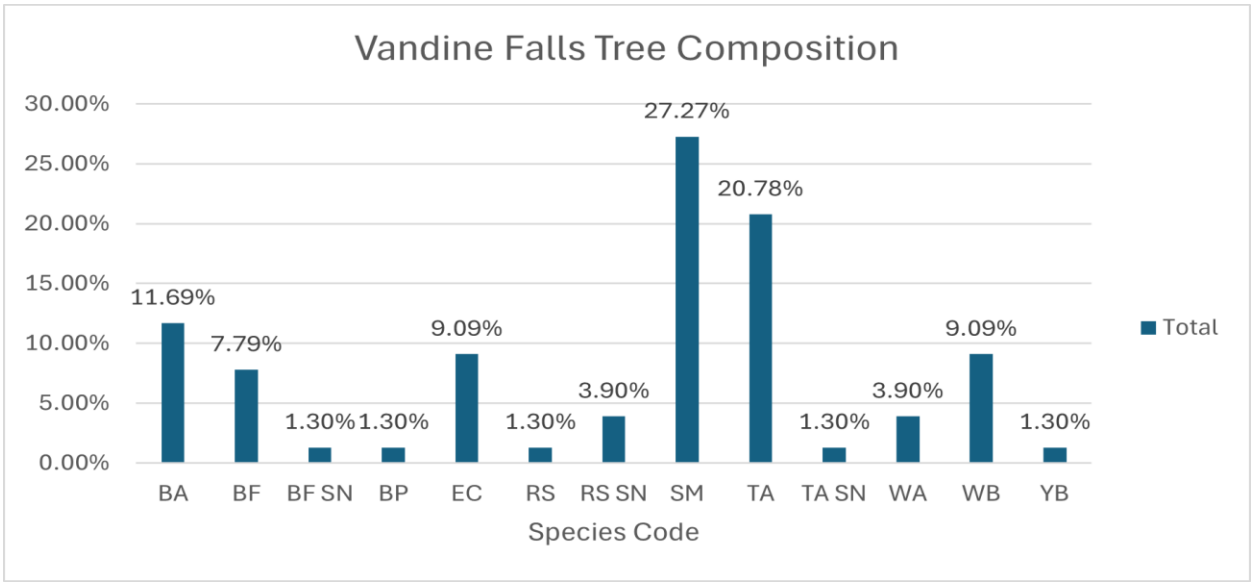

Figure 7: Chart of tree species composition of Vandine Falls, using forest inventory data from 2025 survey. Trees are represented as percentages of grand total and named using tree species code chart from the MRA. Chart created by Devon Noel Bustard.

Discussion:

Using forest inventory data, 17 different forest stands were identified for management. Due to the time-sensitivity of the proposed planting project, stands were characterized into a ranking system based on unfavourable species composition, with 1 being the most unfavourable to 4 being the most favourable. In this ranking system, stands ranked as "1" are deemed to be less resilient and in need of management before stands ranked as "4". Areas such as the riparian grasses, hemlock stands, and cedar-softwood stand of the Wilson Mountain property are deemed to exist in a state that best fits soil conditions and would naturally occur on these sites adjacent to historical AHF. Tree species regeneration in the forested stands mentioned are heavily composed of sugar maple and ash species, which leads to a recommendation of no planting action to reduce risk of overstocking the stands. For stands that currently reflect tolerant hardwood forest types, enrichment planting may elevate these stands to true AHF forest but stands with plantation cover types may require intervention before planting operations.

Table 1: Ranked summary of stands with recommended silvicultural and planting operations.

Stand Name	**Ranking 1-4**	**Site Justification**	**Recommended Species**	**Methods**
WM Tolerant HW 1	3	Lack of AHF indicator species, well drained ridge	Basswood, ironwood, white ash, red oak	Enrichment planting in natural gaps
WM Tolerant HW 2	3	Lack of AHF indicator species, moist bottomland	Basswood, ironwood, butternut, red oak	Enrichment planting in natural gaps
WM Cedar-SW	4	Naturally occurring cedar wetland	N/A	N/A
WM Spruce-Fir	2	High percentage of balsam fir, low light availability	Sugar maple, AHF indicators, eastern hemlock	Enrichment planting in natural gaps
WM Hemlock Side Hill	4	Typical hemlock-red spruce steep slope of AHF forests	N/A	N/A
WM Balsam Fir Mixed Wood	2	Dominated by balsam fir, regeneration mostly fir.	Sugar maple, yellow birch, AHF indicators	Enrichment planting in natural gaps, potential thinning of BF and TA stems
WM Riparian Grasses	4	Ice scoured zone	N/A	N/A
WM Old Hemlock Patch	4	Remnant of historical natural hemlock stand	N/A	N/A
VF Tolerant HW	3	Lack of AHF indicator species	Basswood, ironwood, butternut, red oak	Enrichment planting in natural gaps
VF Riparian Grasses	4	Ice scoured zone	N/A	N/A

Table 1: Continued

BF Balsam Fir North	1	Low diversity plantation of boreal species	Sugar maple, yellow birch, red oak, eastern hemlock, ironwood, white ash	Shelterwood system with irregular gaps opened periodically
BF Balsam Fir South	1	Low diversity plantation of boreal species	Sugar maple, yellow birch, red oak, eastern hemlock, ironwood, white ash	Shelterwood system with irregular gaps opened periodically
BF Spruce North	1	Low diversity plantation of boreal species	Sugar maple, yellow birch, red oak, eastern hemlock, ironwood, white ash	Shelterwood system with irregular gaps opened periodically
BF Spruce South	1	Low diversity plantation of boreal species	Sugar maple, yellow birch, red oak, eastern hemlock, ironwood, white ash	Shelterwood system with irregular gaps opened periodically
BF Red Pine Center	1	Low diversity plantation, wetland area	Yellow birch, red maple, butternut, basswood, white ash	Shelterwood system, allowing RP stems to die naturally
BF Red Pine South	1	Low diversity plantation	Yellow birch, red maple, butternut, basswood white ash, eastern hemlock	Shelterwood system, allowing RP stems to die naturally
BF Mixed Wood	2	Co-dominated by balsam fir and trembling aspen	Sugar maple, yellow birch, AHF indicators	Thinning of BF regen and dense stems, planting in natural gaps and created gaps

Softwood Plantations

All surveyed softwood plantations exist on the Bell Flats property and share similar negative attributes of being nearly pure stands of species not expected to do well under climate change predictions (de Graaf, n.d.). Two stands exist as nearly pure black spruce stands, two of pure red pine, one pure balsam fir and one balsam fir stand (south) that has started to incorporate pioneer hardwoods such as white birch and trembling aspen. Of these stands, row thinning and pre-commercial thins have been completed on all properties except the most southern balsam fir stand. All softwood plantations are near or at rotation age, and the stands may begin to see increased windthrow and rot die off in the coming years as trees pass or grow into maturity. In the two red pine stands, poorly drained soil has caused root rot to kill multiple stems, and likely will continue to affect trees in the future. Due to their nature of being shallow rooted, the black spruce stands have displayed significant windthrow even during the timeframe of forest inventory (June-July) and these stands may create hazards and obstacles for trail users.

To align with both MRA and NBETF values of encouraging and protecting biodiversity and fostering climate resilient forests, a gradual conversion of all softwood plantations into Appalachian hardwood forests is recommended. To achieve this conversion, options such as

clear cutting or intensive removal of unfavourable species were not considered as the Bell Flats property is home to recreational trails, and forest operations such as these may damage walking trails and damage aesthetics of the property. The softwood stands will be converted to hardwood using a shelterwood system that gradually incorporates more hardwood species as years pass. As reported from MVNP trail users, the softwood plantations are favoured due to their open nature and ease of walking, and a shelterwood system will be a less intense shift in forest structure. The shelterwood systems will be created by planting the entire stand area under existing plantation trees, which will initially result in a two-tier canopy and two-aged stand. Following the first few years of successful growth, irregular gaps can be opened in the softwood crowns to allow for shade intolerant trees to colonize the area as a third cohort of trees. This gradual conversion to diversify the structure will allow time for natural recruitment of adjacent hardwood and softwood trees from existing mixed wood and Appalachian hardwood sites, though the MRA should be careful of allowing balsam fir and unfavourable species regeneration.

For planting, species that are shade tolerant or moderately shade tolerant must be used in initial shelterwood systems, unless larger gaps are created for shade intolerant species. Examples of recommended species for use in the shelterwood systems include sugar maple, ironwood, white ash and eastern hemlock. If the MRA chooses to create larger gaps within in the shelterwood system, species such as red oak, basswood or butternut may be planted.

Table 2: Timeline of proposed Bell Flats shelterwood system.

Stage	Timing	Action	Objective	Notes
Pre-Harvest Assessment	Completed	Assess existing stand structure	Determine suitability for shelterwood	
Preparatory Cut	Year 1	Thin softwood overstory by 20-30% where necessary	Increase light availability for saplings	
Site preparation and planting	Year 1-2	Plant saplings in gaps created by stage 2, scarify land where needed	Establish target hardwood and softwood species in stand	
Establishment Cut	Year 3-5	Remove additional canopy 30-40%	Allow for advanced hardwood regeneration	Large irregular gaps may be created at this stage to plant shade intolerant hardwoods
Maintenance	Ongoing	Control competing balsam fir regeneration and pests (deer)	Improve chances of survival and growth of hardwoods	

Mixed Wood Stands

Multiple stands exist on the properties as mixed wood stands and are in general dominated by balsam fir. These stands are in general immature stands, with shared histories of being past farmland allowed to rewild or fallow. Because of the lack of management in the past, these stands display a relatively high percentage of non climate adapted species and create a climate resiliency risk for the future of the MVNP properties. One mixed wood stand can be found on the eastern side of the Bell Flats, where it grades into tolerant hardwood on the Bell Forest property, while the remaining mixed wood sites exist on the Wilson Mountain property and can be further classified into a cedar-softwood mixed wood stand, a balsam fir mixed wood stand and a red spruce-balsam fir mixed wood stand. As the cedar stand is deemed the naturally occurring conditions of the bottomland stream and wetland, this stand will be removed from management for this project to avoid overstocking of species. The spruce-fir site exists on the edges of tolerant hardwood stands and a hemlock-spruce cohort which occupies a steep slope. Because of this stand's proximity to the naturally occurring sites, only supplemental enrichment planting in naturally occurring gaps will be prescribed to allow natural regeneration from targeted AHF and hemlock. Because red spruce is a commonly associated species to AHF hardwoods, it would be best to leave these stems to allow for a wildlife overwintering zone which is presently used by white-tailed deer (*Odocoileus virginianus*). The remaining balsam fir mixed wood stand is the largest mixed wood stand by area (22ha) and would also benefit from enrichment gap planting. While the MRA may choose to manually thin balsam fir and trembling aspen out of this site, it may conflict with their interest of land conservation, thus making a slow introduction of tolerant hardwood species a better option. The last mixed-wood site, found on the Bell Flats property, is dominated by balsam fir and trembling aspen but does show promising regeneration of tolerant hardwoods and AHF indicator species. While a thin of unfavourable regeneration will allow a tolerant hardwood to stand to form quicker, wildlife habitat and browse must be considered, and it is theorized that enrichment planting and the natural decline of boreal species will convert this stand into AHF without the need for thinning, though on a much longer timeframe.

Regarding all mixed wood sites, sites should all be planted by AHF indicator species, as well as yellow birch and sugar maple where not present, which form the dominant crown structure of this forest type. Where possible, assisted migration of red oak into these areas will further strengthen the climate resiliency of these forest stands, while replacing the mast tree function of American beech. Planting sites should be scouted by MRA staff and species matched with suitable sites based on drainage, slope, and aspect.

Tolerant Hardwood Stands

Three true tolerant hardwood stands were observed during inventory operations: one on the Vandine Falls property, and two on the Wilson Mountain property. The Vandine Falls tolerant hardwood stand is composed primarily of sugar maple, with a cohort of trembling aspen as the co-dominant species. This property features only white ash as an AHF indicator species but has potential to be elevated to true AHF with enrichment planting. The two sites on Wilson Mountain may be referred to as Tolerant Hardwood 1 (TH1) and Tolerant Hardwood 2 (TH2). Stand TH2 is bottomlands surrounding and adjacent to a freestone creek, and is comprised of sugar maple, trembling aspen and a significant amount of yellow birch. The tolerant hardwood stand found upon the ridgetop overlooking the stream, TH1, is a similarly comprised stand with sugar maple and balsam fir elements but with the inclusion of American beech and eastern hemlock.

While these stands harbor a significant amount of trembling aspen and balsam fir, the rare understory plants that they also create habitat for create a situation where forest operations may cause more harm than the benefit of removing naturally occurring stems. The recommendation for all tolerant hardwood stands is to enrichment plant AHF indicator tree species and red oak, to not only create a more resilient forest, but true AHF stands that will eventually mature into old growth forests. Enrichment planting may be completed in spring or fall, but spring is recommended due to the deciduous forest cover, which will shade saplings if planted in the fall.

Implementation

Table 3: Timeline of planting and silviculture operations.

Year	Action	Description
2025-2026	Finalize planting zones, order seedlings, prep softwood stands	Use shelterwood and gap planting prep cuts where required
2025 (Fall) - 2026	Plant saplings	Enrichment planting in Bell Flats, Wilson Mountain, Vandine Falls
2026 - 2027	Monitor planting success and natural regen	Survival checks, browse protection, gap expansion where needed
2027-2028	Continue conversion thinning in plantations	Open irregular gaps if regeneration is successful
2029 +	Maintenance, replanting if needed	Fill gaps, control BF regen, trail user monitoring

Limitations

As the Meduxnekeag River Association is a non-profit organization that relies upon external funding for both staff and project budgets, it is important to note that not all silvicultural treatments may be feasible for the MRA to complete in their full extent. One such example is the

thinning of shelterwood systems for rewilding plantations into Appalachian hardwood forest. As it may be costly, as well as difficult to procure a contractor for cutting, the MRA may instead choose to at minimum enrichment gap plant the softwood stands as an alternative to full silvicultural management. While gap planting alone will not alter forest structures and convert the softwood stands into tolerant hardwoods as quickly as the outlined shelterwood system will, it is a better alternative than no management on the plantations. Because of the complexities of running a non-profit organization, the MRA should use these recommendations as a rough guideline as they navigate seed sources, contractors, and site preparation for the following stages of this project.

Final Thoughts

The findings and recommendations of this report provide a framework for restoring Appalachian Hardwood Forest structure across the MVNP properties and creating a more climate resilient forest. Using a combination of shelterwood planting systems, enrichment strategies, and protection of existing tolerant hardwood stands, the Meduxnekeag River Association can guide these forests toward greater climate resiliency and biodiversity. With planting scheduled for 2025 and follow-up actions continuing over the next 3–5 years, these properties may also serve as demonstration sites for ecological forestry and climate adaptation in the region. Continued monitoring, adaptive management, and community education are recommended as integral components of this restoration effort. Future assessments can expand upon this work by measuring regeneration success, wildlife use, and forest structure over time.

Bibliography

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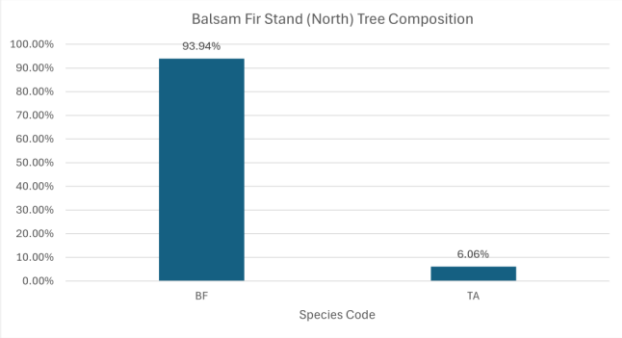
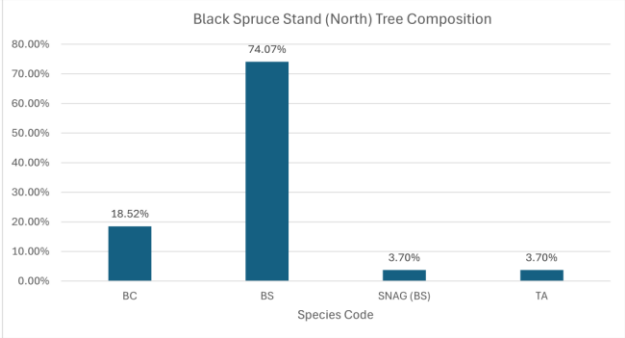
Appendices

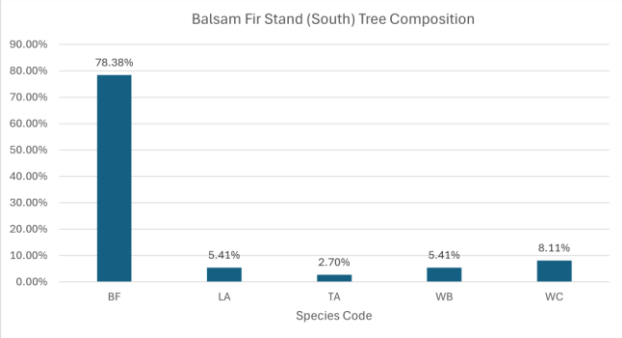
Appendix 1: Table of species codes for forest inventory data

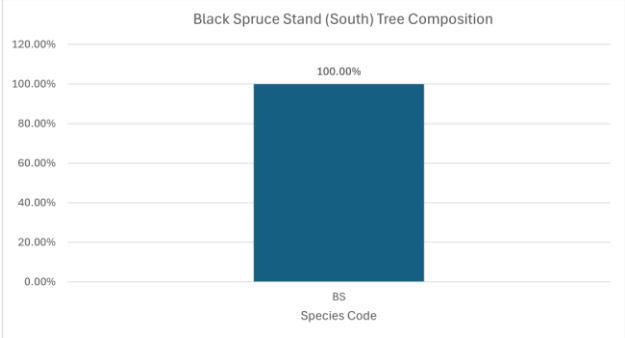
Species Code	Common Name
BF	Balsam Fir
EC/WC	Eastern White Cedar
BC	Black Cherry
EL	Eastern Larch
BS	Black Spruce
RS	Red Spruce
AB	American Beech
EH	Eastern Hemlock
SM	Sugar Maple
STM	Striped Maple
RM	Red Maple
YB	Yellow Birch
WB	White Birch
SN/SNAG	Snag
AE	American Elm
IW	Ironwood
TA	Trembling Aspen
LA	Largetooth Aspen
BW	Basswood
WP	White Pine
RP	Red Pine
WA	White Ash
BA	Black Ash
AB (C)	American Beech with Canker

Appendix 2: Bell Forest tree species composition charts of balsam fir and black spruce stands.

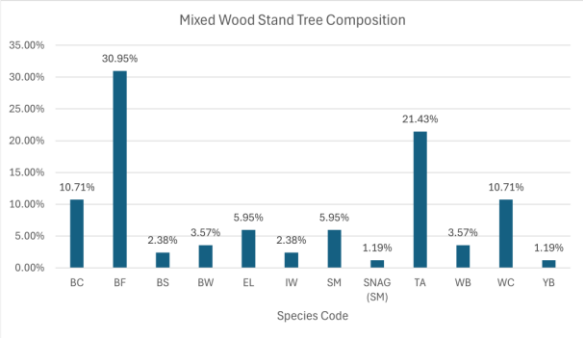


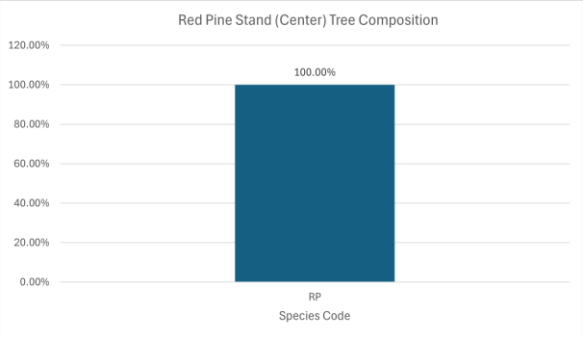


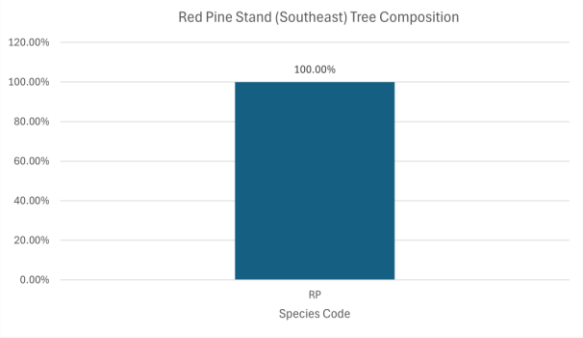




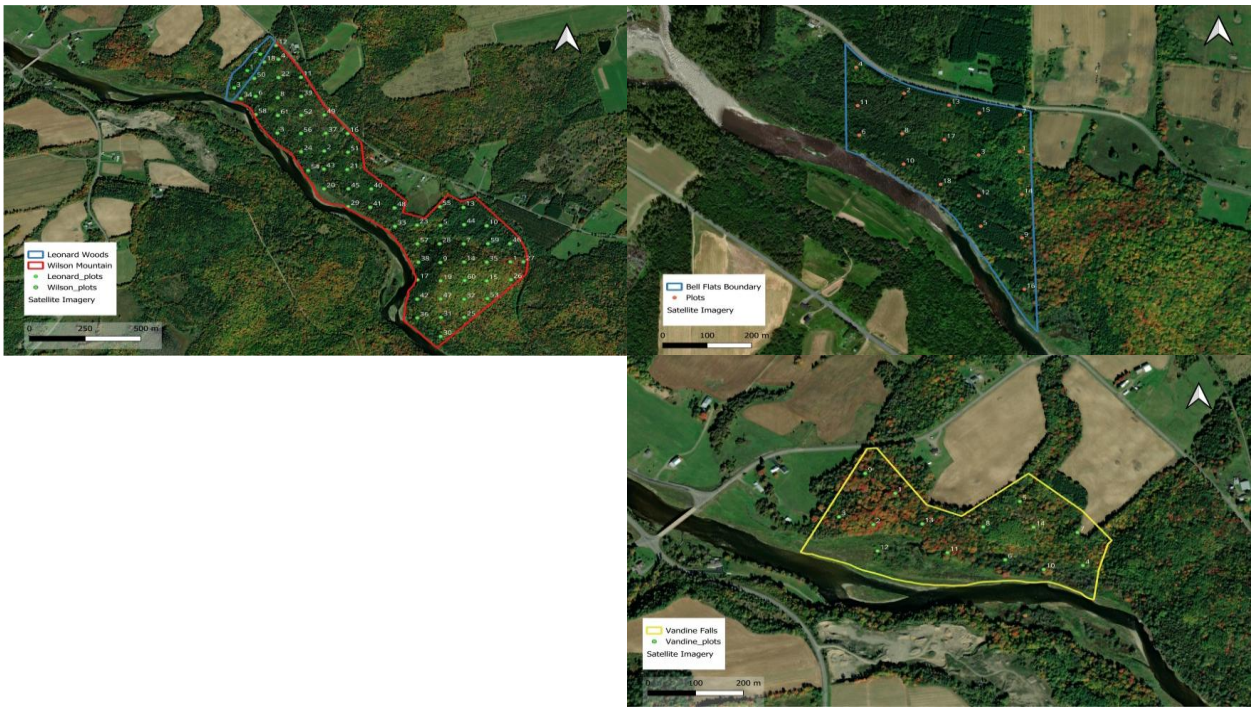
Appendix 3: Bell Forest tree species composition charts of mixed wood and red pine stands.



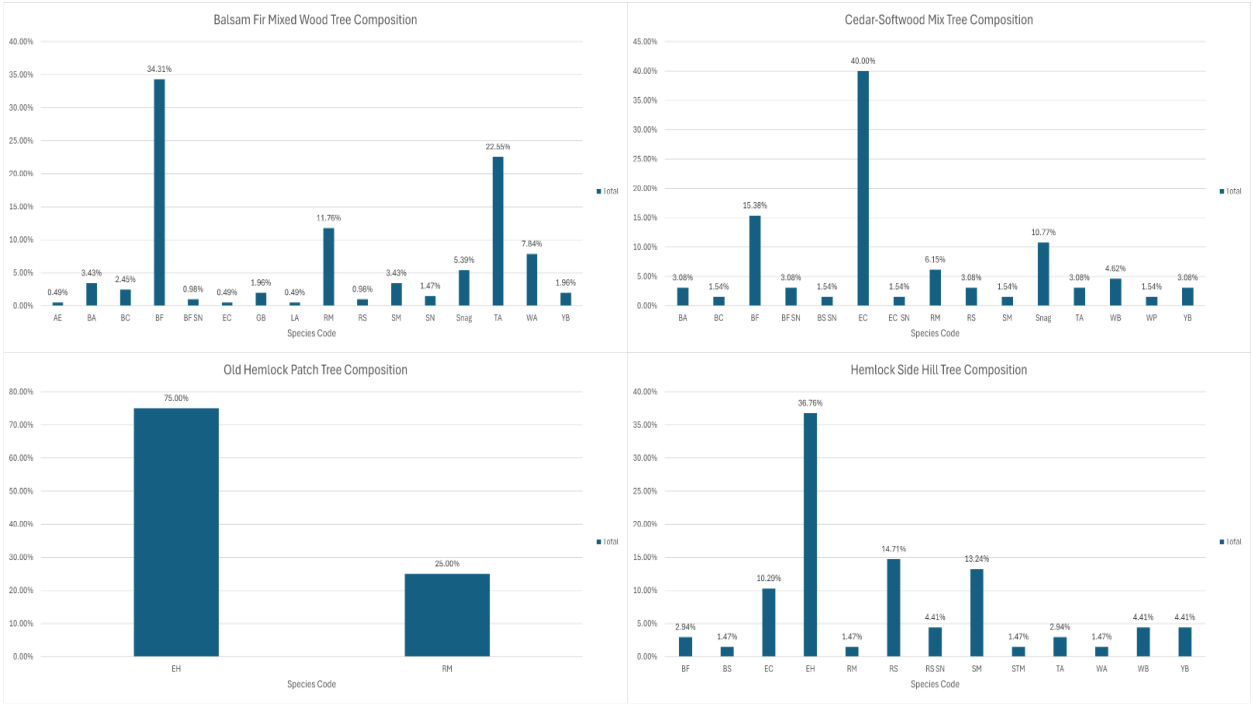




Appendix 4: Maps of forest inventory plots completed during 2025 survey, situated on Bell Forest, Vandine Falls, Leonard Woods, and Wilson Mountain.



Appendix 5: Wilson Mountain tree species composition of mixed wood and hemlock stands.



Appendix 6: Wilson Mountain tree species composition of spruce and tolerant hardwood stands.