Whitebark and Limber Pine Seed Orchard Summary

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Why whitebark and limber pine?

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Primary threats




PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Whitebark Pine (*Pinus albicaulis*) in Canada

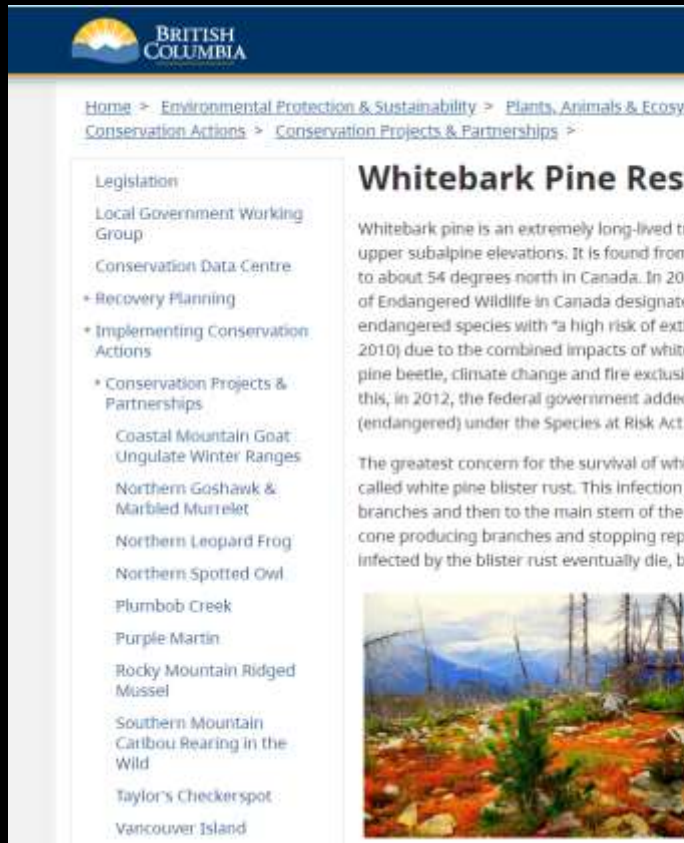
Whitebark Pine

Genetic conservation strategy for whitebark pine in British Columbia

Genetic Conservation Technical Advisory Committee

Forest Genetics Council

March 2009



Parks Canada's Conservation and Restoration Program

Parks Canada's Conservation and Restoration Program

- Message from the Minister
- Overview
- Atlantic
- Quebec and Nunavut
- Ontario
- Prairies, Yukon and Northwest Territories
- Pacific and mountain parks

Restoring coastal dunes in Pacific Rim National Park Reserve

Item 1 of 5

Play

Diverse, yet standardized

Parks Canada's Conservation and Restoration Program (CoRe) projects are as varied as the 33 national parks, national historic sites, and national marine conservation areas in which they occur.

A report on Parks Canada's Conservation and Restoration Program [PDF - 7.38MB]

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A natural priority

A report on Parks Canada's Conservation and Restoration Program

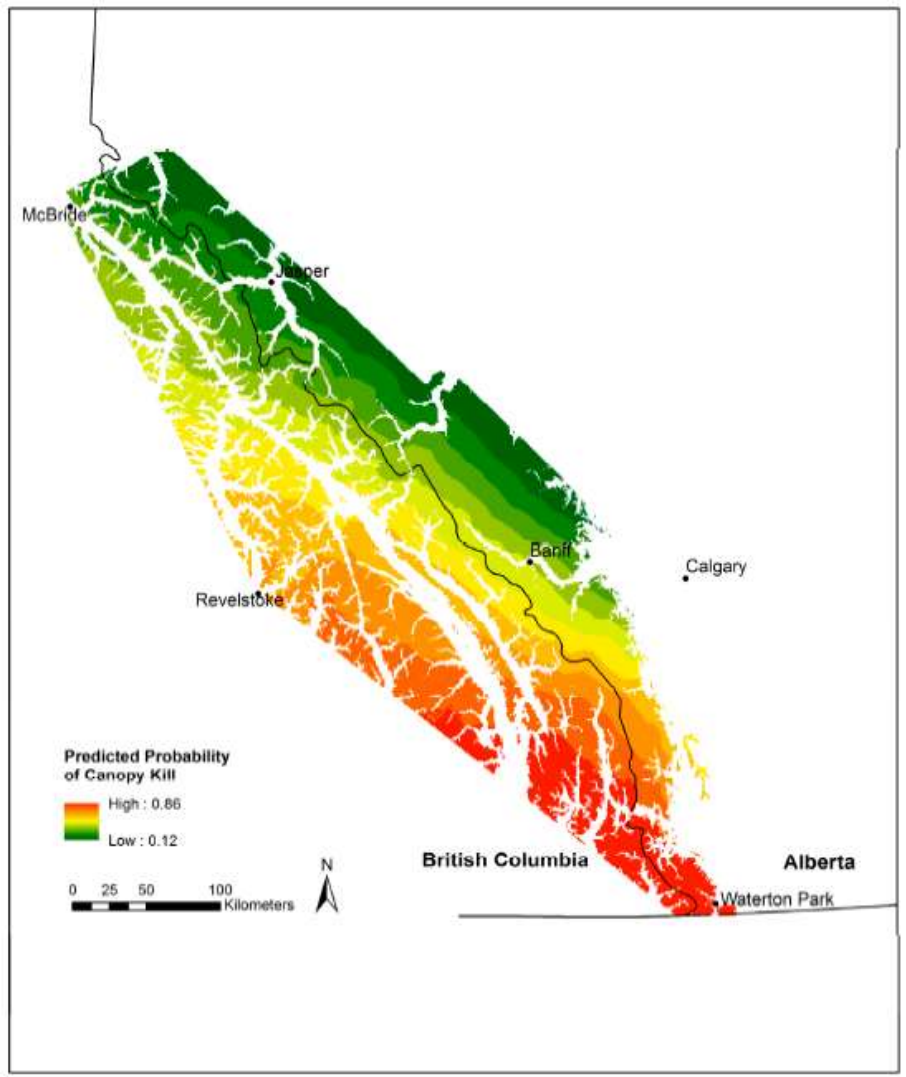
2014-2018: *Complete*

- Planted ~ 20,800 whitebark and 1,500 limber pine seedlings
- Contributed seeds from 159 parent trees for rust-resistance testing
- Protected more than 250 plus trees from mountain pine beetle attacks using pheromones
- Restored more than 1,100 hectares of whitebark pine and 7 hectares of limber pine habitat using prescribed fire
- Hosted Inter-agency Open Standards for Conservation workshops
- Thinned ~ 30 hectares of pine habitat to reduce competition and wildfire risk
- Developed/implemented five needle pine education and outreach programs

2019-2024: *Planned*

- Plant 43,500 putatively resistant whitebark and limber pine seedlings
- Contribute seeds from 150 new parent trees to rust-resistance testing
- Protect 400 high value trees per year with pheromones to prevent mountain pine beetle attack
- Restore 28 stands in whitebark and limber pine habitat
- **Facilitate the establishment of joint whitebark and limber pine seed orchards**
- Support rust resistance testing facilities
- Support research into whitebark pine mycorrhizal associations
- Expand education and outreach programs

Monitoring permanent Health Transects



forests

MDPI

Article

Ten Years of Monitoring Illustrates a Cascade of Effects of White Pine Blister Rust and Focuses Whitebark Pine Restoration in the Canadian Rocky and Columbia Mountains

Brenda Shepherd [1,*], Brad Jones [2], Robert Sissons [3], Jed Cochrane [4], Jane Park [5], Cyndi M. Smith [6] and Natalie Stafl [7]

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6 Scientist Emeritus, Parks Canada Agency, Waterton Lakes National Park, Waterton Park, AB T0K 2M0, Canada; Cyndi.Smith9@gmail.com
7 A/Ecologist Team Lead, Parks Canada Agency, Mount Revelstoke and Glacier National Park, Revelstoke, BC V0E 2S0, Canada; Natalie.Stafl@pc.gc.ca
* Correspondence: Brenda.Shepherd@pc.gc.ca; Tel.: +1-780-852-0341

Received: 30 January 2018; Accepted: 9 March 2018; Published: 14 March 2018

Abstract: Whitebark pine forests are declining due to infection by white pine blister rust and mountain pine beetle, combined with the effects of climate change and fire suppression. The Canadian Rocky

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Plus Tree Identification and Cone Collection




Planting

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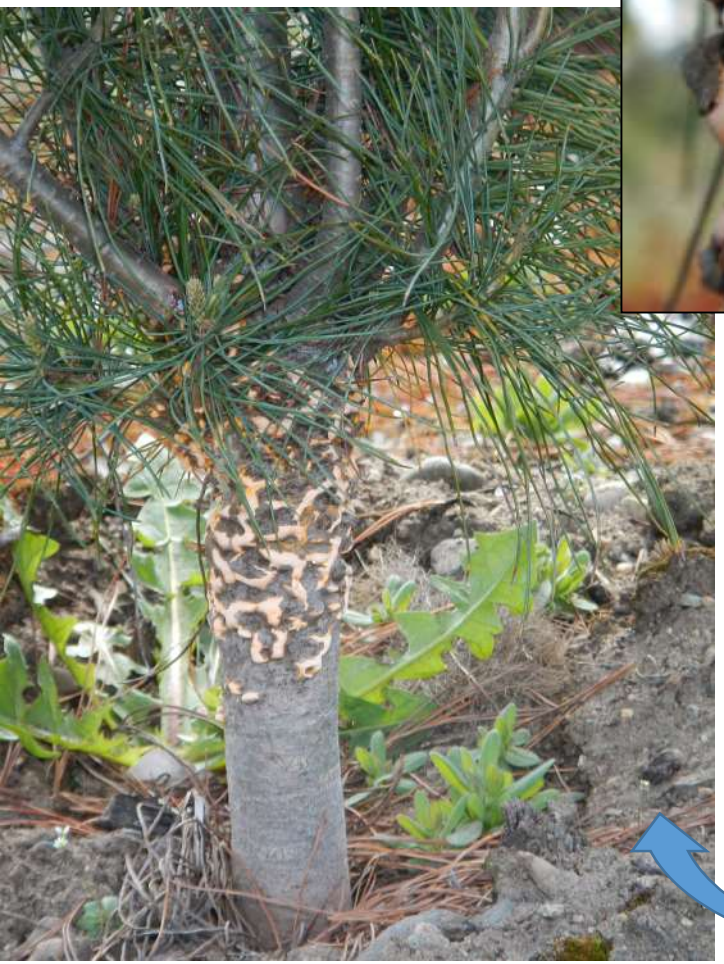
Pheromone deployment

Blister Rust Screening

White Pine Blister Rust Lifecycle

Aecia



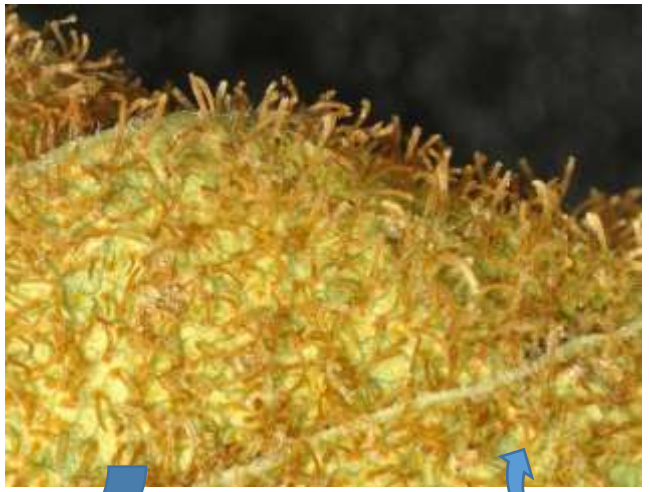
Whitebark Pine

Aeciospores

Ribes (currants)

Uridio-spores

Uridia



Telia

Basidiospores

Plus Tree Identification and Cone Collection

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Screening Results to Date

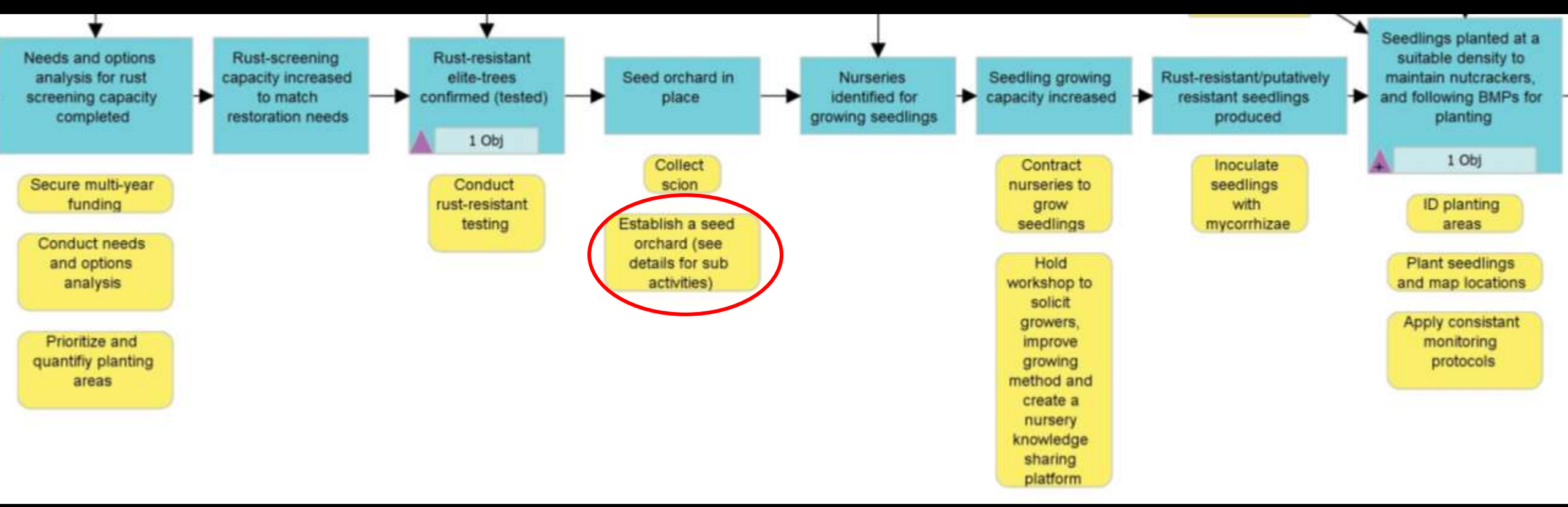
- Families Screened: 149
- Seedlings Screened: 5482
- Resistant Families Selected: 23
- Future: Hope to ramp up to 100-200 families screened/year

Why a seed orchard?

Five Needle Pine Open Standards Workshop
January 29 – February 2 2018
April 2-4 2019

Vision: *"To establish self-sustaining, rust-resistant meta-populations of whitebark and limber pine throughout their Canadian range"*

Five Needle Pine Open Standards Workshop
January 29 – February 2 2018
April 2-4 2019



Five Needle Pine Open Standards Workshop
January 29 – February 2 2018
April 2-4 2019

Whitebark and Limber Pine Seed Orchard Workshop

Revelstoke, BC Nov 21-22 2019

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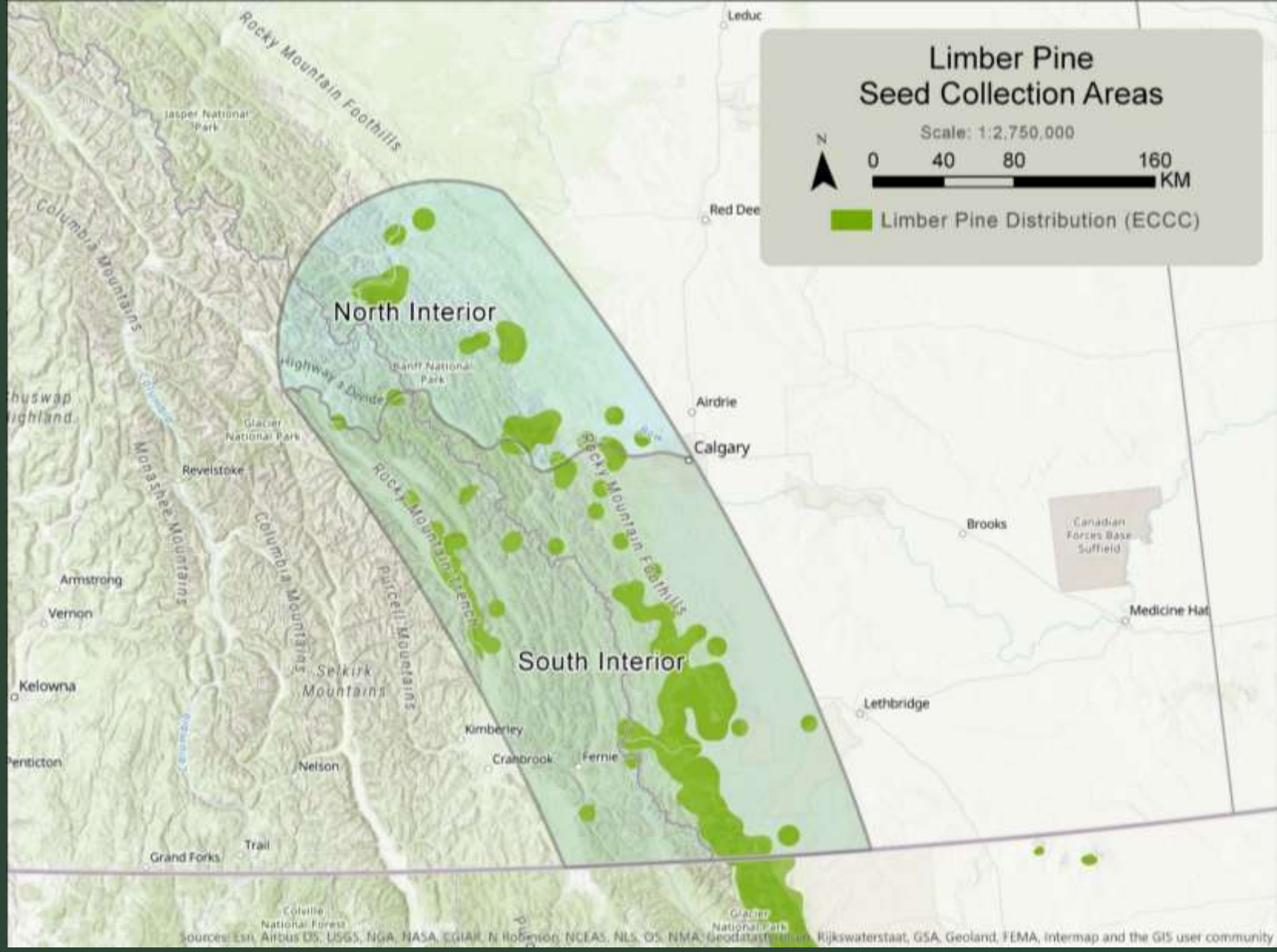
- BC Perspective
- AB Perspective
- PCA Perspective
- Whitebark Pine Ecosystem Foundation
- US Lessons Learned
- Seed Orchards 101
- A Historical Overview of Seed Orchards in BC
- Clone bank discussion
- Results from early whitebark grafting trials
- Update from whitetail cone stimulation trials
- National Tree Seed Centre

Seed Collection Areas

Limber pine



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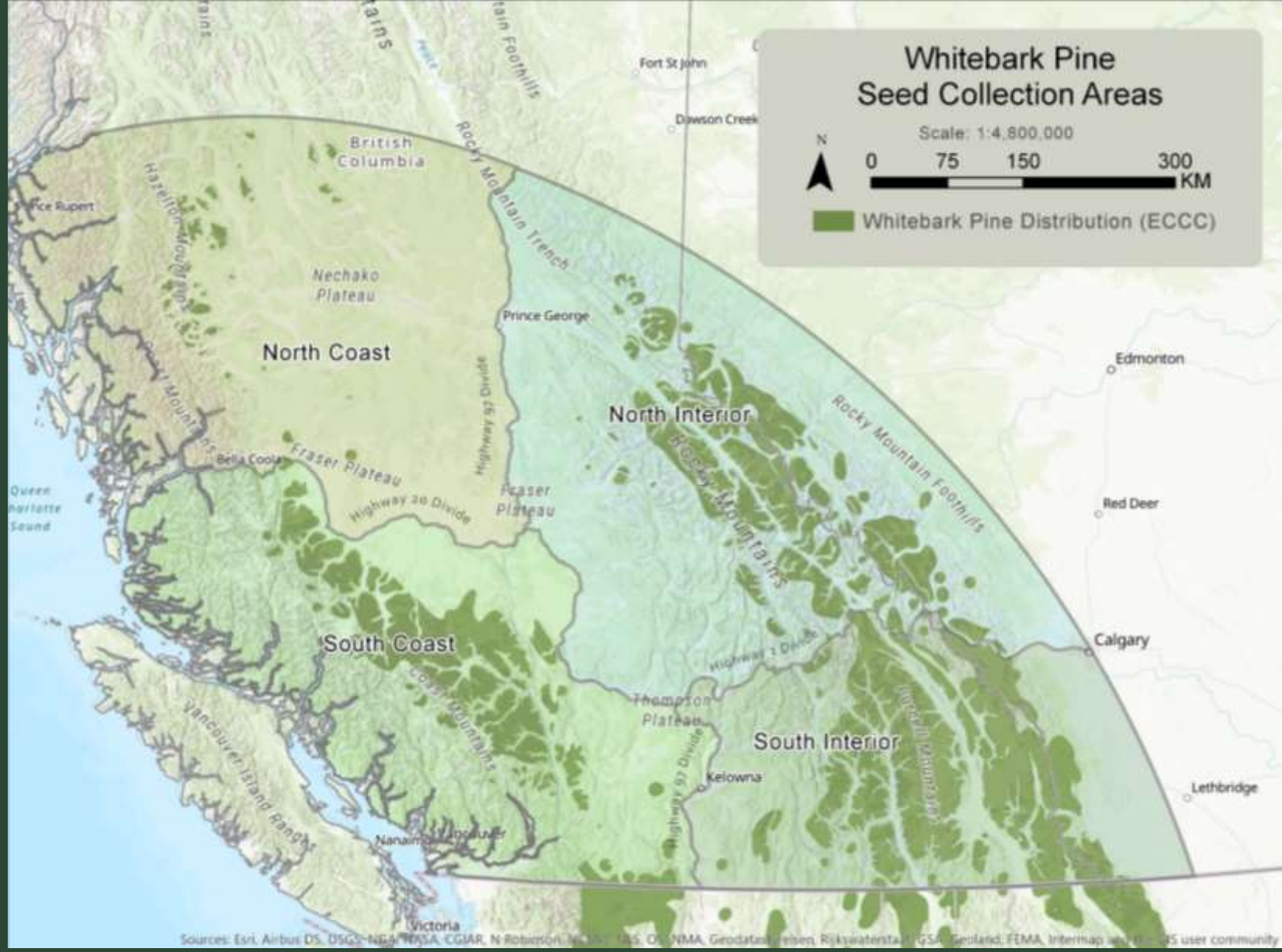
Seed Collection Areas

Whitebark pine



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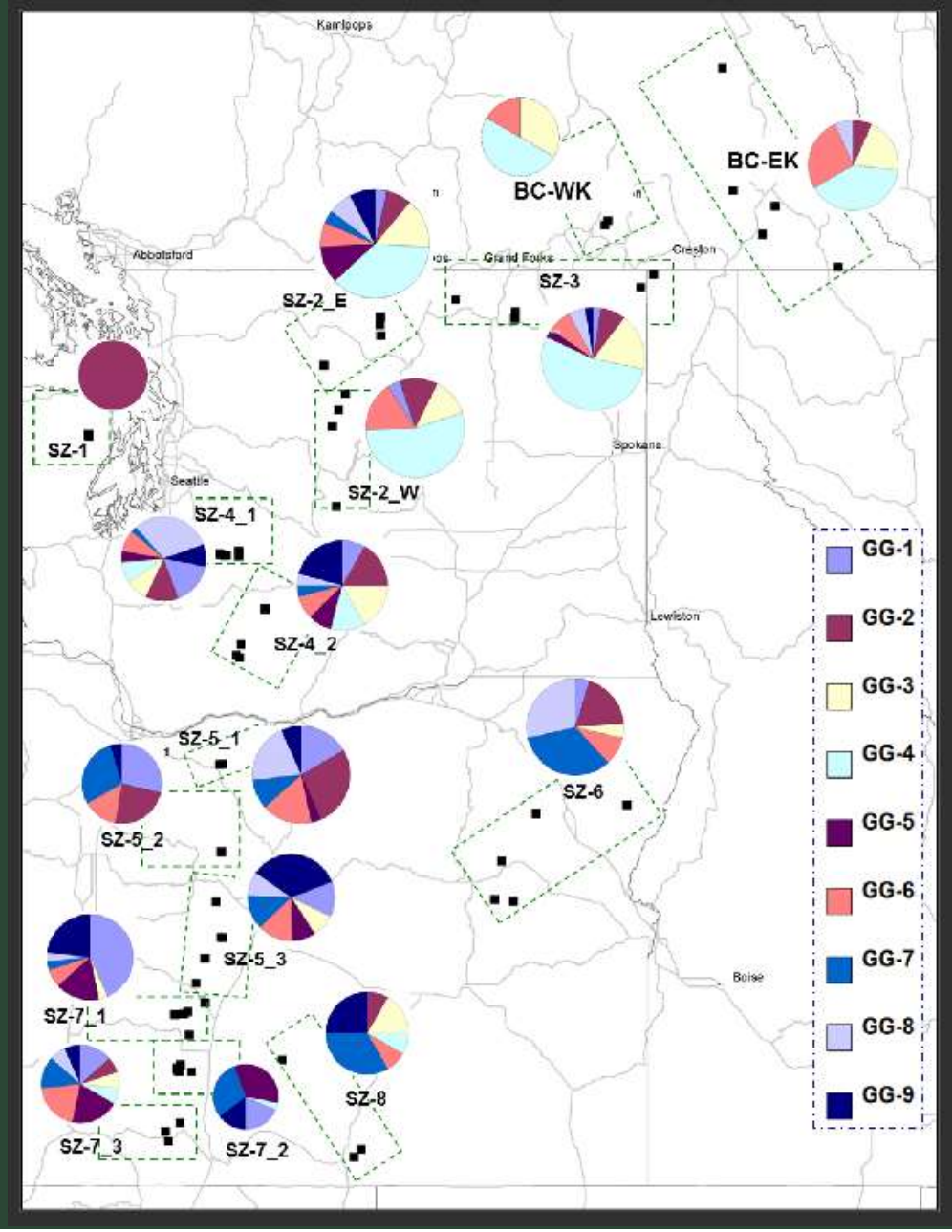
Seed Collection Areas

Whitebark pine

Liu J-J, Sniezko R, Murray M, Wang N, Chen H, Zamany A, et al. (2016) Genetic Diversity and Population Structure of Whitebark Pine (*Pinus albicaulis* Engelm.) in Western North America. PLoS ONE 11(12)

Bower, A.D. and S.N. Aitken. 2008. Ecological genetics and seed transfer guidelines for *Pinus albicaulis* (Pinaceae). Am. J. Bot. 95:66-76.



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PARENT TREE TARGET

60 tested parent trees achieve ‘elite’ status per seed zone per species and are represented in seed orchards. Seedlings from each parent tree will be represented in a minimum of two seed orchards.

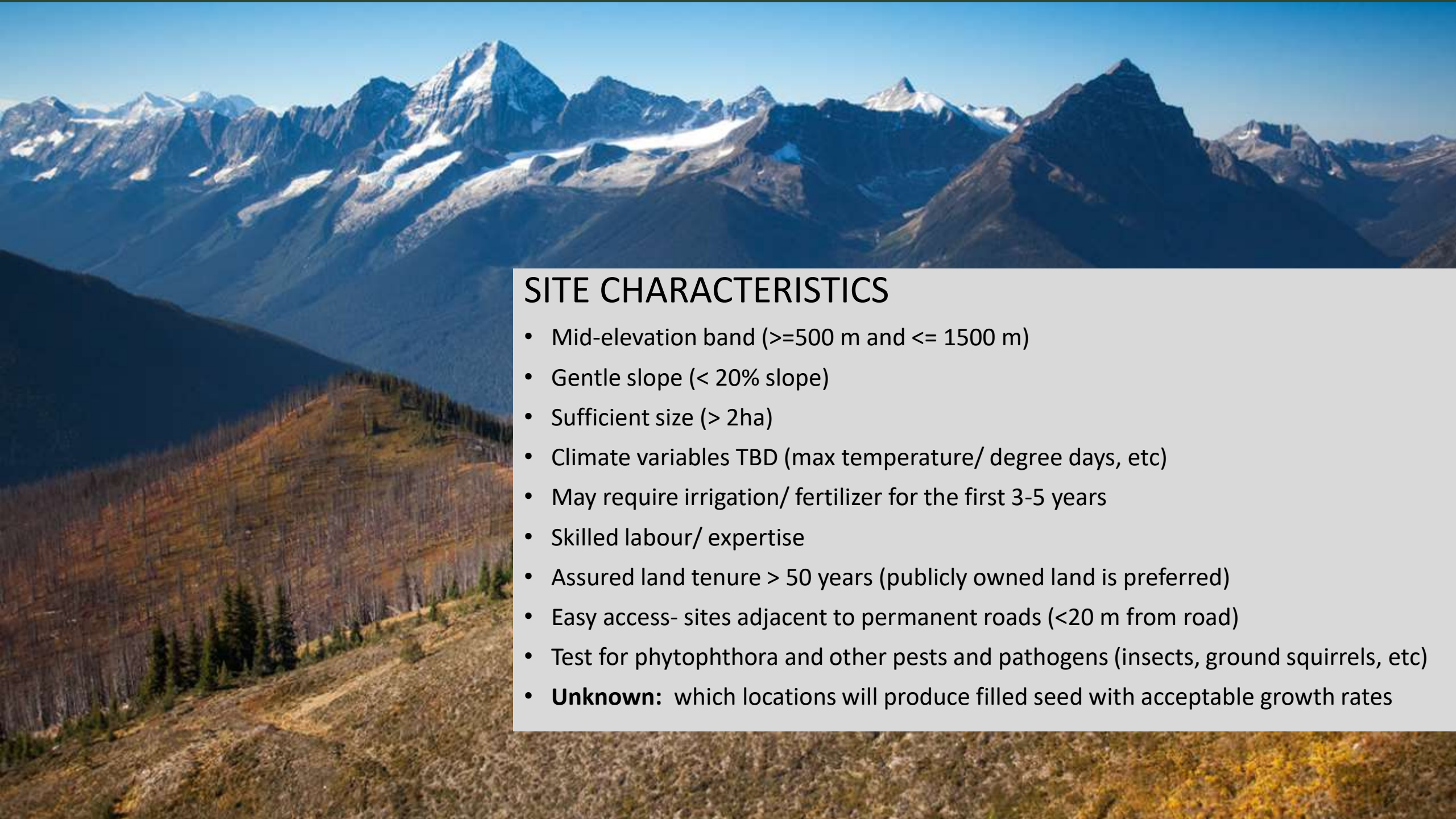
WHITEBARK PINE TARGET:

4 seed orchards / Minimum 1 clone bank for whitebark pine (replicated in at least 2 locations)

LIMBER PINE TARGET:

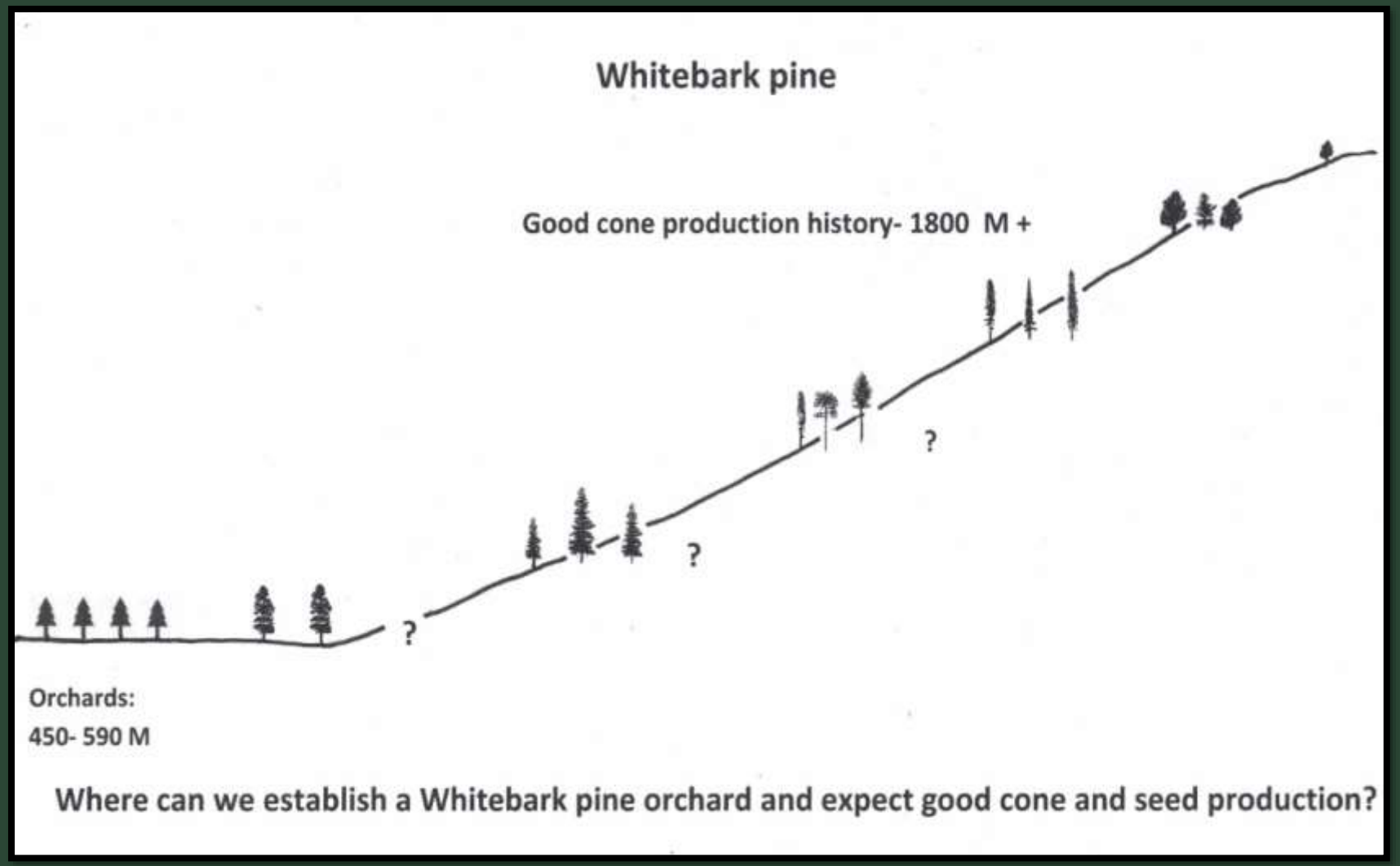
2 seed orchards / Minimum 1 clone bank for limber pine (replicated in at least 2 locations)

Target = 60 elite parent trees per seed zone per species, minimum= 20 elite parent trees per seed zone per species



SITE CHARACTERISTICS

- Mid-elevation band (>=500 m and <= 1500 m)
- Gentle slope (< 20% slope)
- Sufficient size (> 2ha)
- Climate variables TBD (max temperature/ degree days, etc)
- May require irrigation/ fertilizer for the first 3-5 years
- Skilled labour/ expertise
- Assured land tenure > 50 years (publicly owned land is preferred)
- Easy access- sites adjacent to permanent roads (<20 m from road)
- Test for phytophthora and other pests and pathogens (insects, ground squirrels, etc)
- **Unknown:** which locations will produce filled seed with acceptable growth rates



Potential Seed Orchard Sites

Site	Existing Orchard?	Infra-structure	Species	Extreme high	July high	June high	GDD>5	Elevation (m)	Slope
Quesnel Seed Orchard	Yes	Yes	Whitebark	35.1	24.2	21.6	1453	562	Flat
Prince George Tree improvement Station	Yes	Yes	Whitebark	34	22.8	20.3	1284	600	Flat
Skimikin Seed Orchards	Yes	Yes	Whitebark	36.6	25.7	22.5	1671	580	Flat
Teck Elkford greenhouse site	No	Yes	Whitebark/ Limber	30.8	19.4	15.5	738	1600	Flat
Waterton 1	No	Yes	Limber	33.6	22.9	18.8	1201	1285	Flat
Calgary Zoo	No	Yes	Whitebark/ Limber	36	24.4	21.9	1488	912	Flat
Healy Pit (near Banff)	No	No	Whitebark/ Limber	31.4	19.5	16.1	757	1400	<5%
Harrop (near Nelson)	No	No	Whitebark	36.8	25.7	22	1773	555	
Alex Fraser Research Forest	No	Yes	Whitebark	32.9	21.1	18.2	1368	800	Varies
Kootenay Crossing	No	Yes	Whitebark/ Limber	34.4	22.9	19.8	975	1175	<3
Redstreak Restoration Area	No	Yes	Whitebark/ Limber	35.4	24	20.7	1288	1010	<3
Barnes Creek Clone Bank	No	No	Whitebark	37.5	25	21.6	1582	680	<3
Revelstoke Dam	No	No	Whitebark	35.8	25.4	22.3	1611	540	Flat
Castlegar Airport +	No	No	Whitebark	38	27.2	23	1951	585	20%
Brilliant Dam (Castlegar)	No	No	Whitebark	38	27.2	23	1902	586	Max:50%
Nelson Rail Trail	No	No	Whitebark	36.5	25.1	21	1624	795	11%
Waterton 2	No	No	Limber	32.7	21.9	17.9	1090	1334	
Silver Star Park	No	No	Whitebark	30.1	17.9	14.8	853	1650	NA
Bull River (Cranbrook)	No	No	Whitebark	37.2	26.1	22	1589	887	6%
Moyie (E of Creston)	No	No	Whitebark	29	16.9	12.5	640	2078	23%
Mt Baldy (E of Osoyoos)	No	No	Whitebark	30.8	18	14.1	492	2205	25%
Kalamaka Forestry Centre	Yes	Yes	Whitebark	38.1	27.2	23.8	2026	475	Flat
Whitetail Lake seed production area	No	No	Whitebark	30.2	18.1	14.4	672	2015	20%

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Grafting Program

Graft Timing

Method	Scion Collected	Grafts made	Number	Survival Nov 2019	Overall Survival	Family Survival
Traditional	Feb 2017	May 2017	234	224	95.7%	79-100%
Traditional	Feb 2018	June 2018	552	542	98.2%	67-100%
Summer Hot Graft	July 2018	July 2018	112	35	31.3%	7-54%
Fall – Fall	Oct 2018	Oct 2018	494	281	56.9%	0-100%
Fall – Spring	Oct 2018	June 2019	474	435	91.7%	0-100%

Next Steps

- Review draft seed collection areas with forest geneticists

- Plant grafted clonal material at:
  - Existing seed orchard facilities
  - Lower end of whitebark pine habitat on a site of known good cone and seed production
  - Intermediate elevation site on a well- drained southerly exposure

- Conduct site visits in June 2020

- Secure funding commitments

Questions?