2025 Annual Project Report

University of Alberta Research Forest

Project Forest

Contents

Land Acknowledgement

| Traditional Territories

Elder Rufus Pretty Young Man of Siksika First Nation

Project Forest acknowledges that our work is conducted on both Treaty and non-Treaty lands. These lands are the traditional territories of First Nations and Indigenous Peoples. We recognize that our work is intertwined with the deep and diverse histories of Indigenous Peoples. We are grateful for the opportunity to work in these territories and are committed to the recognition and respect of those who live or have lived, travelled, and gathered on these lands for time immemorial.

About Us

| Our Mission, Values and Purpose

Rewilding Canada, one forest at a time.

Project Forest is a non-profit organization working in partnership with conservation groups, Indigenous communities and Canadian businesses to make a positive environmental and social impact in our communities through planting forests. The forests we plant clean air and water, increase biodiversity and contribute to the overall health and well-being of our community.

Our work is rooted in our values.

Responsibility

We believe it is our responsibility to use our skills, knowledge, and experience to bring about positive change in the world.

Reciprocity

We recognize that we have benefited from the earth's resources and are committed to giving back through careful and thoughtful solutions.

Humility

We are grateful for the opportunity to learn from nature, to contribute to improving our environment, and to make a positive impact in people's lives.

Transparency

We document, monitor, and share our processes and findings with partners and the public—every step of the way, on every project.

Community

We create spaces where people can connect with nature, and each other. We respect every community we are invited into, and work together to make positive change.

Our Purpose

Inspiring interconnectedness and hope rooted in reciprocity and community

Overview

| United Nations Sustainability Development Goals

Goals to Transform Our World

Planting new forests is critically important in addressing the challenges of our time, particularly when aligned with the United Nations Sustainable Development Goals (UN SDGs). As communities grapple with climate change and biodiversity loss, forests emerge as pivotable solutions that intersect with multiple UN SDGs including combating climate change and preserving biodiversity, fostering economic development, ensuring food security, promoting clean water access and advancing social equity. Aligning the impacts of our forests with the UN SDGs is essential for communicating to stakeholders our dedication to sustainability, transparency and the measure of progress over time.

In our 2025 Annual Report, we have linked the outcomes of our rewilding projects with relevant UN SDG targets and indicators, as well as aligned them with corresponding Environment, Social and Governance goals. This comprehensive approach ensures that our partners have readily accessible information for corporate reporting, simplifying the process and enhancing transparency.

Purpose & Positive Impact

The following UN SDGs are impacted by Project Forest's University of Alberta Research Forest:

Purpose

Positive Impact

Overview

| Forest Facts

About the forest you funded.

NAME

University of Alberta Research Forest

LOCATION

Peace River, Alberta
Treaty 8 Territory
56°33'44.2"N 117°51'40.7"W

DATE PLANTED

May 2024
June 2025

SIZE

10.7 hectares

TOTAL SEEDLINGS PLANTED

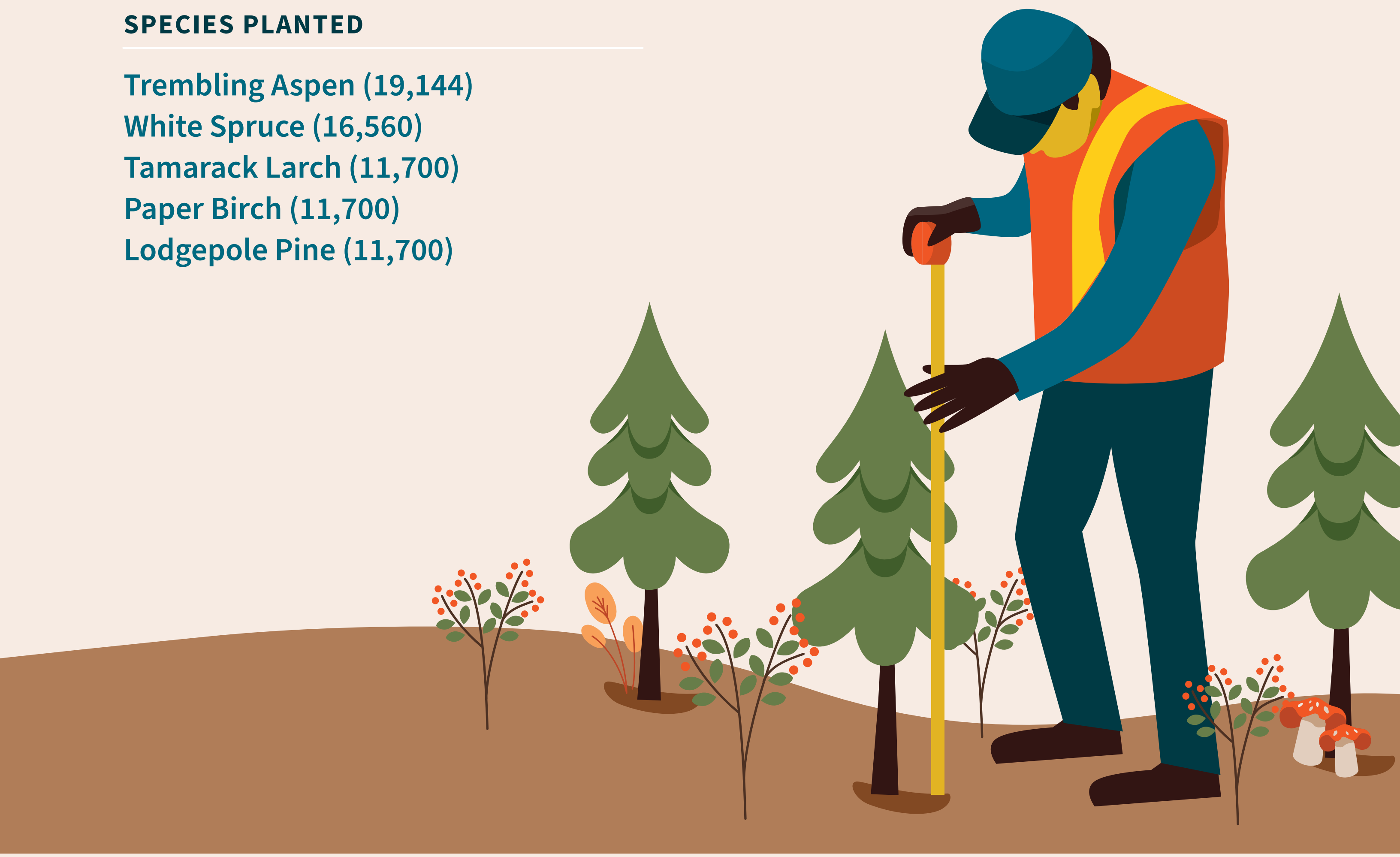
70,210

TOTAL SPECIES PLANTED

5

SPECIES PLANTED

Trembling Aspen (19,144)
White Spruce (16,560)
Tamarack Larch (11,700)
Paper Birch (11,700)
Lodgepole Pine (11,700)



Purpose

| UN SDG 15 - Life on Land

Goal: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

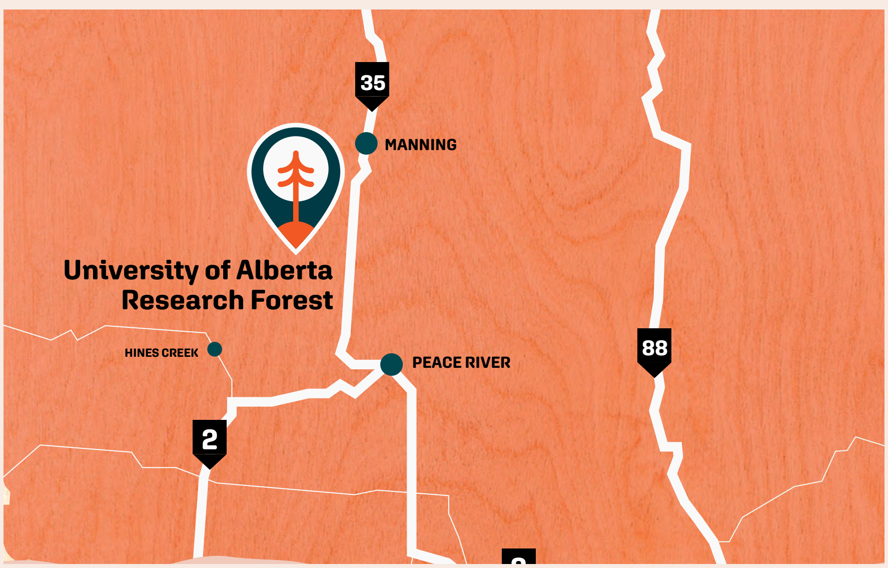
Matching ESG Goals:

- Providing clean air and water.
- Improving biodiversity.
- Re-establishing traditional landscapes.

15 LIFE ON LAND

Project Forest is making a positive impact through restoring degraded land to increase forest cover, enhance biodiversity, and promote the sustainable use of terrestrial ecosystems.

Indicator 15.1.1: Forest area as a proportion of total land area.



70,210

Total Trees and Shrubs Planted in 2024 and 2025

Project Forest's University of Alberta Research Forest is a collaboration with Dr. Charles Nock's **Ecosystem-based Forest Management Lab** embedded within the internationally recognized EMEND Project (Ecosystem Management Emulating Natural Disturbance). The 10.7-hectare project site sits within the EMEND land base, a 7,000-hectare forested landscape protected for long-term ecological research.

Purpose

| UN SDG 15 - Life on Land

Indicator 15.1.2: Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type.

Project Forest partners with Indigenous communities to plant trees, shrubs, food and medicinal plants that contribute to increasing the overall forested areas in Western Canada.

More than 20 combinations of trembling aspen, tamarack, paper birch, white spruce and lodgepole pine are tested to further understand how mixed-species boreal stands support biodiversity. It also examines regenerative methods that maintain biodiversity, forest structure and overall ecosystem integrity.

10.7
Hectares of Land Planted

Plots are established across a range of spacing densities and fenced vs. unfenced conditions, generating data on how external pressures affect species establishment and long-term ecosystem integrity, [Appendix A - Tree Diversity Experiment Establishment Report]. Results from the experiment will answer questions about how retention of green-tree residuals affects forest regeneration, patterns of succession, and biodiversity. These findings will be able to inform forest management policy at provincial and national levels, contributing to a more evidence-based approach to sustainable forestry in Canada.

Future Activities

The University of Alberta has identified additional land for expansion, with a second planting event scheduled for 2027. Data from this phase will be reported following the first full growing season.

Purpose
| UN SDG 15 - Life on Land

Indicator 15.2.1: Progress towards sustainable forest management.

Sustainable forest management balances the needs of the community with the long-term use of forest resources while preserving the ecological integrity and benefits the forest provides to people and the environment.

Through collaboration with research agencies, governments and forest product companies in Alberta, EMEND is leading the way in sustainable forest management, with research examining the significance of variable retention harvesting in supporting and promoting biodiversity within forest ecosystems. The Ecosystem-based Forest Management Lab performs rigorous scientific monitoring, which documents seedling survival, stem density, height and root collar diameter to build a long-term dataset that forest management depends on (Nock, 2026).

Rather than following Project Forest's traditional rewilding plan and monitoring assessments, this experiment functions as an advanced form of adaptive forest management. This is done by using controlled species diversity and density treatments to determine which combinations best support resilient forest establishments under varying conditions. Findings from this work are designed to be transferable, informing not only the management of this site but contributing to the broader scientific understanding of how forests can be restored and sustained in the face of climate change.

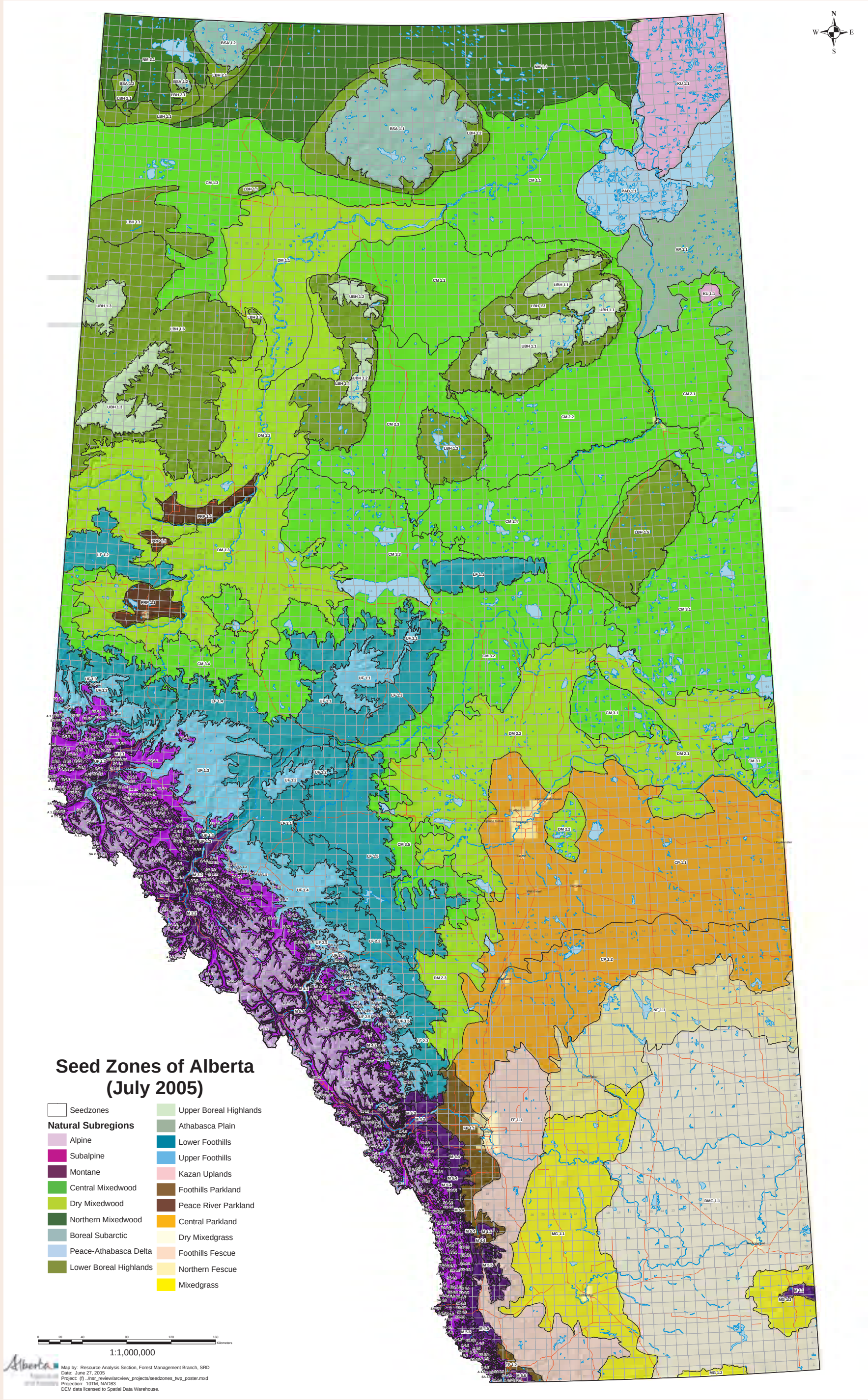
One aspect of this research is its potential to inform a reassessment of Alberta's Seed Zone legislation (Alberta Forest Genetic Resource Management and Conservation Standards). These were established to ensure that seed is sourced from genetically appropriate local populations. As temperatures rise and precipitation patterns shift, the species and seed sources that once thrived in any given zone may no longer be optimally suited to future conditions. The long-term survival and growth data generated at the University of Alberta Research Forest will provide evidence-based insight into whether current seed zone boundaries remain ecologically appropriate, and whether policy updates are needed to support climate-adapted reforestation across the province.

Sustainable Forest Management is a way of using and caring for forests to maintain their environmental, social, cultural and economic values and benefits over time (NRCAN, 2024)

Purpose

| UN SDG 15 - Life on Land

Figure 2: Seed Zones of Alberta

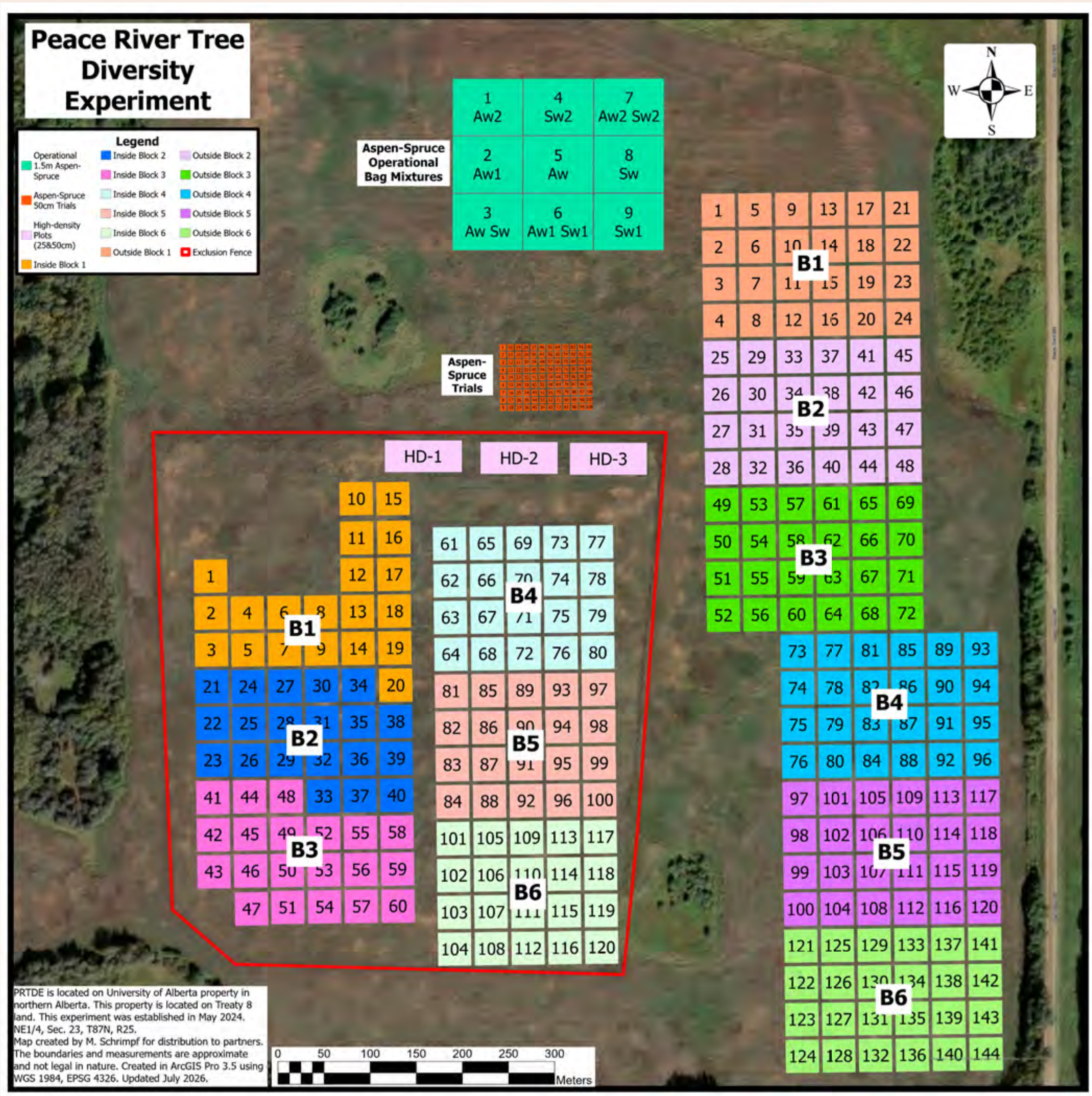


The University of Alberta Research Forest serves as both a living laboratory and a long-term investment in the ecological knowledge that future generations of land stewards will depend on.

Purpose

| UN SDG 15 - Life on Land

Figure 3: University of Alberta Planting Site



Purpose

| UN SDG 15 - Life on Land

Indicator 15.3.1: Proportion of land that is degraded over total land area.

Haeussler et al. (2002) define ecosystem degradation as an event or process that reduces the productivity or value of an ecosystem, or that delays or prevents recovery from disturbance through normal successional processes.

Project Forest systematically targets these very landscapes which have been damaged or altered by human land-use change. Each project begins the multi-decade process of soil transition from minimally diverse agricultural profiles towards complex forest soil ecosystems, rich in organic matter, biological activity and structural resilience (Young & Crawford, 2004).

Indicator 15.5: Take action to reduce degradation of natural habitats, halt biodiversity loss and protect threatened species.

Project Forest prescribes a distinct, site-specific mix of trees and shrubs across all of our projects. By assessing each species for ecological fit, climate resilience, and functional role within the emerging ecosystem, a structural and compositional diversity is developed. The result is a layered landscape of varied canopy heights, understory densities, and species compositions that builds genuine structural complexity. In addition, functional, adaptable habitats are created for wildlife that will continue to self-sustain as conditions change over time.

Seedling marker at the University of Alberta Research Forest Planting site

Purpose

| UN SDG 13 - Climate Action

Goal: Take urgent action to combat climate change and its impacts.

Matching ESG Goals:
- Reducing GHG emissions.
- Experiencing nature in an educational and interactive way.

13 CLIMATE ACTION

The forests we plant can have a significant impact on mitigating climate change.

Indicator 13.2.2: Total greenhouse gas emissions per year.

Forests act as carbon sinks, absorbing carbon dioxide (CO2) from the atmosphere through photosynthesis and storing it in their biomass and soil. By planting forests, we increase the amount of CO2 sequestered, thereby reducing the concentration of greenhouse gases (GHGs) in the atmosphere. This helps mitigate climate change by reducing the amount of CO2 that contributes to global warming (NRCAN, 2024).

The University of Alberta Research Forest is a long-term project forecasted to run for one stand rotation, or approximately 80-100 years. The species combinations being trialed are explicitly designed to identify which mixtures are most resilient to a changing climate, with the long-term goal of enhancing the adaptive capacity of Canada's boreal forests.

As the experimental forest matures into a functioning carbon sink, the research data it generates will extend its impact far beyond the site's 10.7-hectare footprint. Results will inform silvicultural decisions and shape forest management policy at provincial, national, and international levels for years to come.

The amount of CO2 projected to be removed from the atmosphere over the lifetime of the University of Alberta Research Forest has not yet been finalized. Project Forest uses the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) modelling framework developed by Natural Resources Canada to assess the impacts of our forests on carbon. This is

Carbon Budget Model of the Canadian Forest Sector is an aspatial, stand- and landscape-level modeling framework used for international reporting of the forest carbon balance of Canada's managed forest (NRCAN, 2024)

Purpose
| UN SDG 13 - Climate Action

the national standard for reporting on forest carbon. However, the initial calculations returned figures that require further review by project lead Dr. Charles Nock of the niversity of Alberta, and an updated projection will be confirmed in a subsequent report.

Research Forest planting grounds

Target 13.3: Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

Hands-on student training and contributions of the original findings to a global network of forest experiments will build institutional capacity for evidence-based climate action. The university's collaboration with numerous research agencies, provincial and federal governments and forestry companies will give the project's diversity data a broad, durable policy audience.

11

Project Funding Partners

Project Forest also provides our partners and the wider community with the opportunity to participate in educational activities through our Community and Corporate Outreach activities. Experiencing nature in an educational and interactive way enriches knowledge, fosters a connection with the environment, promotes well-being, and encourages responsible environmental behaviour.

Purpose

| UN SDG 13 - Climate Action

These are some of the engagement activities Project Forest conducted in 2025:

Indigenous Engagement

- Opportunity to learn from Indigenous Knowledge Keepers and Elders in various capacities from presentations, interviews and talks, to one-on-one exchanges at our Corporate Planting Events and Annual Partner Celebration.

Lunch and Learns, Keynote Presentations and Panel Discussions

- Overview of the rewilding process, our projects, and stories of community impact.
- Stakeholder project impacts and opportunity to engage with the Project Forest team.

Tree Planting Events

- Educational talks around seedling physiology, forest succession, tree planting technique, tree planting survey methodology, seed collection, plant identification, and traditional plant uses.
- Corporate Events: In-person, hands-on volunteering opportunities for partners.
- Community Events: Ground-breaking events are open to community members and partners to come together, engage with the project and share stories over shared food.

Media Outreach (podcasts, radio, tv and webinars)

- Overview of the rewilding process for general audiences.
- Discussions of more in-depth topics such as working with Indigenous communities, operating a non-profit, and sustainable forest practices.

Annual Partner Celebration

- Presentations featuring a wide range of speakers from the Project Forest community.
- Focus on Indigenous reconciliation through rewilding, sustainable business practices, and community investment.

Community Engagement

- Seed Kits are built by local high school students to be given away throughout the year at various conferences and events.
- An Annual Seedling Giveaway at Siksika Nation raises awareness for projects, share stories behind them, and place stewardship of the land directly into the hands of community members.

Purpose

| UN SDG 11 - Sustainable Cities and Communities

Goal: Make cities and human settlements inclusive, safe, resilient and sustainable.

Matching ESG Goals:

- Generating social & economic growth.
- Advancing health & wellbeing.
- Developing deeply ingrained Indigenous relationships.

Restoring degraded land can have a positive impact on communities through creating safe, resilient, and sustainable natural spaces.

Indicator 11.a.1: Number of countries that have national urban policies or regional development plans that (a) respond to population dynamics; (b) ensure balanced territorial development; and (c) increase local fiscal space.

The University of Alberta Research Forest creates a local hub of scientific activity, attracting students, researchers, and institutional partners whose presence supports regional knowledge-economy development. By contributing to research that shapes sustainable forestry policy, the project supports balanced territorial development while a permanence framework ensures that forests planted at the research site remains protected, contributing to stable green infrastructure for surrounding communities.

The forests we plant provide areas for recreation and traditional land use within the community. Our funding partners finance the rewilding costs including seedlings, planting, and labour, allowing communities to allocate more funds to services and infrastructure.

Local fiscal space is defined as the sum of financial resources available to a government for the improved delivery of basic services without any prejudice to the sustainability of a government's financial position (Heller, 2005)

Purpose

| UN SDG 11 - Sustainable Cities and Communities

Tree Planter at the Project Forest University of Alberta Research Forest

Rewilding projects require labour to complete, including but not limited to:

- Mechanical site preparation
- Seed collection
- Vegetation management
- Survival assessment survey and data collection
- Cover crop deployment
- Construction work

By investing in rewilding, Project Forest funding partners are creating employment opportunities. The income earned by individuals through these jobs can have a positive economic impact and expand local fiscal space.

Positive Impact

| UN SDG 3 - Good Health and Well-Being

3 GOOD HEALTH AND WELL-BEING

Goal: Ensure healthy lives and promote well-being for all, at all ages.

Planting a forest can have several positive impacts on ensuring healthy lives and promoting well-being for all ages.

Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Accessible green spaces are increasingly recognized as essential health infrastructure, delivering measurable benefits to both humans, wildlife, and the ecosystems they depend on. As urban expansion continues to fragment natural landscapes, forests serve as vital refuges for biodiversity while simultaneously protecting communities from the pollution and environmental hazards identified under UN SDG 3.9.

By rewilding Canada's forests, Project Forest creates meaningful gathering spaces that foster social connection, community cohesion, and belonging. Beyond these social benefits, exposure to green space is strongly linked to improved mental and physical health, regardless of whether people actively seek it out.

A systematic review and meta-analysis found that proximity to green space is associated with reduced cardiovascular disease, lower cortisol levels, and decreased rates of depression and anxiety (Twohig-Bennett & Jones, 2018). Because these benefits accrue simply through everyday proximity, communities living near restored forest sites stand to gain real improvements to their wellbeing, whether or not they consciously engage with the space at all.

Forest bathing, or shinrin-yoku, is the practice of deliberately and mindfully immersing oneself in a forested environment through slow, sensory engagement. Originating in Japan in the 1980s, it has demonstrated measurable reductions in anxiety, depression, anger, and fatigue, as well as improvements in mood and feelings of vitality (Li, 2010).

Positive Impact

| UN SDG 3 - Good Health and Well-Being

The broad spectrum of health and well-being benefits that forests generate across these interconnected dimensions include:

Air Quality and Pollution Reduction

- Trees absorb harmful airborne pollutants, reducing community exposure to toxic gases.
- Leaf surfaces intercept and capture fine particulate matter from urban air.
- Canopy cover reduces ground-level ozone formation during hot weather.
- Green corridors dilute traffic-related nitrogen dioxide concentrations near roadways.

Pollution Buffering and Environmental Health

- Forest edges buffer noise pollution, reducing stress and sleep disruption.
- Vegetation filters stormwater runoff, reducing pollutant loads in waterways.
- Tree roots stabilize soils, preventing dust and sediment mobilization.
- Dense plantings reduce windblown agricultural chemicals reaching residential areas.

Biodiversity and Wildlife Health

- Plant diversity supports pollinator populations critical to local food systems.
- Connected green corridors allow wildlife movement between fragmented habitat patches.
- Healthy urban biodiversity increases ecosystem resilience against pest and disease outbreaks.
- Diverse understory plantings support soil microbiome health and nutrient cycling.
- Urban forests provide nesting, foraging, and refuge habitat, buffering species against climate-driven displacement.

Temperature Regulation and Heat-Related Health

- Urban tree canopy can reduce surface temperatures by up to 8 degrees Celsius.
- Shade and transpiration cooling lower heat-related illness risk significantly.
- Green spaces reduce urban heat island intensity, protecting vulnerable populations.
- Shelterbelts buffer wind while moderating extreme temperature fluctuations seasonally.
- Cooler microclimates reduce cardiovascular and respiratory strain during heat events.

Mental and Physical Well-Being

- Regular green space access lowers cortisol and reduces chronic stress.
- Proximity to urban nature is linked to reduced anxiety and depression.
- Walkable green corridors increase daily physical activity among residents.
- Green schoolyards improve children's attention, mood, and emotional regulation.
- Communal green spaces reduce social isolation and strengthen community cohesion.

Positive Impact

| UN SDG 6 - Clean Water and Sanitation

Goal: **Ensure availability and sustainable management of water and sanitation for all.**

The forests we plant can have positive impacts on ensuring the availability and sustainable management of water.

Indicator 6.3.2: Proportion of bodies of water with good ambient water quality.

Forests filter, purify and improve the quality of our water. Tree roots help retain soil and reduce the transport of pollutants into water bodies. Planting forests in watershed areas can contribute to protecting water quality, ensuring access to clean water for communities. (NRCAN, 2025)

The University of Alberta Research Forest is adjacent to the EMEND Field Research Facility, which has an established body of research on groundwater characteristics and nutrient cycling under different forest management treatments.

While planting forests alone cannot solve all our water-related challenges, they do offer nature-based solutions to help achieve sustainable management of our water resources.

Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

Forests act as natural sponges and filters, absorbing rainfall and gradually releasing it while purifying it as it passes through the ecosystem. By restoring forests, we can enhance water quality, reduce erosion, and promote water retention in the landscape.

Positive Impact

| UN SDG 17 - Partnerships for the Goals

Goal: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Matching ESG Goals:

- Coordinating conservation, Indigenous, and business partnerships.
- Directing private capital toward public-good outcomes.
- Strengthening ESG transparency and accountability.

17 PARTNERSHIPS FOR THE GOALS

Every forest planted by Project Forest is made possible by the coming together of funding partners, Indigenous communities, conservation organizations, and land stewards, each contributing something the others cannot provide alone.

Indicator 17.3.1: Additional financial resources mobilized from multiple sources.

Rewilding benefits everyone, yet it rarely has a natural funding source. Project Forest's funding model is designed to draw resources from multiple sectors, allowing partners to share the full cost of rewilding in a manner that is structured, accountable and scalable. Since 2020, this approach has grown to include 77 funding partners, connecting the Canadian business community to Indigenous territories and conservation sites in a meaningful way.

77

Total funding partners between 2020 and 2025

The University of Alberta Research Forest was made possible through partnerships built on shared values and a collective commitment to long-term rewilding. This alignment demonstrates how multi-source funding can generate a lasting ecological and community legacy.

Target 17.16: Enhance the Global Partnership for Sustainable Development through multi-stakeholder partnerships.

Our forests are the product of relationships that no single organization could build alone. Conservation groups contribute land and ecological expertise. Indigenous communities contribute land, traditional knowledge, cultural context, and long-term stewardship. Businesses provide

Positive Impact
| UN SDG 17 - Partnerships for the Goals

the financial resources that make planting possible. Post-secondary institutions contribute research capacity and scientific rigour that strengthen our understanding of how these forests grow and function over time. When brought together in alignment, Project Forest is able to coordinate their contributions and ensure that the outcomes are documented and shared in a way that keeps all partners accountable and engaged year after year.

With additional guidance from the Indian Resource Council who hold a formal seat on our Board of Directors, we ensure that Indigenous institutional knowledge doesn't only shape our planting plans but our governance. This exchange of resources and knowledge deepens over time as relationships with our partners grow stronger each year. The result is not a transactional arrangement, but a growing community of organizations and individuals united around a shared commitment to rewilding Canada, one forest at a time.

Indicator 17.18.1: Statistical capacity indicator for SDG monitoring.

At the University of Alberta Research Forest, monitoring standards have been designed by Dr. Charles Nock to generate structured, replicable research: each tree serves as a living data point, with plots systematically assigned to varying density treatments, fenced and unfenced conditions, and species diversity levels. Annual inventories track height, root collar diameter, survivorship, and stand density, while drones, sensors, and geotechnical equipment provide a depth of ecological monitoring rarely seen at a rewilding site.

The findings generated here are intended to reach well beyond Alberta, informing Canadian forest management policy and feeding into international reporting frameworks. In this way, every seedling planted is not only restoring a landscape but contributing to a growing body of knowledge that will shape how forests are understood, managed, and valued for decades to come.

Partner

| Funding Partners

Our work is not possible without you.

Thank you to our funding partners!

Diamond Willow

Platinum Forest

Silver Orchard

Bronze Grove

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Appendix A - Work scope - WBAC Trial at EMEND Research Facility

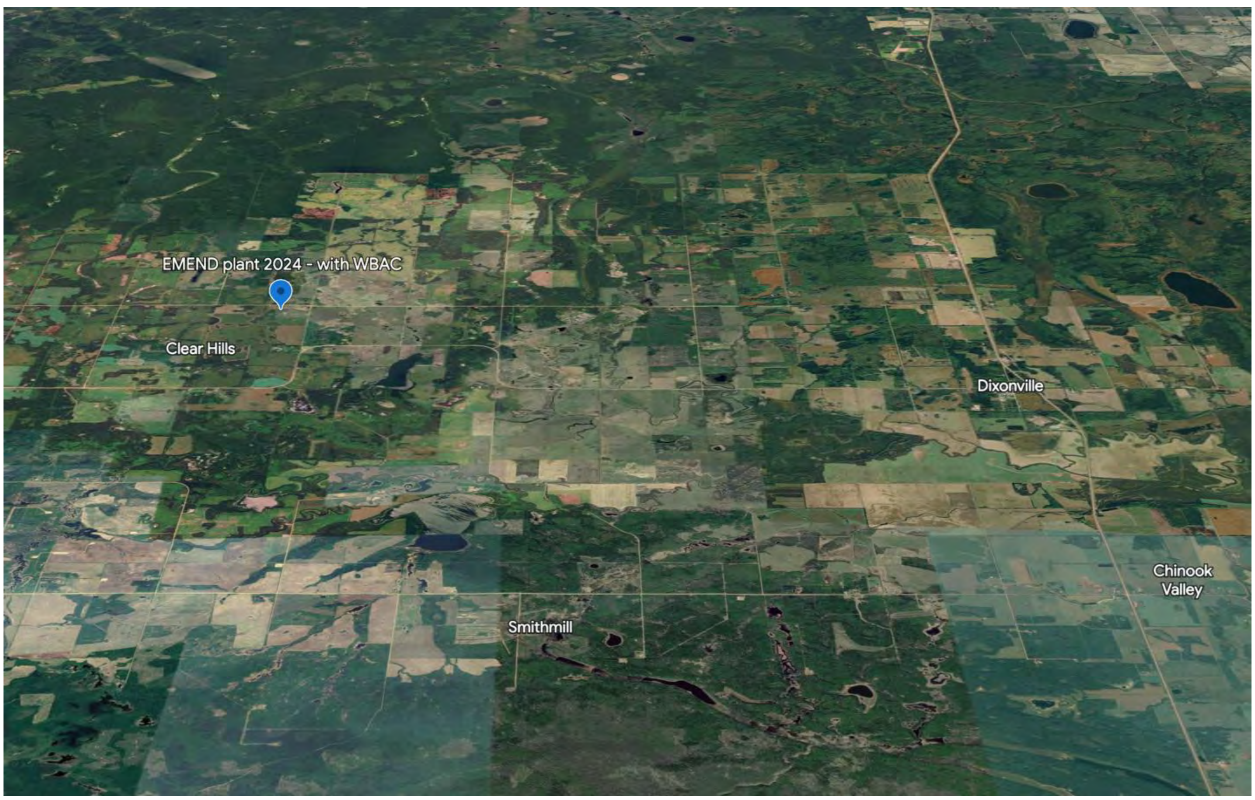
Work scope - Spring/Summer plant 2024 at EMEND Research Facility

Contact: Charles Nock, nock@ualberta.ca, 780-907-5942

Location

56°33'50.24"N

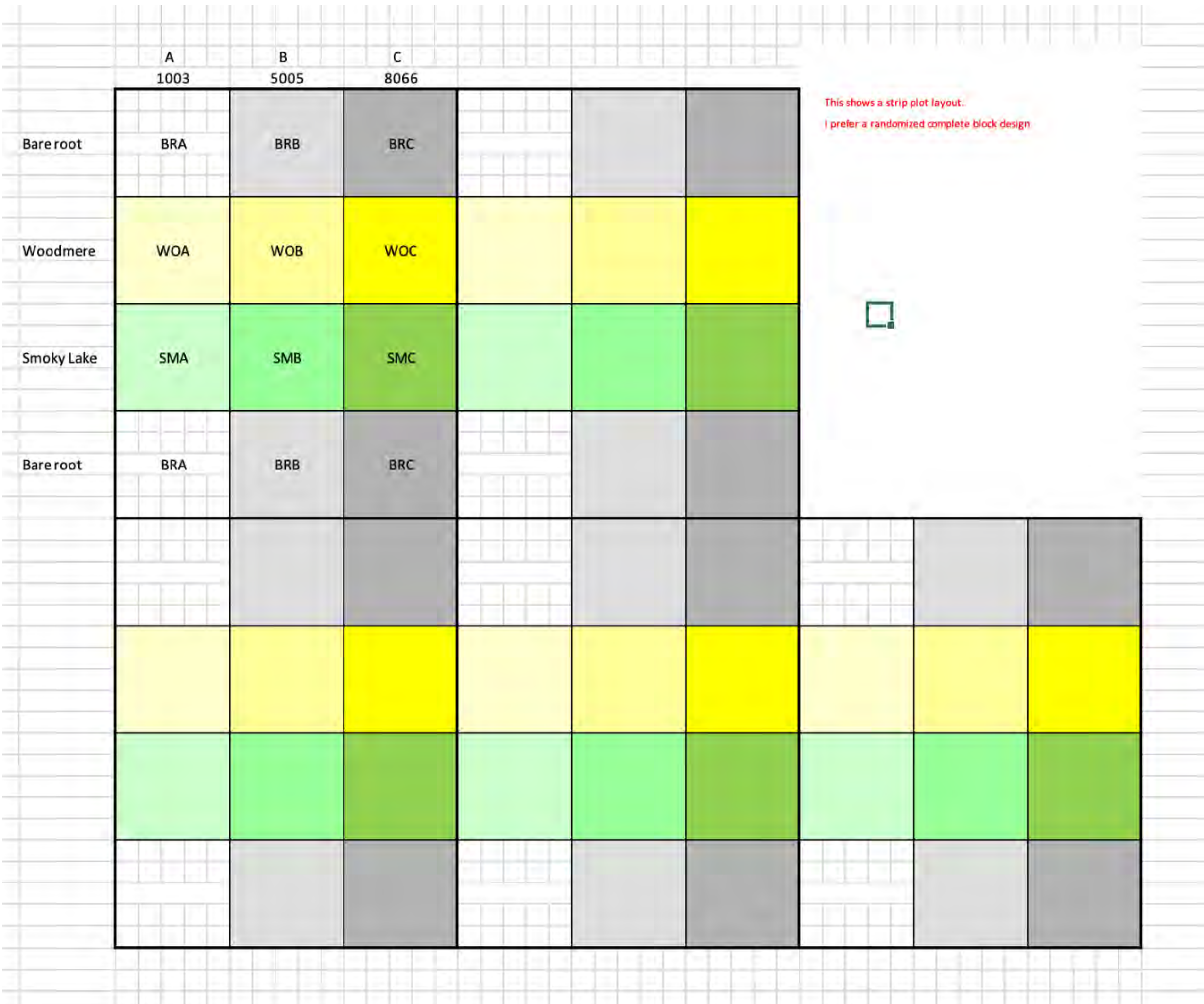
117°51'53.09"W



also attached KML file (EMEND plant 2024.kml)

Planting design

To include 5 blocks - shown below, with 12 plots per block.



Site Preparation

Local farmer able to be contracted to do till or herbicide application. Last crop on field was canola in 2022.

Contact for Trevor Kirschbaum (local farmer I have been in contact with).

trevor@kerbagroup.com

Access

Access to field from Northern end of the site by the camp building (old 2 wire fence has whole in it).

Trees

I am working in getting confirmation from Jean Brouard that we will get the trees from WBAC (jean.brouard@ipfgenetics.ca) (last uodate Fed. 24, 2023).

Area to be planted

There are 300 trees per replicate, so with 5 blocks planned this is a total of 1500 trees.

Treatment structure
for 1 replicate

	1003	5005	8066	
Bare root	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25			75
Woodmere				75
Smoky Lake				75
Bare root				75
	100	100	100	300

Area calculations

PER REP	If planted at 3 x 3 m	0.27	ha
	If 5 reps	1.35	ha
PER REP	If planted at 1 x 1 m	0.03	ha
	If 5 reps	0.15	ha
PER REP	If planted at 2 x 2 m	0.12	ha
	If 5 reps	0.6	ha

Appendix B - University Monitoring Results | 2025

i. Peace River Tree Diversity Experiment Establishment Report

Peace River tree Diversity Experiment Report

Produced for Project Forest

Dr. Charles Nock
Associate Professor
University of Alberta
April 11, 2026

Table of Contents

Introduction

The Peace River tree Diversity Experiment was planned as a collaboration between the University of Alberta and Project Forest. At the University of Alberta, Dr. Charles Nock led a CFI JELF proposal centered on the establishment of an experiment manipulating tree diversity in the boreal forest, which would leverage previous CFI investments, namely a quarter section of land and the EMEND Field Research Facility. The proposal included the purchase of field equipment and drones and sensors for monitoring of the experiment, as well as construction of a large game fence around the site. However, as trees are considered consumables by the CFI, they could not be supported by CFI funds. This was the motivator for the start of the collaboration between U of A and Project Forest, with U of A being the land holder with a goal of starting a forest and maintaining it, and Project Forest being able to support tree supply and planting costs.

This report is the first that documents the establishment of the first phase of the experiment reflecting trees planted in spring 2024, which included: 1) two densities (0.25 m, 0.5 m) in 4 m x 4 m plots, 2) one density of 1.5 m in 20 x 20 m plots and fenced, and, 3) one density of 1.5 m in 20 x 20 m plots and not fenced.

A fill plant was conducted in June 2025 with a threshold ~25% of trees missing or dead as a threshold for replanting. Tree density data in this report do not then include trees planted as part of the fill plant. This will be reflected in a report which will follow the spring 2026 inventory. There was also then planting of an additional experiment with aspen, spruce, and improved aspen and spruce (to be inventoried in Spring 2026, so not included in this report).

A number of digital appendices with the data summaries will be included with this report.

Site Description

The experiment was planted at the site of the EMEND Field Research Facility, which lies just west of Dixonville, Alberta to the north and west of Peace River, Alberta (Figure 1). The property is a quarter section which was acquired as part of a previous CFI proposal to serve as the base for research at the EMEND experiment. The property is a mix of residual forest elements and cultivated fields, which were worked up until planting of the trees in 2024. Most recently, crops cultivated on the site included canola and clover.

Abundant potential tree competitors included residual and volunteer canola, thistle, bindweed. Photos of plot condition, including weedy cover, were collected during the inventory in spring 2025

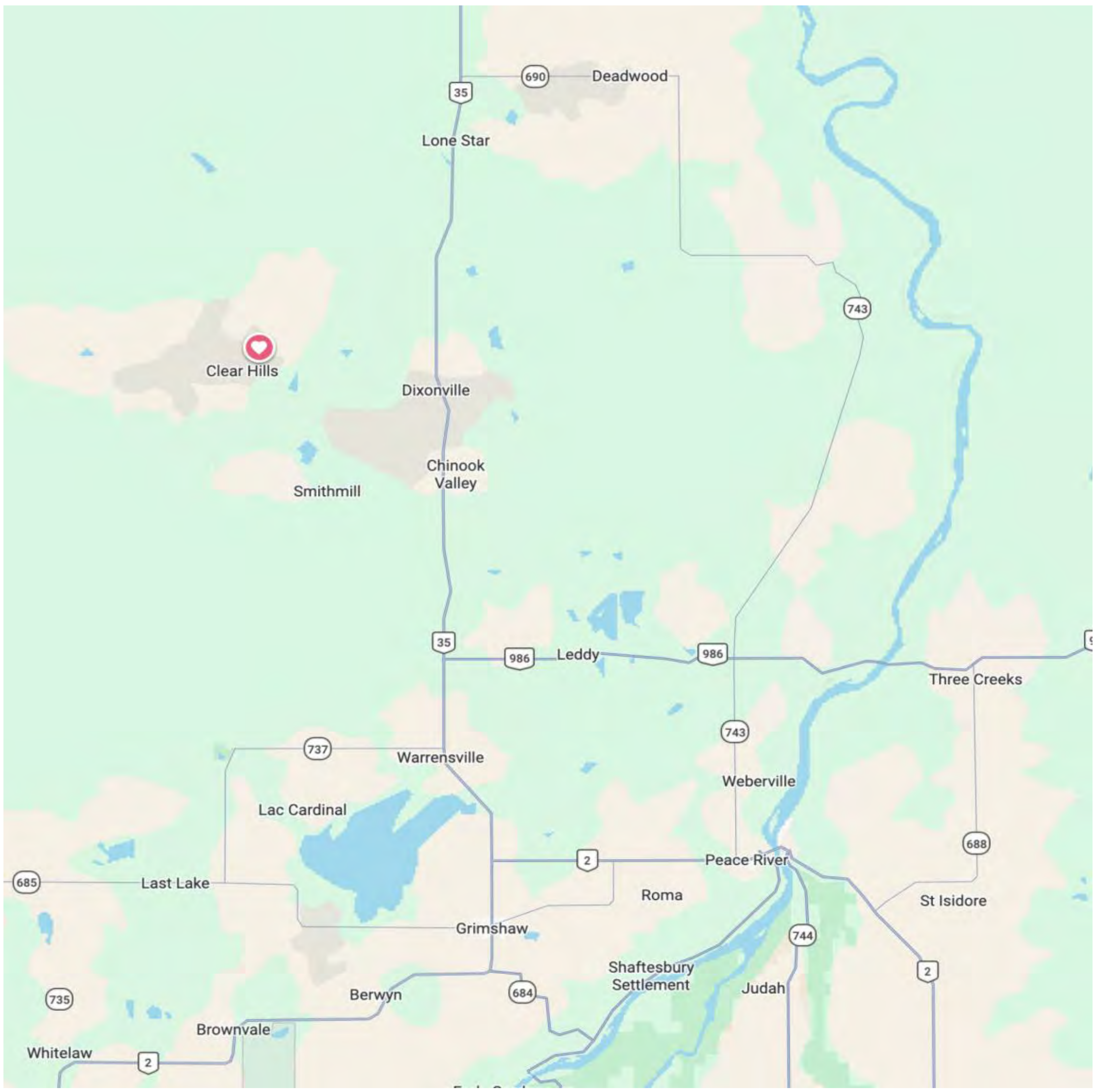


Figure 1. Location of the field site which is NW of the city of Peace River Alberta and just west of Dixonville.

Site preparation

Site was prepared by a local farmer pulling a large disc with a tractor. Site was sprayed with . For blocks planted inside the fence, we followed discing with laying a plastic mulch using a walk behind tractor and mulch laying attachment (BCS).

Experimental design

Unless noted, species provenances were those local to the area. Species planted included: For inventory or maps the first two letters of the genus and the first two letters of the species are used as an abbreviation: *Populus tremuloides*, POTR, (aspen); *Larix Lariciana*, LALA (larch), Betula papyrifera, BEPA (birch), Picea glauca, PIGL spruce, and Pinus Contorta (PICO) lodgepole pine.

Table 1. Summary of experimental installations at the site and design details**.**

Fenced	Density	Species pool	Blocks	Plots total	Plot size (area, m2)	Spp. Diversit y	Number of trees / plot	Total trees	Total plot area (m2)
Yes	0.25 m	5	3	48	4 x 4 m (16)	1,2,5	(14x14), 196	9408	768
Yes	0.5 m	5	3	48	4 x 4 m (16)	1,2,5	(7x7), 49	2352	768
Yes	1.5 m	5	6	120	20 x 20 m (400)	1,2,4	(13x13), 169	20280	48000
No	1.5 m	5	6	144	20 x 20 m (400)	1,2,4,5	(13x13), 169	24336	57600

Inventory methods

Generally all trees within each plot were assessed and whether the tree was living was noted and the height and the diameter at the root collar diameter (RCD) noted in the spring of 2025 (early May to early June). In some cases, the outer rows of the plot were not measured to reduce the number of trees sampled. Height was measured with a ruler or meter stick from the ground to the top of the plant (living bud). RCD was measured using a digital caliper. Details on number of trees measured is in Tables A1 and A2.

Overview of tree inventory results

Survivorship patterns across treatments

Overall tree survivorship was high across the experimental plots, but varied systematically with both spacing treatment and fence protection.

Survivorship varied among species, with generally high survival across most taxa. Picea glauca (PIGL) and Betula papyrifera (BEPA) both exhibited high survival (91.5 ± 1.87% and 92.4 ± 1.09%, respectively), while Pinus contorta (PICO) had the highest survivorship overall (94.4 ± 0.81%). In contrast, Larix laricina (LALA) showed moderately lower survival (83.3 ± 1.85%), and Populus tremuloides (POTR) had the lowest survivorship among species (71.9 ± 1.86%). These results indicate that while most species established successfully, POTR experienced substantially reduced survival relative to the others, with LALA also showing somewhat lower performance. POTR was observed to flush late, in some cases with leaves not coming until mid-June or even later. For LALA, stock was often small and this could have been a contributing factor.

At the high-density site (Table A1), survivorship was consistently high under both spacing treatments. Mean survival was 87.1 ± 1.31% (SE) at 25 cm spacing and 88.8 ± 1.24% (SE) at 50 cm spacing. Differences between spacing treatments were therefore modest, suggesting that early survivorship was relatively insensitive to planting density within this range.

In contrast, strong differences emerged between inside and outside fence treatments (Figure 2; Table A2). Mean survivorship inside the fence was 85.3 ± 1.00% (SE), whereas outside the fence it declined substantially to 59.2 ± 1.54% (SE). This represents a large reduction in survival (~26 percentage points), consistent with strong biotic pressure (e.g., herbivory) outside fenced conditions.

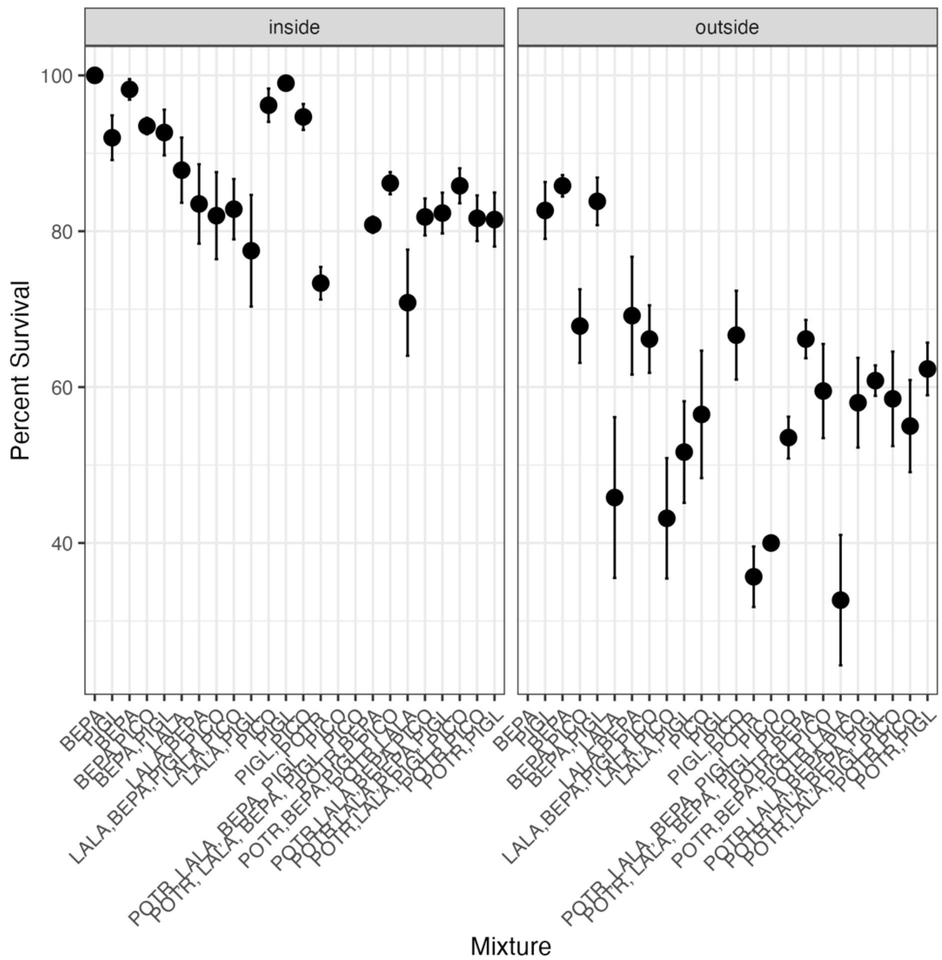


Figure 2. Variation in mean (+-SE) percent survival across the different mixtures and separated by inside the fence and mulched plots vs. outside the fence and not-mulched plots.

Variation among mixtures was present but generally secondary to treatment effects. While some mixtures exhibited slightly higher or lower survival, these differences were small relative to the pronounced effect of fencing. This suggests that species composition had a weaker influence on early survival than environmental protection, at least over the time frame captured here.

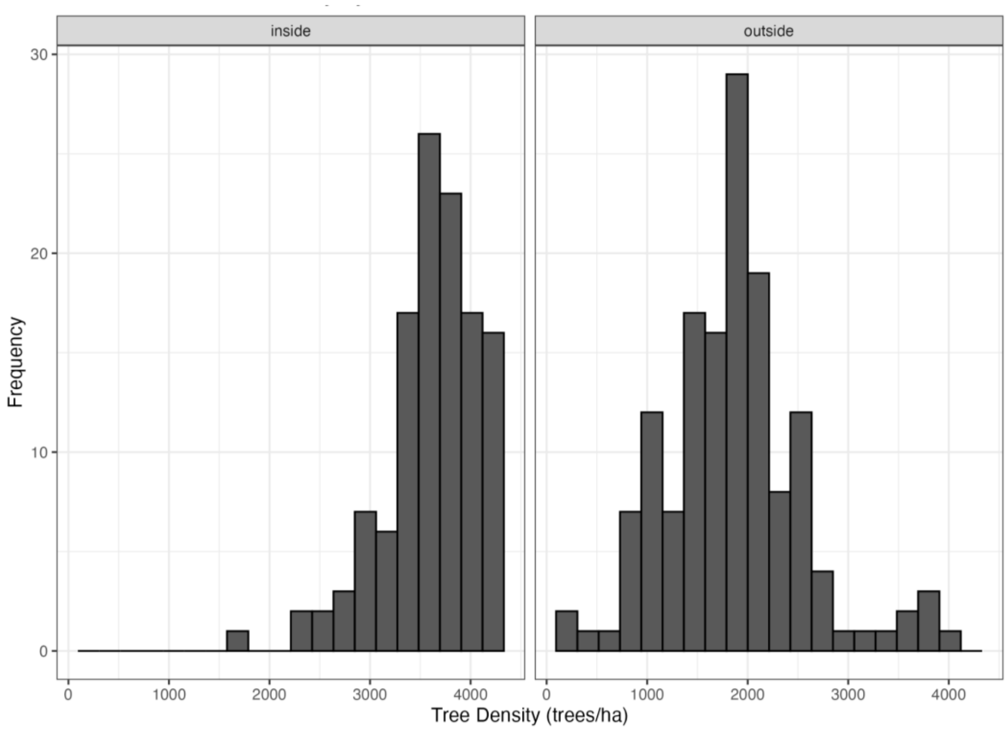


Figure 3. Histogram of tree density (stems / ha) across all plots inside the fence (also mulched; left panel) and outside the fence (not mulched). The lowest tree density is 200 stems / ha outside the fence and is Larix Laricina (trees were quite small). Spacing is 1.5 m and plots are 20 x 20 m in size.

Plots inside the fence exhibit higher and more tightly clustered densities, centered around ~3000–4000 trees ha^{-1} (**Fig.** 3). In contrast, outside the fence densities are substantially lower and more variable, with many plots below ~2500 trees ha^{-1}. This pattern indicates reduced survival and greater heterogeneity outside the fence, consistent with strong external pressures such as herbivory or competition with weeds as plots outside were also not mulched.

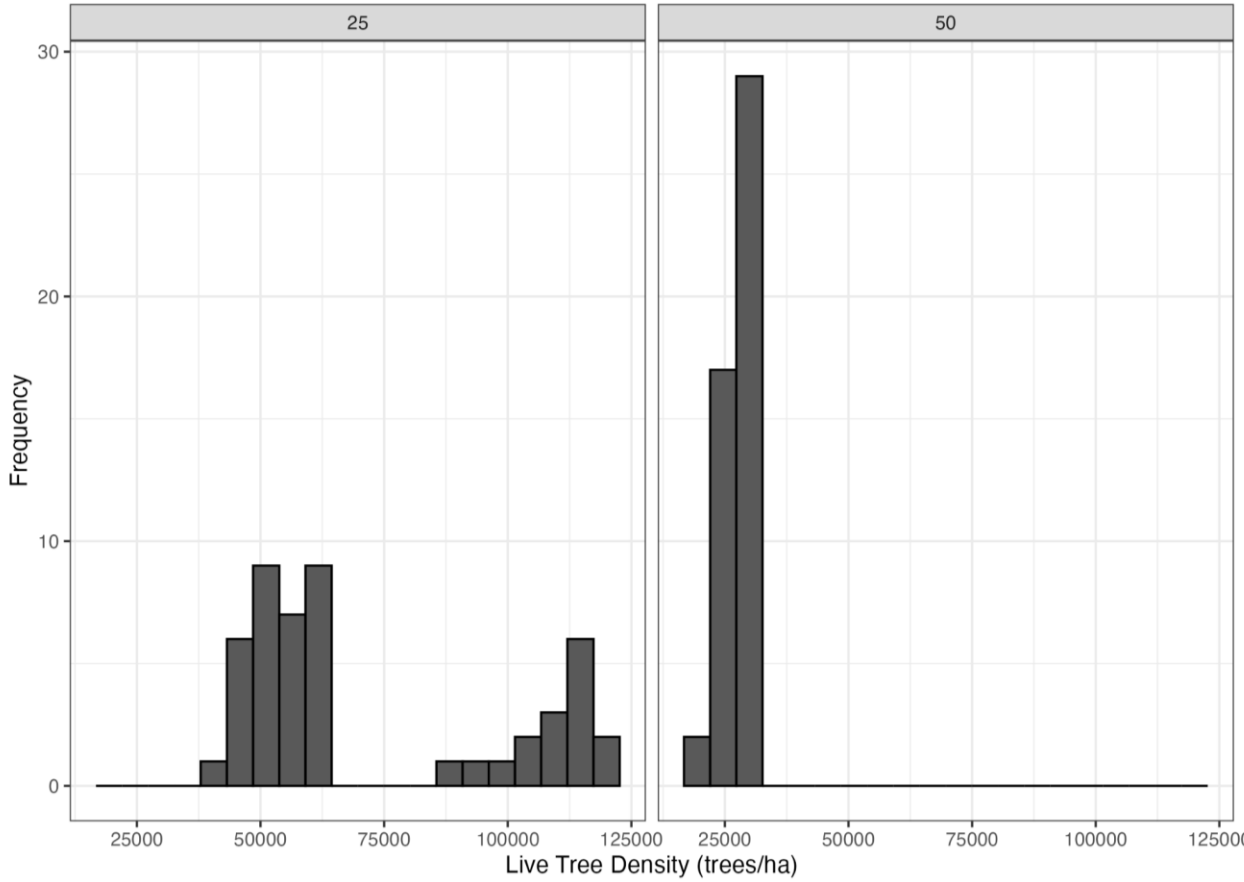


Figure 4 Histogram of tree density (stems / ha) for the high density area. Spacing is 0.25 and 0.5 m and plots are 4 x 4 m in size.

Fig. 4 shows the distribution of live tree density (trees ha^{-1}) across spacing treatments. Plots at 25 cm spacing exhibit substantially higher and more variable densities, with values spanning roughly 40,000 to >110,000 trees ha^{-1} and a somewhat bimodal distribution. In contrast, 50 cm spacing results in lower and more tightly clustered densities (~20,000–35,000 trees ha^{-1}).

Weed cover

Inside the fence the mulch appeared to be performing well to limit the amount of weed competition with planted trees. There were instance were thistle had grown in the hole in the mulch in which the tree was planted, but generally this situation was not observed to be resulting in heavy shade given the number of thistle plants adjacent to the tree. Bindweed was observed to be climbing trees and in some cases pulling the leader of POTR and BEPA over, but interestingly did not appear to be able to climb PIGL.

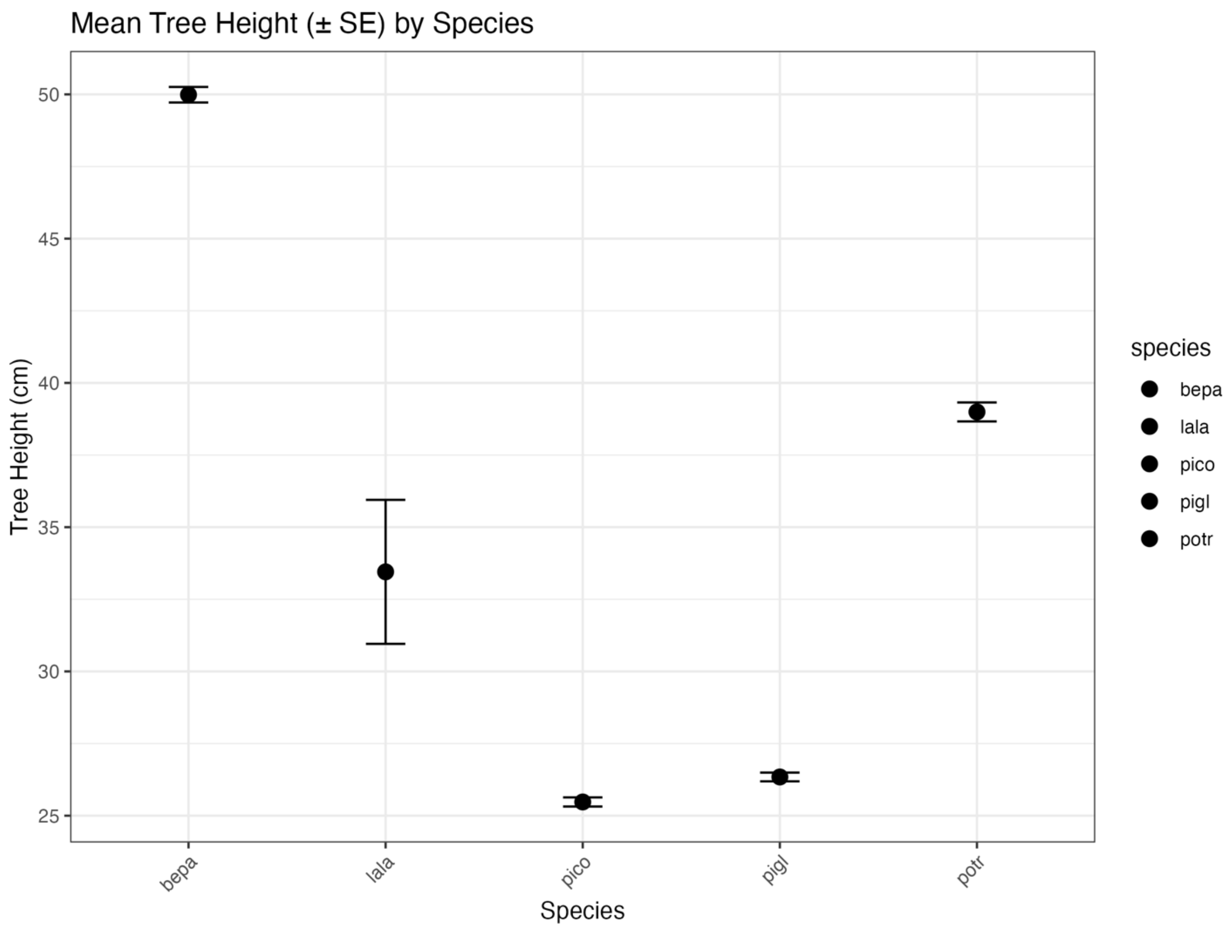


Figure 5. Mean tree height (with standard error) for all planted tree species.

Appendix – data files delivered with the report.

Table A1: Excel table for survivorship and living tree density in spring 2025 for plots with 0.25 m and 0.5 m spacing (File Table_A1.xls)..

Table A2: Excel table for survivorship and living tree density in spring 2025 for plots with 1.5 m spacing both inside the fenced area with mulch and outside the fenced area without mulch (File Table_A2.xls).

Map.

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ii. Peace River Tree Diversity Experiment Inventory Summary

Peace River Tree diversity Experiment (PRTE) - University of Alberta Research Forest Project Forest

Tree Inventory report May 2025

Introduction

The PRTE was planted in June 2024 in collaboration with Project Forest and consists of communities (plots) varying in tree diversity and different densities of planting (0.25, 0.5 m, 1.5 m spacing spacing). The 1.5 m spaced plots being planted inside a fenced area (as are 0.25, 0.5 m), as well as outside the fenced area. Plots inside the fence included a plastic mulch treatment, whereas plot outside the fence were left unmulched.

Methods

As part of an annual inventory which will provide data on tree growth and survivorship which will allow for testing the main experimental hypothesis that more diverse tree communities are more productive and resistant/resilient to drought, individual tree height, diameter, vital status (alive/dead), and health were recorded starting May 5. Trees with a very poor health rating will also be included in a total count of trees to be replaced. Replacement was planned for 2025 and no subsequent replacement planting will occur after 2025.

The purpose of this report is to summarize data on vital status and health to provide an estimate of the number of trees needed for replanting.

Data presented here represents a large sample of over 80 plots from inside the fence (each with 169 trees, total N=13,520). In addition, we were also able to complete some measurements of plots outside the fence. Given these were not mulched, we assumed that mortality was likely going to be higher due to competition with vegetation and given a number of dry periods following planting in 2024. Number of plots used to calculate average mortality varies by species because we are not finished inventory for all plots and examined species in order of flushing to be sure of vitality (in order of having leaves at time of inventory start; Pine = Spruce > Birch = Larch > Aspen).

It was noted in 2024 that still by the end of June many (circa 20% estimated) of the planted aspen had not flushed. In addition, many larch were undersized (~10 cm) and there were concerns over the larch survival in this size class.

Table 1. *Summary of average mortality across 70 measured plots (inside fence and mulched) for the five tree species planted in PRTE.*

	Lar. laricina	Pic. glauca	Pin. contorta	Bet. papyrifera	Pop. tremuloides
Average mortality	30%	9%	9%	8%	21%

Note that this includes individuals which are still living but were estimated to potentially die in 2025.

Calculation of number of trees for replant

- trees inside and outside fence at 1.5 m spacing = 264 plots * 169 trees/plot = 44,616
- trees inside high density (0.25, 0.5m) = 11,760 trees
- Total trees = 44,616+11,760=56,376
- Total trees per species = 56,376 / 5 = 11,275

Table 2. *Tree replacement calculation based on number of trees per species * average mortality*

	Lar. laricina	Pic. glauca	Pin. contorta	Bet. papyrifera	Pop. tremuloides
Average mortality	30%	9%	9%	8%	21%
total trees	11275	11275	11275	11275	11275
Number of replacements	3382	1015	1015	902	2368

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iii. Table A1 Dead Plot Summary – Overall

block	plot	spacing	mixture	n_trees	n_dead	n_live	pct_dead	pct_live	density_ha	density_live_ha	density_dead_ha	check
1	1	25	bepa_pigl	100	6	94	6	94	62500	58750	3750	yes
1	2	25	bepa_pico	100	6	94	6	94	62500	58750	3750	yes
1	6	25	lala	100	17	83	17	83	62500	51875	10625	yes
1	7	25	pico_potr	100	20	80	20	80	62500	50000	12500	yes
1	9	25	bepa_lala	100	18	82	18	82	62500	51250	11250	yes
1	13	25	potr	99	31	68	31	69	61875	42500	19375	yes
1	17	25	pico_pigl	100	3	97	3	97	62500	60625	1875	yes
1	18	25	pigl	100	2	98	2	98	62500	61250	1250	yes
1	20	25	lala_pico	99	9	90	9	91	61875	56250	5625	yes
1	23	25	lala_pigl	100	21	79	21	79	62500	49375	13125	yes
1	26	25	pico	100	4	96	4	96	62500	60000	2500	yes
1	28	25	bepa_lala_pico_	100	18	82	18	82	62500	51250	11250	yes
1	29	25	bepa_potr	100	21	79	21	79	62500	49375	13125	yes
1	30	25	pigl_potr	100	26	74	26	74	62500	46250	16250	yes
1	31	25	bepa	100	11	89	11	89	62500	55625	6875	yes
1	32	25	lala_potr	100	28	72	28	72	62500	45000	17500	yes
2	1	25	bepa_pico	100	11	89	11	89	62500	55625	6875	yes
2	3	25	bepa_potr	100	21	79	21	79	62500	49375	13125	yes
2	6	25	lala_pico	100	13	87	13	87	62500	54375	8125	yes
2	7	25	bepa_lala_pico_	100	21	79	21	79	62500	49375	13125	yes
2	8	25	bepa_lala	100	19	81	19	81	62500	50625	11875	yes
2	10	25	bepa_pigl	100	2	98	2	98	62500	61250	1250	yes
2	12	25	potr	100	29	71	29	71	62500	44375	18125	yes
2	13	25	bepa	100	4	96	4	96	62500	60000	2500	yes
2	14	25	pico	100	2	98	2	98	62500	61250	1250	yes
2	15	25	pigl	100	0	100	0	100	62500	62500	0	yes
2	17	25	bepa_pico	100	2	98	2	98	62500	61250	1250	yes
2	18	25	pico_pigl	100	2	98	2	98	62500	61250	1250	yes
2	20	25	pico_potr	100	28	72	28	72	62500	45000	17500	yes
2	21	25	lala_pigl	100	23	77	23	77	62500	48125	14375	yes
2	22	25	pigl_potr	100	25	75	25	75	62500	46875	15625	yes
2	23	25	lala	100	8	92	8	92	62500	57500	5000	yes
3	2	25	bepa_lala_pico_	196	30	166	15	85	122500	103750	18750	yes
3	3	25	bepa_pigl	196	17	179	9	91	122500	111875	10625	yes
3	6	25	lala	196	4	192	2	98	122500	120000	2500	yes
3	7	25	pico_pigl	196	11	185	6	94	122500	115625	6875	yes
3	8	25	lala_pico	196	11	185	6	94	122500	115625	6875	yes
3	9	25	pico	196	17	179	9	91	122500	111875	10625	yes
3	11	25	bepa_pico	196	10	186	5	95	122500	116250	6250	yes
3	16	25	bepa	196	14	182	7	93	122500	113750	8750	yes
3	17	25	pigl_potr	196	34	162	17	83	122500	101250	21250	yes
3	23	25	bepa_potr	196	31	165	16	84	122500	103125	19375	yes
3	24	25	pico_potr	196	46	150	23	77	122500	93750	28750	yes
3	25	25	bepa_lala	196	15	181	8	92	122500	113125	9375	yes
3	26	25	pigl	196	5	191	3	97	122500	119375	3125	yes
3	27	25	lala_pigl	196	12	184	6	94	122500	115000	7500	yes
3	28	25	potr	196	53	143	27	73	122500	89375	33125	yes
3	32	25	lala_potr	196	20	176	10	90	122500	110000	12500	yes
1	3	50	lala_potr	49	12	37	24	76	30625	23125	7500	yes
1	4	50	potr	49	15	34	31	69	30625	21250	9375	yes
1	5	50	lala_pigl	49	5	44	10	90	30625	27500	3125	yes
1	8	50	bepa_potr	49	8	41	16	84	30625	25625	5000	yes
1	10	50	pigl	49	1	48	2	98	30625	30000	625	yes
1	11	50	bepa_pico	49	2	47	4	96	30625	29375	1250	yes
1	12	50	pico_pigl	49	1	48	2	98	30625	30000	625	yes
1	14	50	bepa_pigl	49	4	45	8	92	30625	28125	2500	yes
1	15	50	pico_potr	49	7	42	14	86	30625	26250	4375	yes
1	16	50	pico	49	0	49	0	100	30625	30625	0	yes
1	19	50	lala	49	9	40	18	82	30625	25000	5625	yes
1	21	50	bepa	49	2	47	4	96	30625	29375	1250	yes
1	22	50	bepa_lala	49	9	40	18	82	30625	25000	5625	yes
1	24	50	bepa_lala_pico_	49	9	40	18	82	30625	25000	5625	yes
1	25	50	pigl_potr	49	3	46	6	94	30625	28750	1875	yes
1	27	50	lala_pico	49	4	45	8	92	30625	28125	2500	yes
2	2	50	lala_potr	49	18	31	37	63	30625	19375	11250	yes
2	4	50	lala_pigl	49	4	45	8	92	30625	28125	2500	yes
2	5	50	bepa_lala	49	2	47	4	96	30625	29375	1250	yes
2	9	50	pigl_potr	49	10	39	20	80	30625	24375	6250	yes
2	11	50	pico	49	1	48	2	98	30625	30000	625	yes
2	16	50	pico_pigl	49	3	46	6	94	30625	28750	1875	yes
2	19	50	lala_potr	49	9	40	18	82	30625	25000	5625	yes
2	24	50	lala_pico	49	4	45	8	92	30625	28125	2500	yes
2	25	50	bepa_potr	49	9	40	18	82	30625	25000	5625	yes
2	26	50	bepa_lala_pico_	49	11	38	22	78	30625	23750	6875	yes
2	27	50	bepa	49	3	46	6	94	30625	28750	1875	yes
2	28	50	lala	49	0	49	0	100	30625	30625	0	yes
2	29	50	potr	49	8	41	16	84	30625	25625	5000	yes

2	30	50	pico_potr	49	12	37	24	76	30625	23125	7500	yes
2	31	50	pigl	49	4	45	8	92	30625	28125	2500	yes
2	32	50	bepa_pigl	49	2	47	4	96	30625	29375	1250	yes
3	1	50	bepa_lala	49	2	47	4	96	30625	29375	1250	yes
3	4	50	bepa	49	1	48	2	98	30625	30000	625	yes
3	5	50	bepa_lala_pico_	49	8	41	16	84	30625	25625	5000	yes
3	10	50	bepa_pigl	49	5	44	10	90	30625	27500	3125	yes
3	12	50	lala_potr	49	5	44	10	90	30625	27500	3125	yes
3	13	50	pigl_potr	49	7	42	14	86	30625	26250	4375	yes
3	14	50	bepa_potr	49	12	37	24	76	30625	23125	7500	yes
3	15	50	pico_potr	49	11	38	22	78	30625	23750	6875	yes
3	18	50	pico_pigl	49	5	44	10	90	30625	27500	3125	yes
3	19	50	lala	49	5	44	10	90	30625	27500	3125	yes
3	20	50	lala_pigl	49	8	41	16	84	30625	25625	5000	yes
3	21	50	potr	49	3	46	6	94	30625	28750	1875	yes
3	22	50	pigl	49	2	47	4	96	30625	29375	1250	yes
3	29	50	lala_pico	49	1	48	2	98	30625	30000	625	yes
3	30	50	pico	49	2	47	4	96	30625	29375	1250	yes
3	31	50	bepa_pico	49	1	48	2	98	30625	30000	625	yes

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iv. Table A2 Plot Survival Summary

Inside_fence	plot_id	mixture	n_trees	n_live	n_dead	pct_live	pct_dead	density_ha	check
inside	1	LALA,BEPA,PIGI	169	152	17	90	10	3800	yes
inside	2	LALA,BEPA	169	141	28	83	17	3525	yes
inside	3	POTR,PIGL	169	142	27	84	16	3550	yes
inside	4	POTR,PICO	169	132	37	78	22	3300	yes
inside	5	LALA,PIGL	169	150	19	89	11	3750	yes
inside	6	LALA,PICO	169	155	14	92	8	3875	yes
inside	7	BEPA	169	168	1	99	1	4200	yes
inside	8	BEPA,PIGL	169	165	4	98	2	4125	yes
inside	9	LALA	169	163	6	96	4	4075	yes
inside	10	PIGL,PICO	169	160	9	95	5	4000	yes
inside	11	BEPA,PICO	169	154	15	91	9	3850	yes
inside	12	POTR,LALA,BEF	169	126	43	75	25	3150	yes
inside	13	POTR,BEPA	169	140	29	83	17	3500	yes
inside	14	PICO	169	168	1	99	1	4200	yes
inside	15	POTR,BEPA,PIG	169	141	28	83	17	3525	yes
inside	16	POTR,LALA,PIG	169	136	33	80	20	3400	yes
inside	17	POTR,LALA,BEF	169	130	39	77	23	3250	yes
inside	18	POTR	169	132	37	78	22	3300	yes
inside	19	POTR,LALA	169	137	32	81	19	3425	yes
inside	20	PIGL	169	157	12	93	7	3925	yes
inside	21	LALA,PICO	169	122	47	72	28	3050	yes
inside	22	POTR,LALA,BEF	169	136	33	80	20	3400	yes
inside	23	POTR,LALA,BEF	169	140	29	83	17	3500	yes
inside	24	POTR,LALA	169	113	56	67	33	2825	yes
inside	25	POTR	168	120	48	71	29	3000	yes
inside	26	LALA	169	155	14	92	8	3875	yes
inside	27	LALA,BEPA,PIGI	169	158	11	93	7	3950	yes
inside	28	PICO	169	161	8	95	5	4025	yes
inside	29	PIGL,PICO	170	166	4	98	2	4150	yes
inside	30	POTR,LALA,PIG	169	146	23	86	14	3650	yes
inside	31	POTR,PICO	169	136	33	80	20	3400	yes
inside	32	LALA,BEPA	169	156	13	92	8	3900	yes
inside	33	POTR,BEPA	169	142	27	84	16	3550	yes
inside	34	POTR,PIGL	169	135	34	80	20	3375	yes
inside	35	BEPA	169	169	0	100	0	4225	yes
inside	36	PIGL	169	169	0	100	0	4225	yes
inside	37	BEPA,PIGL	169	161	8	95	5	4025	yes
inside	38	LALA,PIGL	169	158	11	93	7	3950	yes
inside	39	BEPA,PICO	169	156	13	92	8	3900	yes
inside	40	POTR,BEPA,PIG	169	143	26	85	15	3575	yes
inside	41	BEPA	169	169	0	100	0	4225	yes
inside	42	PICO	169	167	2	99	1	4175	yes
inside	43	POTR,BEPA,PIG	169	154	15	91	9	3850	yes
inside	44	LALA,PICO	169	143	26	85	15	3575	yes
inside	45	LALA,BEPA,PIGI	169	154	15	91	9	3850	yes
inside	46	POTR,LALA	169	119	50	70	30	2975	yes
inside	47	PIGL,PICO	169	159	10	94	6	3975	yes
inside	48	POTR,PIGL	169	145	24	86	14	3625	yes
inside	49	POTR,LALA,PIG	169	152	17	90	10	3800	yes
inside	50	POTR,LALA,BEF	169	144	25	85	15	3600	yes
inside	51	LALA	169	142	27	84	16	3550	yes
inside	52	POTR,LALA,BEF	169	147	22	87	13	3675	yes
inside	53	LALA,BEPA	169	155	14	92	8	3875	yes
inside	54	PIGL	169	160	9	95	5	4000	yes
inside	55	BEPA,PICO	169	155	14	92	8	3875	yes
inside	56	POTR,BEPA	169	136	33	80	20	3400	yes
inside	57	LALA,PIGL	169	154	15	91	9	3850	yes

inside	58	POTR	169	128	41	76	24	3200	yes
inside	59	BEPA,PIGL	169	161	8	95	5	4025	yes
inside	60	POTR,PICO	169	157	12	93	7	3925	yes
inside	61	POTR,LALA,BEF	169	141	28	83	17	3525	yes
inside	62	LALA,PICO	169	119	50	70	30	2975	yes
inside	63	POTR,BEPA,PIG	169	152	17	90	10	3800	yes
inside	64	POTR,PIGL	169	153	16	91	9	3825	yes
inside	65	PICO	169	146	23	86	14	3650	yes
inside	66	LALA,BEPA	169	99	70	59	41	2475	yes
inside	67	POTR,BEPA	169	132	37	78	22	3300	yes
inside	68	LALA	169	163	6	96	4	4075	yes
inside	69	POTR,PICO	169	137	32	81	19	3425	yes
inside	70	POTR,LALA	169	68	101	40	60	1700	yes
inside	71	BEPA	169	157	12	93	7	3925	yes
inside	72	POTR	169	133	36	79	21	3325	yes
inside	73	LALA,BEPA,PIGI	169	96	73	57	43	2400	yes
inside	74	BEPA,PIGL	169	133	36	79	21	3325	yes
inside	75	POTR,LALA,BEF	169	140	29	83	17	3500	yes
inside	76	POTR,LALA,PIG	169	157	12	93	7	3925	yes
inside	77	PIGL	169	150	19	89	11	3750	yes
inside	78	LALA,PIGL	169	97	72	57	43	2425	yes
inside	79	BEPA,PICO	169	160	9	95	5	4000	yes
inside	80	PIGL,PICO	169	166	3	98	2	4150	yes
inside	81	BEPA	169	169	0	100	0	4225	yes
inside	82	POTR,LALA,BEF	169	127	42	75	25	3175	yes
inside	83	POTR,LALA,PIG	169	147	22	87	13	3675	yes
inside	84	POTR	169	112	57	66	34	2800	yes
inside	85	POTR,PICO	169	146	23	86	14	3650	yes
inside	86	LALA,PICO	169	152	17	90	10	3800	yes
inside	87	PICO	169	167	2	99	1	4175	yes
inside	88	POTR,PIGL	169	138	31	82	18	3450	yes
inside	89	PIGL	168	166	2	99	1	4150	yes
inside	90	POTR,LALA	169	142	27	84	16	3550	yes
inside	91	POTR,LALA,BEF	169	154	15	91	9	3850	yes
inside	92	BEPA,PIGL	169	166	3	98	2	4150	yes
inside	93	BEPA,PICO	169	165	4	98	2	4125	yes
inside	94	PIGL,PICO	169	163	6	96	4	4075	yes
inside	95	POTR,BEPA,PIG	169	144	25	85	15	3600	yes
inside	96	LALA,BEPA	169	147	22	87	13	3675	yes
inside	97	POTR,BEPA	169	139	30	82	18	3475	yes
inside	98	LALA	169	152	17	90	10	3800	yes
inside	99	LALA,PIGL	169	137	32	81	19	3425	yes
inside	100	LALA,BEPA,PIGI	169	143	26	85	15	3575	yes
inside	101	POTR,LALA,PIG	169	134	35	79	21	3350	yes
inside	102	LALA,PIGL	169	91	78	54	46	2275	yes
inside	103	LALA,PICO	169	149	20	88	12	3725	yes
inside	104	POTR,BEPA,PIG	169	141	28	83	17	3525	yes
inside	105	BEPA,PICO	169	158	11	93	7	3950	yes
inside	106	POTR,PIGL	169	111	58	66	34	2775	yes
inside	107	LALA,BEPA,PIGI	169	128	41	76	24	3200	yes
inside	108	LALA,BEPA	169	148	21	88	12	3700	yes
inside	109	BEPA	169	168	1	99	1	4200	yes
inside	110	BEPA,PIGL	169	153	16	91	9	3825	yes
inside	111	LALA	169	117	52	69	31	2925	yes
inside	112	PICO	169	167	2	99	1	4175	yes
inside	113	POTR,BEPA	169	131	38	78	22	3275	yes
inside	114	POTR,PICO	169	121	48	72	28	3025	yes
inside	115	PIGL,PICO	169	147	22	87	13	3675	yes
inside	116	POTR,LALA	169	141	28	83	17	3525	yes
inside	117	PIGL	169	141	28	83	17	3525	yes
inside	118	POTR,LALA,BEF	170	128	42	75	25	3200	yes
inside	119	POTR	169	118	51	70	30	2950	yes
inside	120	POTR,LALA,BEF	170	155	15	91	9	3875	yes
outside	1	BEPA	169	149	20	88	12	3725	yes
outside	2	POTR,LALA,BEF	121	69	52	57	43	1725	yes
outside	3	POTR,LALA,BEF	121	54	67	45	55	1350	yes

outside	4	LALA,PICO	121	36	85	30	70	900	yes
outside	5	POTR,LALA,BEF	121	78	43	64	36	1950	yes
outside	6	POTR,PICO	121	80	41	66	34	2000	yes
outside	7	PICO	121	38	83	31	69	950	yes
outside	8	POTR,LALA,BEF	121	38	83	31	69	950	yes
outside	9	POTR	121	46	75	38	62	1150	yes
outside	10	POTR,LALA	121	49	72	40	60	1225	yes
outside	11	PIGL	121	85	36	70	30	2125	yes
outside	12	BEPA,PICO	121	61	60	50	50	1525	yes
outside	13	POTR,LALA,PIG	121	49	72	40	60	1225	yes
outside	14	LALA	121	55	66	45	55	1375	yes
outside	15	LALA,BEPA	121	56	65	46	54	1400	yes
outside	16	POTR,PIGL	121	82	39	68	32	2050	yes
outside	17	POTR,LALA,BEF	121	69	52	57	43	1725	yes
outside	18	POTR,LALA,BEF	121	57	64	47	53	1425	yes
outside	19	POTR,BEPA,PIG	121	38	83	31	69	950	yes
outside	20	LALA,PIGL	121	33	88	27	73	825	yes
outside	21	POTR,BEPA	121	82	39	68	32	2050	yes
outside	22	LALA,BEPA,PIGI	121	75	46	62	38	1875	yes
outside	23	PIGL,PICO	121	55	66	45	55	1375	yes
outside	24	BEPA,PIGL	121	95	26	79	21	2375	yes
outside	25	POTR,LALA,BEF	121	43	78	36	64	1075	yes
outside	26	POTR,LALA,BEF	119	71	48	60	40	1775	yes
outside	27	POTR,LALA,PIG	121	78	43	64	36	1950	yes
outside	28	POTR	120	44	76	37	63	1100	yes
outside	29	POTR,PIGL	121	67	54	55	45	1675	yes
outside	30	POTR,PICO	121	45	76	37	63	1125	yes
outside	31	BEPA,PIGL	121	104	17	86	14	2600	yes
outside	32	POTR,LALA,BEF	121	58	63	48	52	1450	yes
outside	33	PICO	121	43	78	36	64	1075	yes
outside	34	PIGL,PICO	120	85	35	71	29	2125	yes
outside	35	LALA,PICO	121	40	81	33	67	1000	yes
outside	36	PIGL	121	97	24	80	20	2425	yes
outside	37	BEPA,PICO	121	82	39	68	32	2050	yes
outside	38	BEPA	121	104	17	86	14	2600	yes
outside	39	POTR,LALA	121	12	109	10	90	300	yes
outside	40	POTR,LALA,BEF	121	55	66	45	55	1375	yes
outside	41	POTR,LALA,BEF	121	49	72	40	60	1225	yes
outside	42	LALA,BEPA	121	57	64	47	53	1425	yes
outside	43	POTR,BEPA,PIG	121	77	44	64	36	1925	yes
outside	44	POTR,BEPA	121	72	49	60	40	1800	yes
outside	45	LALA,PIGL	121	58	63	48	52	1450	yes
outside	46	LALA	120	8	112	7	93	200	yes
outside	47	POTR,LALA,BEF	121	70	51	58	42	1750	yes
outside	48	LALA,BEPA,PIGI	121	80	41	66	34	2000	yes
outside	49	LALA,BEPA	169	133	36	79	21	3325	yes
outside	50	BEPA,PICO	121	97	24	80	20	2425	yes
outside	51	BEPA	121	102	19	84	16	2550	yes
outside	52	POTR,BEPA	121	89	32	74	26	2225	yes
outside	53	POTR,BEPA,PIG	121	78	43	64	36	1950	yes
outside	54	POTR,PIGL	121	72	49	60	40	1800	yes
outside	55	POTR,LALA,BEF	121	70	51	58	42	1750	yes
outside	56	POTR,LALA,BEF	121	65	56	54	46	1625	yes
outside	57	BEPA,PIGL	121	102	19	84	16	2550	yes
outside	58	POTR,LALA,BEF	121	72	49	60	40	1800	yes
outside	59	POTR,LALA,PIG	121	81	40	67	33	2025	yes
outside	60	POTR,PICO	121	65	56	54	46	1625	yes
outside	61	PIGL,PICO	121	67	54	55	45	1675	yes
outside	62	POTR,LALA,BEF	121	83	38	69	31	2075	yes
outside	63	POTR,LALA	121	29	92	24	76	725	yes
outside	64	POTR,LALA,BEF	121	58	63	48	52	1450	yes
outside	65	LALA,PICO	120	30	90	25	75	750	yes
outside	66	LALA	121	31	90	26	74	775	yes
outside	67	PIGL	121	95	26	79	21	2375	yes
outside	68	PICO	121	79	42	65	35	1975	yes
outside	69	POTR,LALA,BEF	122	55	67	45	55	1375	yes

outside	70	LALA,BEPA,PIGI	119	65	54	55	45	1625	yes
outside	71	POTR	121	47	74	39	61	1175	yes
outside	72	LALA,PIGL	121	62	59	51	49	1550	yes
outside	73	POTR,PIGL	121	63	58	52	48	1575	yes
outside	74	POTR,LALA,BEF	121	40	81	33	67	1000	yes
outside	75	POTR,BEPA,PIG	122	72	50	59	41	1800	yes
outside	76	BEPA,PIGL	121	87	34	72	28	2175	yes
outside	77	LALA	120	72	48	60	40	1800	yes
outside	78	POTR,LALA,PIG	121	48	73	40	60	1200	yes
outside	79	BEPA,PICO	121	98	23	81	19	2450	yes
outside	80	LALA,PIGL	121	66	55	55	45	1650	yes
outside	81	PIGL,PICO	121	90	31	74	26	2250	yes
outside	82	POTR,LALA,BEF	121	69	52	57	43	1725	yes
outside	83	POTR,LALA	121	15	106	12	88	375	yes
outside	84	POTR,LALA,BEF	121	34	87	28	72	850	yes
outside	85	POTR,LALA,BEF	121	67	54	55	45	1675	yes
outside	86	PIGL	122	99	23	81	19	2475	yes
outside	87	POTR,LALA,BEF	121	53	68	44	56	1325	yes
outside	88	LALA,BEPA,PIGI	121	74	47	61	39	1850	yes
outside	89	POTR,BEPA	121	83	38	69	31	2075	yes
outside	90	POTR,LALA,BEF	121	60	61	50	50	1500	yes
outside	91	POTR,PICO	121	46	75	38	62	1150	yes
outside	92	PICO	121	71	50	59	41	1775	yes
outside	93	POTR	122	30	92	25	75	750	yes
outside	94	LALA,PICO	121	45	76	37	63	1125	yes
outside	95	BEPA	121	97	24	80	20	2425	yes
outside	96	LALA,BEPA	121	86	35	71	29	2150	yes
outside	97	POTR,BEPA,PIG	185	120	65	65	35	3000	yes
outside	98	POTR,LALA,BEF	121	97	24	80	20	2425	yes
outside	99	LALA,BEPA	121	108	13	89	11	2700	yes
outside	100	POTR,PICO	121	82	39	68	32	2050	yes
outside	101	POTR,LALA,BEF	122	82	40	67	33	2050	yes
outside	102	POTR,LALA	121	62	59	51	49	1550	yes
outside	103	LALA,BEPA,PIGI	121	104	17	86	14	2600	yes
outside	104	POTR,LALA,BEF	121	87	34	72	28	2175	yes
outside	105	LALA,PIGL	121	63	58	52	48	1575	yes
outside	106	POTR,LALA,BEF	121	80	41	66	34	2000	yes
outside	107	LALA	121	76	45	63	37	1900	yes
outside	108	POTR,BEPA	121	82	39	68	32	2050	yes
outside	109	POTR	122	61	61	50	50	1525	yes
outside	110	POTR,PIGL	121	79	42	65	35	1975	yes
outside	111	BEPA,PICO	121	77	44	64	36	1925	yes
outside	112	POTR,LALA,PIG	121	79	42	65	35	1975	yes
outside	113	PIGL	121	111	10	92	8	2775	yes
outside	114	PIGL,PICO	121	87	34	72	28	2175	yes
outside	115	POTR,LALA,BEF	121	76	45	63	37	1900	yes
outside	116	BEPA,PIGL	121	112	9	93	7	2800	yes
outside	117	LALA,PICO	121	79	42	65	35	1975	yes
outside	118	BEPA	121	108	13	89	11	2700	yes
outside	119	PICO	121	76	45	63	37	1900	yes
outside	120	POTR,LALA,BEF	121	77	44	64	36	1925	yes
outside	121	POTR,BEPA,PIG	120	89	31	74	26	2225	yes
outside	122	POTR,BEPA	121	70	51	58	42	1750	yes
outside	123	BEPA,PIGL	169	151	18	89	11	3775	yes
outside	124	POTR,PIGL	121	89	32	74	26	2225	yes
outside	125	LALA,PICO	121	84	37	69	31	2100	yes
outside	126	POTR,LALA	121	71	50	59	41	1775	yes
outside	127	LALA,BEPA	121	101	20	83	17	2525	yes
outside	128	POTR,LALA,BEF	121	84	37	69	31	2100	yes
outside	129	LALA	169	125	44	74	26	3125	yes
outside	130	LALA,BEPA,PIGI	120	80	40	67	33	2000	yes
outside	131	POTR,LALA,PIG	121	91	30	75	25	2275	yes
outside	132	POTR	121	30	91	25	75	750	yes
outside	133	PICO	169	144	25	85	15	3600	yes
outside	134	POTR,PICO	121	81	40	67	33	2025	yes

outside	135	LALA,PIGL	121	93	28	77	23	2325	yes
outside	136	PIGL,PICO	169	141	28	83	17	3525	yes
outside	137	POTR,LALA,BEF	121	87	34	72	28	2175	yes
outside	138	POTR,LALA,BEF	121	75	46	62	38	1875	yes
outside	139	PIGL	169	159	10	94	6	3975	yes
outside	140	POTR,LALA,BEF	121	72	49	60	40	1800	yes
outside	141	POTR,LALA,BEF	120	72	48	60	40	1800	yes
outside	142	BEPA,PICO	121	78	43	64	36	1950	yes
outside	143	POTR,LALA,BEF	121	72	49	60	40	1800	yes
outside	144	BEPA	169	148	21	88	12	3700	yes