



Introduction to Climate Based Seed Transfer

Webinar

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What is Climate Based Seed Transfer (CBST)?

“Climate Based Seed Transfer (CBST) refers to a seed transfer system based on climate, for the purposes of adapting to and mitigating the impacts of climate change.”





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How does CBST compare with BC's current seed transfer approach?

Current

- A geographically-based methodology using, longitude, latitude, elevation and biogeoclimatic zone,

CBST

- A climate-based methodology that matches the climate of the seed source with the current and (near) future climate of a planting site.
- Based on new and emerging climate and forest genetic science.
- Includes “assisted migration.”

Both systems are science based and supported by data from provenance trials

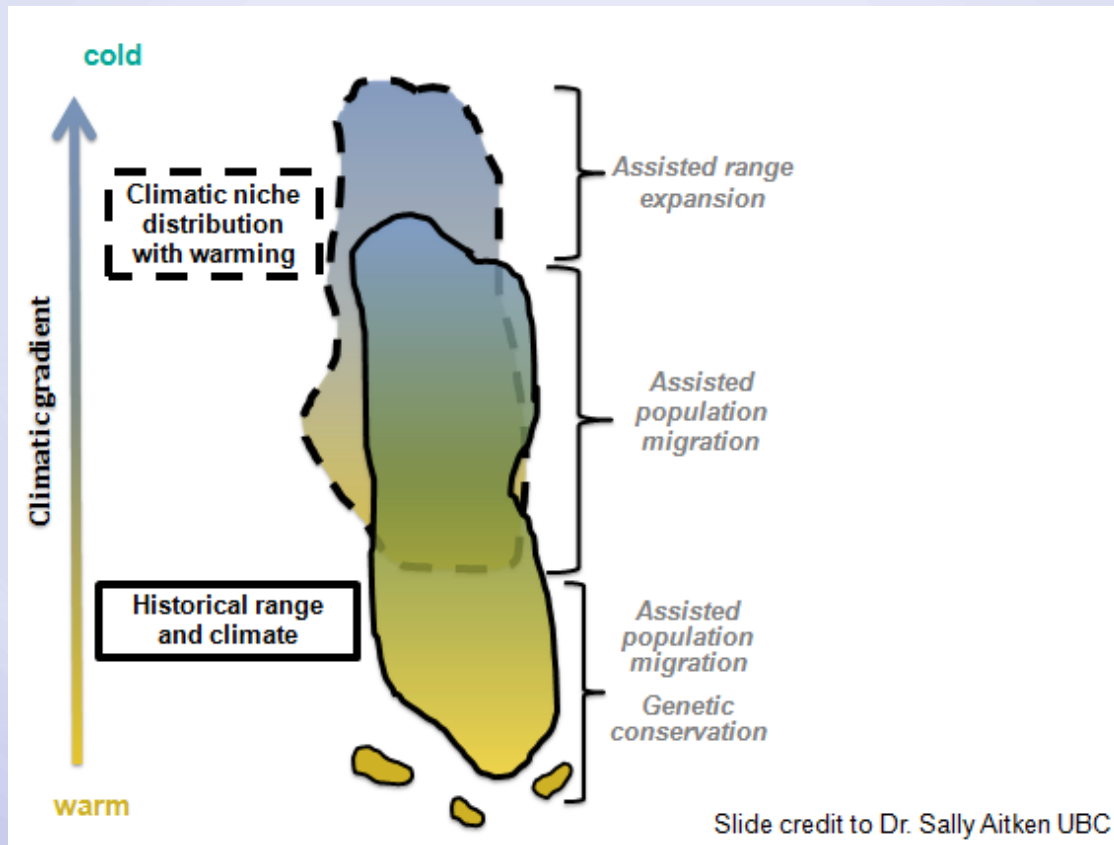


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“Assisted Migration”

(1) is a climate change adaptation strategy;

(2) is the intentional movement of tree seed, from areas they grow naturally, to planting sites that are climatically suitable for their growth at the present time and in the near future.



Slide credit to Dr. Sally Aitken UBC



CBST Science Foundation

- Based on climate and forest genetic (provenance) data
- Climate represented by **BEC variants**
- CBST accounts for both past (adaptation lag ~70years) and future climate change (15yrs coast; 20yrs interior)
= Climate migration distance is to the first quarter rotation

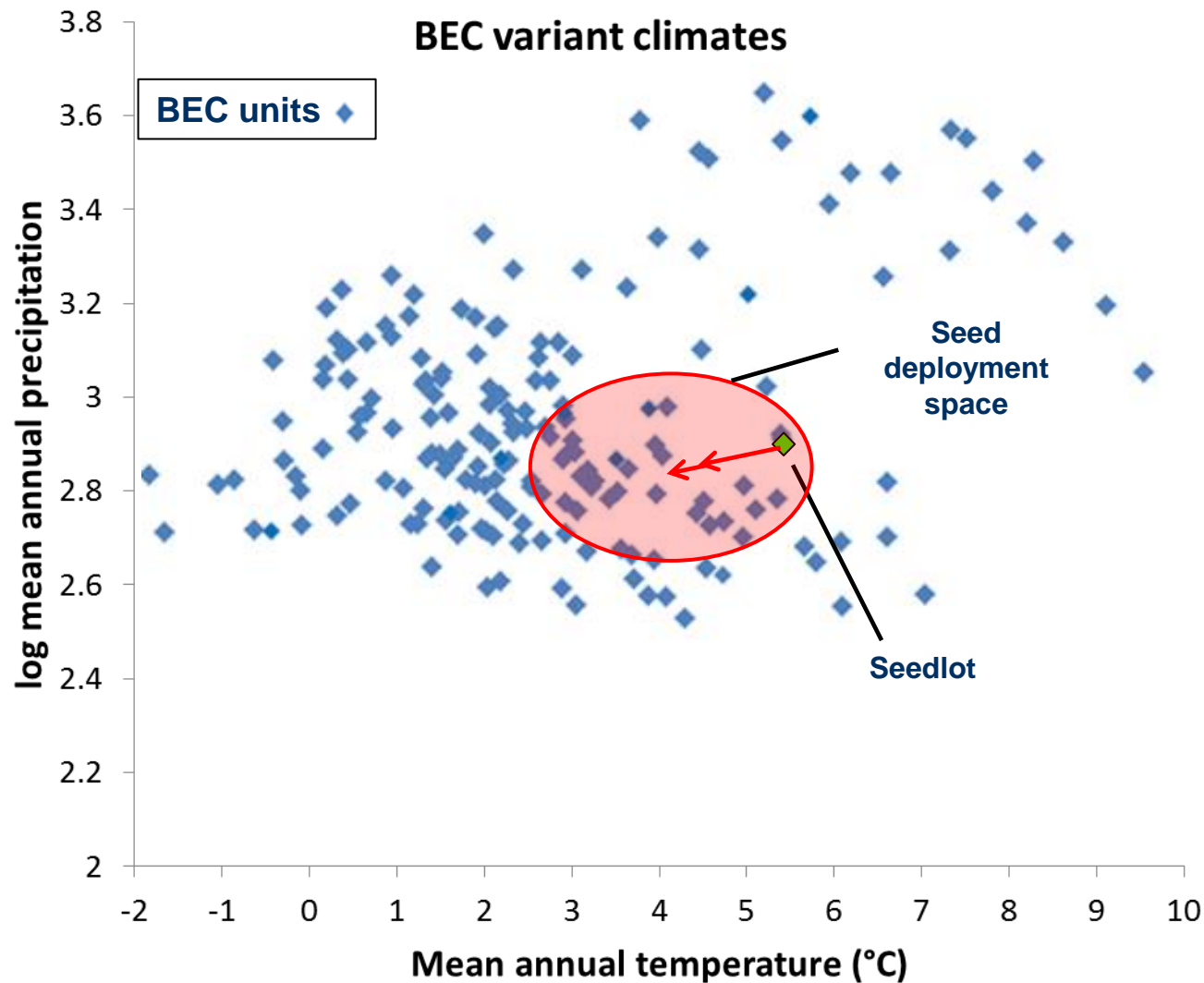
Baseline data sets

- BEC10
- ClimateBC
- Transfer functions
- Minimum genetic and species suitability thresholds
- Expert opinion

For more information, see **Technical Report 099: “A Proposed Climate-based Seed Transfer System for British Columbia”** by G O'Neill, T Wang, N Ukrainetz, L Charleson, L McAuley, A Yanchuck and S Zedel. (2017)



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Migrating
the climate
space
(BEC variants
represent
climate space)

Example of Shift to a Seedlot Area of Use



CBST Seedlot Selection Tool Version 2.0

Instructions

I Have A Cutblock

I Have A Seedlot

Seedlot Number:

60281

Set Species & BEC

OR

Species:

PLI

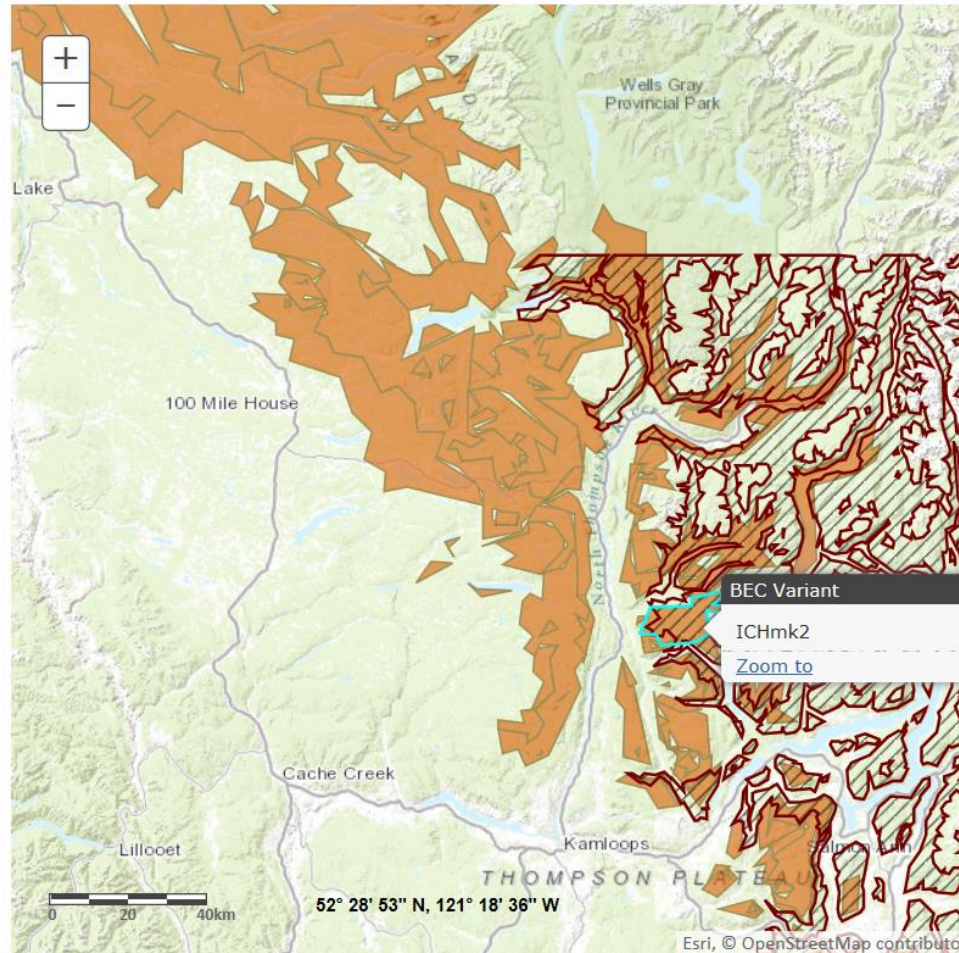
BEC Variant:

ICHdw3

GO

Plantation BEC	Seed BEC	Species Suitability	Limit
ESSFdc3	ICHdw3	Suitable	
ICHdk	ICHdw3	Suitable	
ICHdw3	ICHdw3	Suitable	
ICHmk1	ICHdw3	Suitable	
ICHmk2	ICHdw3	Suitable	
ICHmk3	ICHdw3	Suitable	
ICHmk4	ICHdw3	Suitable	
ICHmm	ICHdw3	Suitable	
ICHmw1	ICHdw3	Suitable	

Area available to seedlot: 4,763,368 Ha.



The CBST seed deployment area (i.e. CBST Area of Use) comprises the **orange** areas marked on the map. The current seed deployment area (or Area of Use) is marked in the **brick red** colour.



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The **CBST Seedlot Selection Tool** enabled mapping of shifts in seed deployment and procurement areas under CBST

/Vegetative Lot for CBST

Search Lot Info Requests Reports Services Maintenance TSC Registration Admin

Lot Type: Active/Expired: *

Species: *

Latitude: Longitude: Default BEC

BEC Zone: * BEC Subzone: * Variant: SeedMap

No. of Seedlings (000's):

Specific Lot(s):

Crown/Private: Registered:

Owner Agency:

Cutting Quantity:

Seed Quantity:

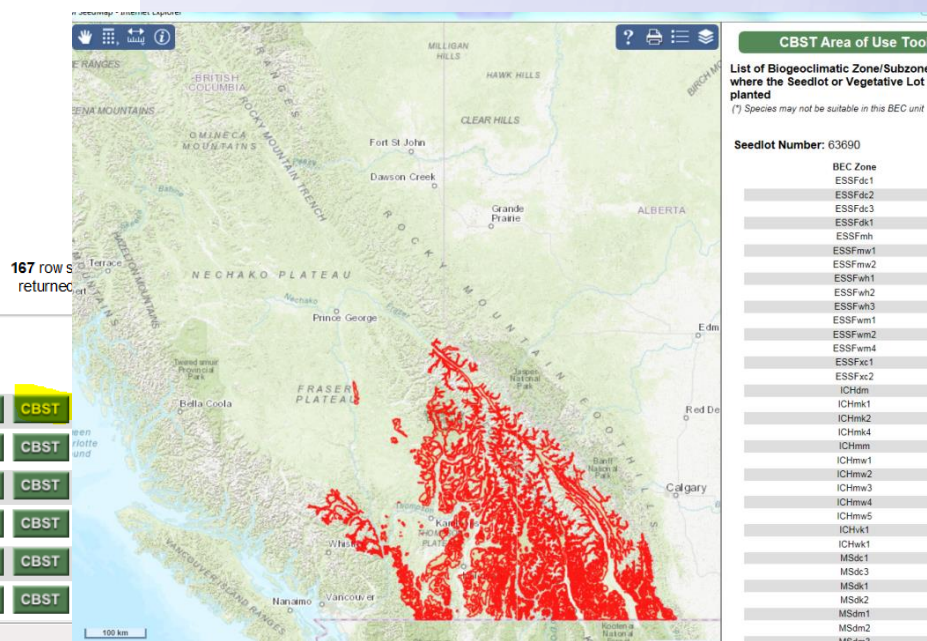
Go

Display: ☒ Trees ☐ Quantity (grams/cuttings) ☒ Orchard No./Location ☐ Lat/Long Refresh Print

Seedlot Quantity is displayed in grams; Vegetative lot Quantity is displayed in No. of Cuttings (in thousands)

Genetic Lot No.	Class & Germ. %	C/P	Agency	BEC	Orchard No. / Location	Coll. / Reserve Prod. Year	Trees (000's)	Surplus Trees (000's)	DT	CBST
63690	A G+34	96	C BCTS 00	ICHmw 2	324 - BAILEY	2016	121.3	0	DT	CBST
63690	A G+34	96	C MOF 20	ICHmw 2	324 - BAILEY	2016	0	38.3	DT	CBST
63586	A G+34	89	C BCTS 00	ICHmw 2	324 - BAILEY	2015	34.5	0	DT	CBST
63586	A G+34	89	P TOLKO 01	ICHmw 2	324 - BAILEY	2015	1.6	0	DT	CBST
63535	A G+34	84	C BCTS 00	ICHmw 2	324 - BAILEY	2014	0	3.5	DT	CBST
63377	A G+33	82	C BCTS 00	ICHmw 2	324 - BAILEY	2012	0	3.1	DT	CBST

Functionality and data now incorporated into **SPAR** – training to begin in August, for 2019 Seedling Requests





Chief Forester's Standards for Seed Use

Section 169 of the *Forest and Range Practices Act*

the chief forester may establish, vary or revoke standards respecting
(a) tree gene resources for purposes related to this Act...

Section 43 of the *Forest Planning and Practices Regulation* & Section 32 of the *Woodlot Licence Planning and Practices Regulation*

a person who plants trees to establish a free growing stand **must use only seed registered, stored, selected and transferred in accordance with the standards established by the chief forester**

Rule of Law not Professional Reliance



Chief Forester's Standards for Seed Use

Amendments of April 5, 2018 come into effect August 6, 2018¹

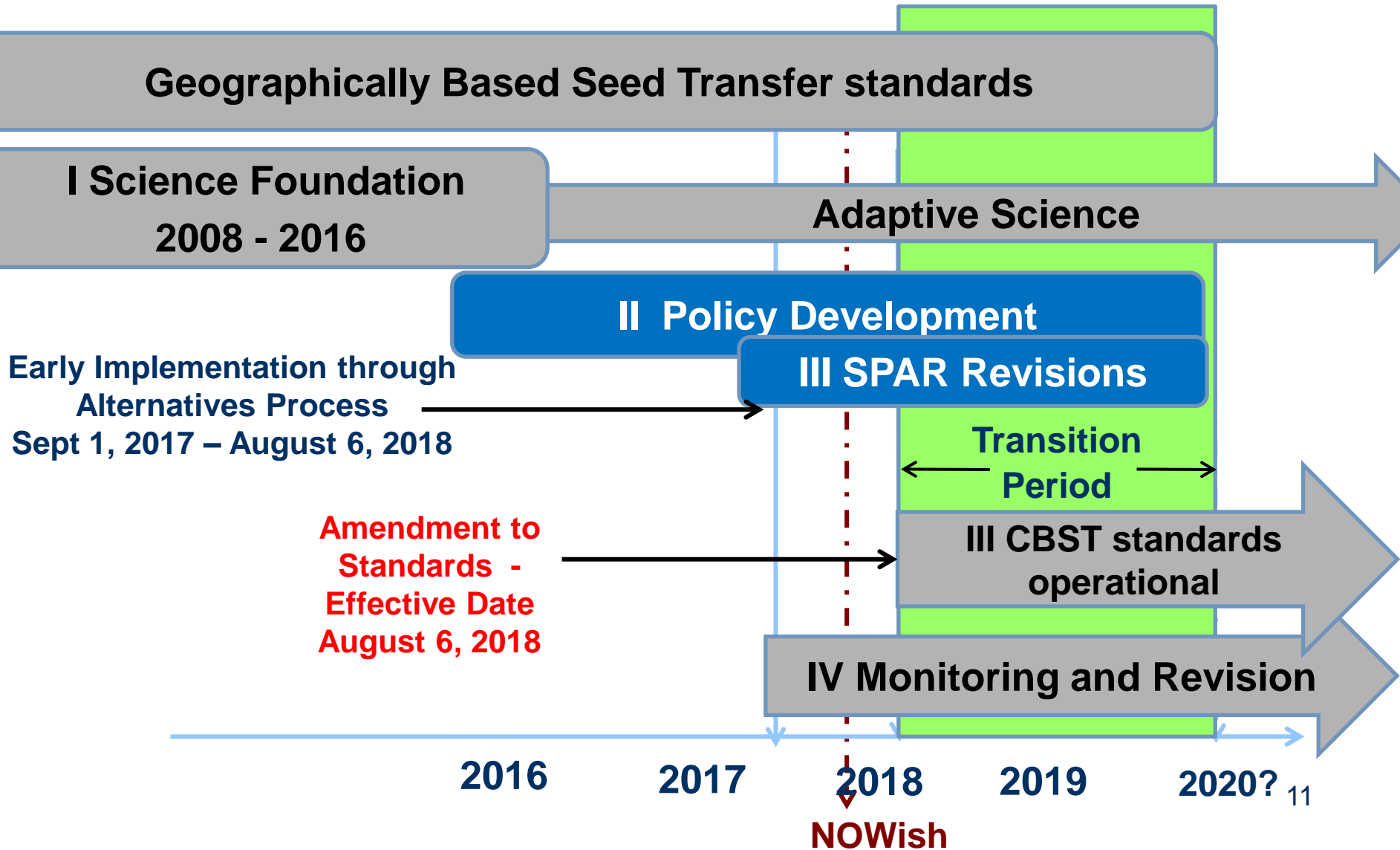
Introduction of:

- Option to use CBST standards, continue with Geographically Based Seed Transfer standards (GBST) or use a mix of both
- New cone collection requirements that align with CBST
- Other minor amendments to update reference and administrative provisions

<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/tree-seed/legislation-standards/chief-forester-s-standards-for-seed-use>

¹Notice period may be waived

CBST Policy Timeline





The Transition Period

- Time to learn the new CBST system – the GBST standards will be removed as an option at end of transition period
- Opportunity to use up seed that you may no longer be able to use in your operating area under CBST
- Current thinking is a 2 year transition
 - subject to broader stakeholder consultation and results of the impact assessment and gap analysis



Strategic Use of Policy Options in Transition Period

If your goal is to maximize productivity of your site, use policy options in this order of priority:

1. Use CBST seed transfer and Class A seed with the highest Genetic Gain
2. Use Current transfer standards with Class A seed with the highest Genetic gain
3. Use CBST seed transfer and Class B seed
4. Use Current transfer standards and Class B seed

*If none of these policy options have seed availability –
consult with FIRM.*



Revised Cone Collection Standards

- New requirements come into effect August 6, 2018 with **no transition period**.
- Seed now required to be collected from a single BEC variant and seed collection area to be mapped in SPAR
- No change to min of 10 trees and max 8 of km radius.
- Needed to create a CBST area of use.



Revised Cone Collection Standards

For more information:

- Cone Collection and Climate Based Seed Transfer Information Bulletin (May 2018)
- Cone Collection workshops in June 2018 (Nanaimo, Vernon, Castlegar, Prince George).
 - Review collection planning, methods and implementation, cone and seed pests, TSC services, projected seed needs and discuss new CBST collection standards.



Risks related to Introduction of CBST

- Doing nothing about climate change is high risk
 - Losses from increased wildfire and pests
 - Loss of productivity through maladaptation
- Using CBST mitigates the impacts of climate change and reduces risk
 - We are currently planting into sites that are too warm for the seed
 - With CBST, we will be planting into sites that are slightly colder (in anticipation of ongoing climate change)
 - CBST takes a conservative approach - focusing more on catching up with climate change to date, rather than projecting too far into the future



Establishment Risk

- There is both establishment risk and productivity risk associated with climate change – CBST lowers both.
- Risk of extreme weather impact during establishment need to be managed regardless of the seed transfer system.
- Foresters have to use all their establishment tools:
 - Use Class A seed with high genetic worth
 - Make robust stock choices
 - Species selection
 - Microsite selection
 - Considerations for pests and disease

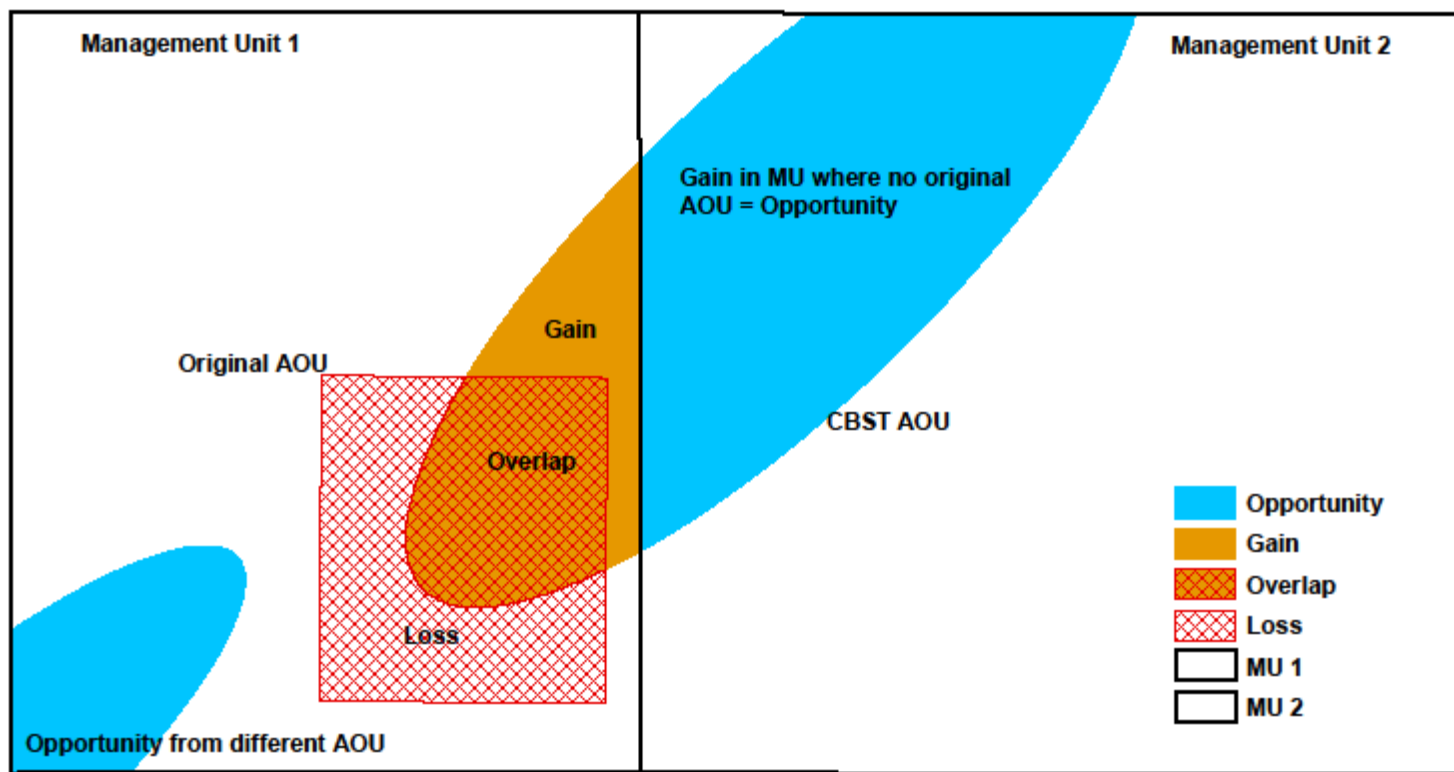


Impact Assessment - key questions

- To what degree does CBST impact seed use, investments, and assets, including impacts to:
 - Seed Users
 - Seed Owners; and
 - Seed Producers?
- How are CBST impacts characterized compared to previous deployability of a seed lot (losses, gains)?
- What are the opportunities (e.g. new seed sources moving in)?
- Where are the gaps in CBST coverage? What are the opportunities to fill them (in short and long term)?
- What do we do about “orphans”? Seedlots with no where to plant, or BEC variants with no seed source?



Schematic of Quantified Impact Analysis:





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Impacts on TFL 37 (WFP North Island), all species

A class seed only

										ANALYSIS 2		ANALYSIS 1				
Losses relative to current AOU										Impact	Losses relative to AOU	Assessment	CBST AOU (gain+overlap) relative to current AOU			
0-33% >100%													new seed source		n/a	1NEW
34-66% 50-100										low	0-33%		expanded deployment		>100%	2GAIN
67-100% <50%										med	34-66%		reduced deployment		50-100	3LOSS
										high	67-100%		significantly reduced		<50%	4SLOSS
Species	Management_Unit	BECvarGroup Name	Seed_BEC	Orchards	Current_AOU_HA	Current_AOU_PCT_Suitable	Gain_HA	Gain_PCT	Loss_HA	Loss_PCT	Loss_Impact	Overlap_HA	Overlap_PCT	CBST_AOU_HA	CBST_PCT	CBST_Impact
CW	TFL37	CWMLOW3	CWHvm1	set([152L, 184L, 140L, 198L, 993L])	186,232	98%	53,343	29%	87,862	47%	2-M	98,370	53%	150,220	81%	3Loss
FDC	TFL37	FDCMLOW2	CWHdm	set([996L, 197L, 166L, 199L, 405L])	238,438	99%	157	0%	74,412	31%	1-L	164,026	69%	164,169	69%	3Loss
FDC	TFL37	FDCMHIGH2	CWHms2	set([406L])	105,578	100%	25,259	24%	58,134	55%	2-M	47,444	45%	72,703	69%	3Loss
FDC	TFL37	FDCSMALL1	CWHms2	set([181L])	0		72,703		0		1-L	0		72,703		1New
HW	TFL37	HWMLLOW3	CWHvh1	set([170L, 182L])	157,061	98%	16,829	11%	9,721	6%	1-L	147,340	94%	164,169	105%	2Gain
HW	TFL37	HWMHIGH2	CWHvm2	set([187L, 196L])	122,534	100%	30,527	25%	17,119	14%	1-L	105,415	86%	135,942	111%	2Gain
PW	TFL37	PWMALL1	CWHxm2	set([998L, 175L])	263,080	99%	86	0%	261,694	99%	3-H	164,083	62%	164,169	62%	3Loss



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Impacts on Bulkley TSA - Fdi AOU opportunities!

A class seed only

Species	Management_Unit	BECvarGroup Name	Seed_BEC	Orchards	Current_AOU_HA	Current_AOU_PCT_Suitable	Gain_HA	Gain_PCT	Loss_HA	Loss_PCT	Loss_Impact	Overlap_HA	Overlap_PCT	CBST_AOU_HA	CBST_PCT	CBST_Impact
FDI	Bulkley TSA	FDIQLLOW1	ICHmk3	set([232L, 226L])	0		21,223		0		1-L	0		21,223		1New
FDI	Bulkley TSA	FDIPGLOW1	SBSdh1	set([225L, 233L])	0		249,148		0		1-L	0		249,148		1New
FDI	Bulkley TSA	FDICTLOW1	SBSdw1	set([231L])	0		69,724		0		1-L	0		69,724		1New

Impacts on Revelstoke TSA - Pli AOU losses!

A class seed only

Species	Management_Unit	BECvarGroup Name	Seed_BEC	Orchards	Current_AOU_HA	Current_AOU_PCT_Suitable	Gain_HA	Gain_PCT	Loss_HA	Loss_PCT	Loss_Impact	Overlap_HA	Overlap_PCT	CBST_AOU_HA	CBST_PCT	CBST_Impact
PLI	Revelstoke TSA	PLINELOW1	ICHdw3	set([307L])	203,847	100%	0	0%	203,847	100%	3-H	0	0%	0	0%	4SLoss
PLI	Revelstoke TSA	PLINELOW2	ICHdw4	set([337L])	203,847	100%	0	0%	203,847	100%	3-H	0	0%	0	0%	4SLoss
PLI	Revelstoke TSA	PLIPGLOW1	ICHwk2	set([237L])	68,959	100%	0	0%	68,959	100%	3-H	0	0%	0	0%	4SLoss
PLI	Revelstoke TSA	PLINELOW3	IDFmw1	set([313L])	203,847	100%	0	0%	203,847	100%	3-H	0	0%	0	0%	4SLoss
PLI	Revelstoke TSA	PLINELOW4	IDFmw2	set([347L])	203,847	100%	0	0%	203,847	100%	3-H	0	0%	0	0%	4SLoss
PLI	Revelstoke TSA	PLIPGLOW2	SBSdh1	set([220L])	68,959	100%	0	0%	68,959	100%	3-H	0	0%	0	0%	4SLoss
PLI	Revelstoke TSA	PLIPGLOW3	SBSdw3	set([352L])	68,959	100%	0	0%	68,959	100%	3-H	0	0%	0	0%	4SLoss
PLI	Revelstoke TSA	PLIPGLOW5	SBSmw	set([244L, 236L, 222L])	68,959	100%	0	0%	68,959	100%	3-H	0	0%	0	0%	4SLoss



Road Map

Near Term (now to 2 years)

- Complete impact and gap analysis, make assessment tools available to all stakeholders / licensees
- Amended standards – Effective Date August 6, 2018
- Broader stakeholder engagement on transition plans and selected policy development
- Transition strategy and full implementation plan
- Ongoing data and climate updates
- Monitoring framework developed



Road Map

Short Term (2 to 5 years)

- New “SPUs”/Breeding Zones defined
- Amendments to Chief Foresters Standards to end transition period
- Increased monitoring and evaluation
- Additional research identified and initiated – public licence

Longer term (5+ years)

- New Seed Orchards come on stream
- Coordination with the Climate Informed Species Selection (CISS) Tool, led by RPB.



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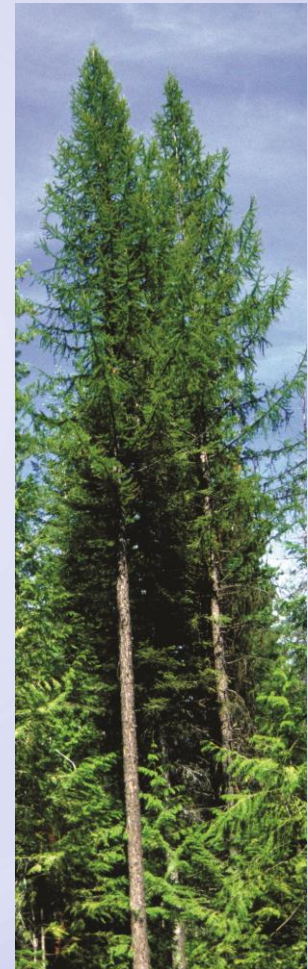
See, Ministry of Forests, Lands, Natural Resource Operations and Rural Development, **Tree Seed** and **CBST** webpages,

www.gov.bc.ca/climatebasedseedtransfer

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SPAR Quick Start Tutorial



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SPAR Quick Start

- “I have a Cutblock” Mode

SPAR TEST SPAR (2) CBST website Chief Forester's Standards... CBST Tool V2 CBST Tool V.6.0 CBST TIB HOME My Learning My Time and Pay My Performance Tree Frog Forestry

ation Home

ed Planning and Registry System

Search	Lot Info	Requests	Reports	Services	Maintenance	TSC	Registration	Adm in
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Lot Search

Seedlot

Vegetative Lot

Suitable Seed/Vegetative Lot

Suitable Seed/Vegetative Lot for CBST

Lot Allocation

Parent Tree

ing and Registry (SPAR) Web Application!

You are currently logged on as: IDIRIM SPENCE

Available links:

1. [SeedMap](#)
2. [SPAR Website](#)
3. [Chief Forester's Standards for Seed Use](#)
4. [Email to SeedInfo](#)



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SPAR Quick Start

- “I have a Cutblock” Mode

Vegetative Lot for CBST

Search	Lot Info	Requests	Reports	Services	Maintenance	TSC	Registration	Admin
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Lot Type: **Active/Expired:** *

Species: *

Latitude: **Longitude:**

BEC Zone: * **BEC Subzone:** * **Variant:**

No. of Seedlings (000's):

Specific Lot(s):

Crown/Private: **Registered:**

Owner Agency:

Cutting Quantity:

Seed Quantity:



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SPAR Quick Start

Note – does not show BECvars
without registered seed – so if wanted
to collect seed check with CBST Tool

- “I have a Cutblock” Mode – switching to “I have a Seedlot” Mode

Lot No.	Genetic Class & Worth	Germ. %	C/P	Agency	BEC	Orchard No. / Location	Coll. / Reserve Prod. Year	Reserve Trees (000's)	Surplus Trees (000's)	DT	CBST
42265	B	99	P	COWANW 00	IDFx h2	HEFFLEY MTN	1995	142.9	0	DT	CBST
53597	B	99	C	BCTS 00	IDFdm1	GRANBY RIVER	2009	174.3	0	DT	CBST
53886	B	99	P	TOLKO 01	IDFmw 1	SPA CREEK	2015	448.2	0	DT	CBST
53979	B	99	P	ARML 00	IDFxm	MAYFIELD FSR, ALKALI LAKE	2016	4577.2	0	DT	CBST
53979	B	99	P	WFM 09	IDFxm	MAYFIELD FSR, ALKALI LAKE	2016	2000	0	DT	CBST
30865	B	98	P	IFP 03	IDFmw 2	VAVENBY	1992	3.6	0	DT	CBST
48508	B	98	P	CANOEF 00	IDFmw 2	SKIMIKIN CREEK	2002	34	0	DT	CBST
53465	B	98	C	BCTS 00	IDFx h4	MCLAREN CREEK	2009	12.2	0	DT	CBST
53466	B	98	C	BCTS 00	IDFdm1	VOLCANIC CREEK	2009	5.5	0	DT	CBST
53600	B	98	C	BCTS 00	IDFx h4	JULY CREEK	2009	349.4	0	DT	CBST
53600	B	98	C	MOF 27	IDFx h4	JULY CREEK	2009	33.2	0	DT	CBST
53825	B	98	C	MOF 27	IDFmw 2	SKIMIKIN LAKE	2013	201	0	DT	CBST



SPAR Quick Start

- I have a “Seedlot” Mode

SPAR

Search Lot Info Requests Reports Services Maintenance TSC Registration Admin

Seedlot Number: 53979 * Go CBSTAreaofUse

Lot Details CBST Owners Tests Commitments Transactions Heritage History

Back

7 rows returned

BEC zone	Subzone	Variant
IDF	dk	1
IDF	dk	3
IDF	dk	4
IDF	xm	
MS	xk	2
SBPS	dc	
SBPS	xc	

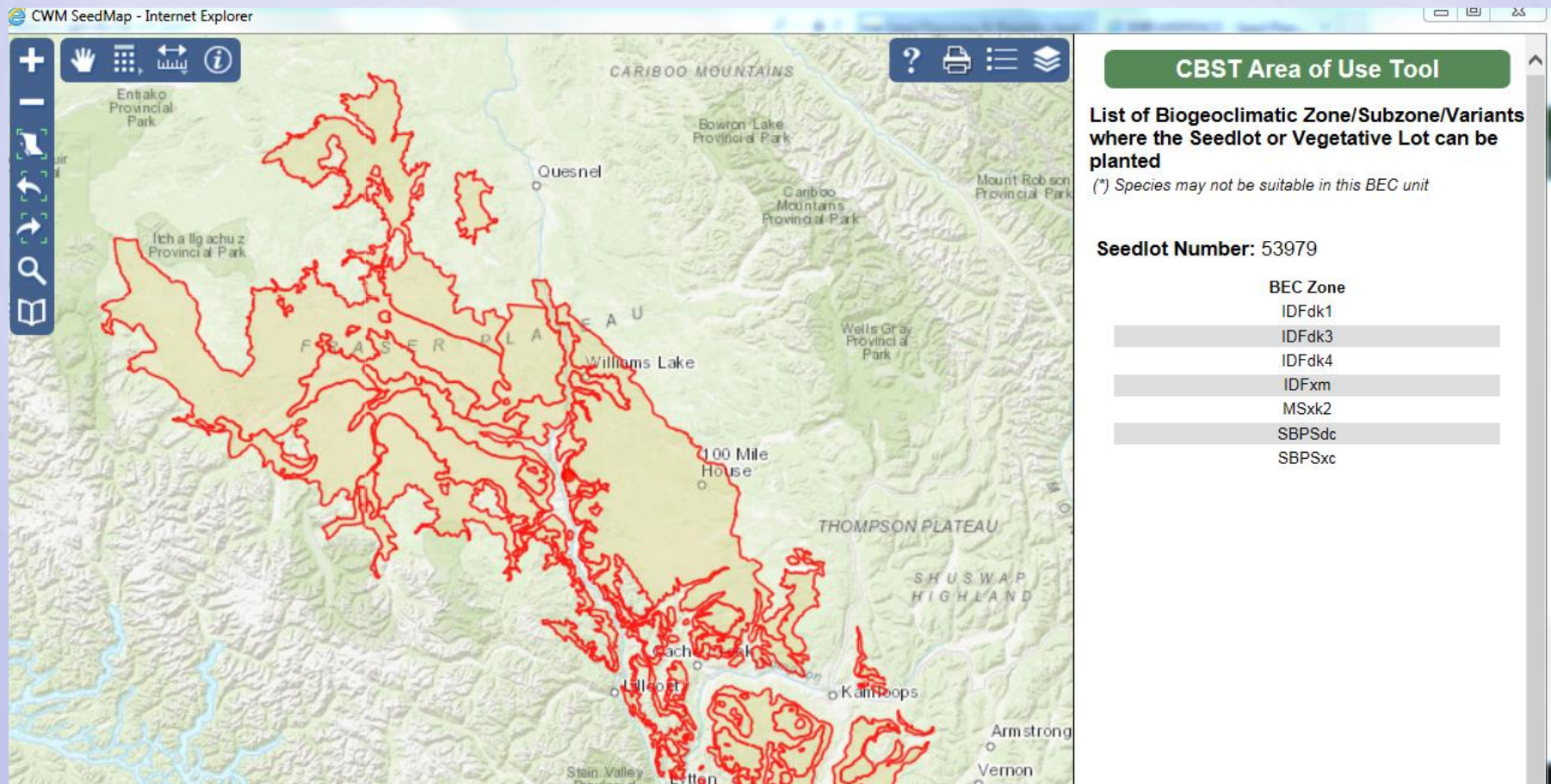
Back



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SPAR Quick Start

- I have a “Seedlot” Mode





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SPAR Quick Start

- I have a “Seedlot” Mode

CWM SeedMap - Internet Explorer

CBST Area of Use Tool

List of Biogeoclimatic Zone/Subzone/Variants where the Seedlot or Vegetative Lot can be planted
(*) Species may not be suitable in this BEC unit

Seedlot Number: 53979

BEC Zone
IDFdk1
IDFdk3
IDFdk4
IDFxm
MSxk2
SBPSdc
SBPSxc



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SPAR Quick Start

- “I have a Seedlot” Mode

SPAR TEST SPAR (2) CBST website Chief Forester's Standards... CBST Tool V2 CBST Tool V.6.0 CBST TIB HOME My Learning My Time and Pay My Performance Tree Frog For

ed Planning and Registry System

Search	Lot Info	Requests	Reports	Services	Maintenance	TSC	Registration	Admin
<ul style="list-style-type: none">Lot SearchSeedlotVegetative LotSuitable Seed/Vegetative LotSuitable Seed/Vegetative Lot for CBSTLot AllocationParent Tree		<ul style="list-style-type: none">Seedlot DetailCBSTOwnershipTestsCommitmentsTransaction HistoryHeritageHistory						

You are currently logged on as: I

Available links:

1. [SeedMap](#)
2. [SPAR Website](#)
3. [Chief Forester's Standards for Seed Use](#)
4. [Email to SeedInfo](#)

R) Web Application!



SPAR Quick Start

- “I have a Seedlot” Mode

Seedlot CBST

Search Lot Info **Request** Reports Services Maintenance TSC Registration Admin

Seedlot Number:

Lot Details **CBST** Owners Tests Commitments Transactions Heritage History

23 rows returned

BEC zone	Subzone	Variant
ESSF	dc	3
ICH	dk	
ICH	dw	3
ICH	mk	1
ICH	mk	2
ICH	mk	3
ICH	mk	4
ICH	mm	
ICH	mw	1
ICH	w k	2
ICH	w k	4
MS	dk	1
MS	dk	2
MS	dm	1
MS	dm	3
SBS	dh	1
SBS	dh	2
SBS	dw	1



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SPAR Quick Start

- “I have a Seedlot” Mode

Seedlot Detail

Search Lot Info Requests Reports Services Maintenance TSC Registration Admin

Seedlot Number: 60281

Lot Details CBST Owners Tests Commitments Transactions Heritage History

Seedlot Number:	60281	Registered:	Yes - 1995-12-22 - Active
Species:	PLI - lodgepole pine		
Genetic Class/Worth	A G+06	Collection Year:	1995

Source Information

Orchard No:	307 - KALAMALKA		
Tested Parent Trees:	Yes	Heritage:	No
BGC Zone/Subzone/Variant:	ICH dw 3	BEC Version:	

Area of Use

Seed Planning Zone(s):	NE PGN TON	<input type="button" value="SeedMap"/>
Elevation Range: Min-Max (m)	700 - 1600	
Latitude Range: Min-Max	No Limit	
Area of Use Comment:	Maximum elevation increased as of April 1, 2009 (Chief Forester's Standards for Seed Use Amendment)	

Quantity and Test Information

Germination (%):	95	Peak Value:	95/ 9
Seeds per Gram:	254	Seedlings per Gram:	126
Potential Trees (000's):		Grams:	

Reserved Available: 0.0 0.0

Geographic based seed transfer standards