Climate Based Seed Transfer (CBST) Update

FGC Interior Technical Advisory Committee
February 6, 2019

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Forest Improvement and Res Mgmt Branch

Options for Seed Transfer Standards

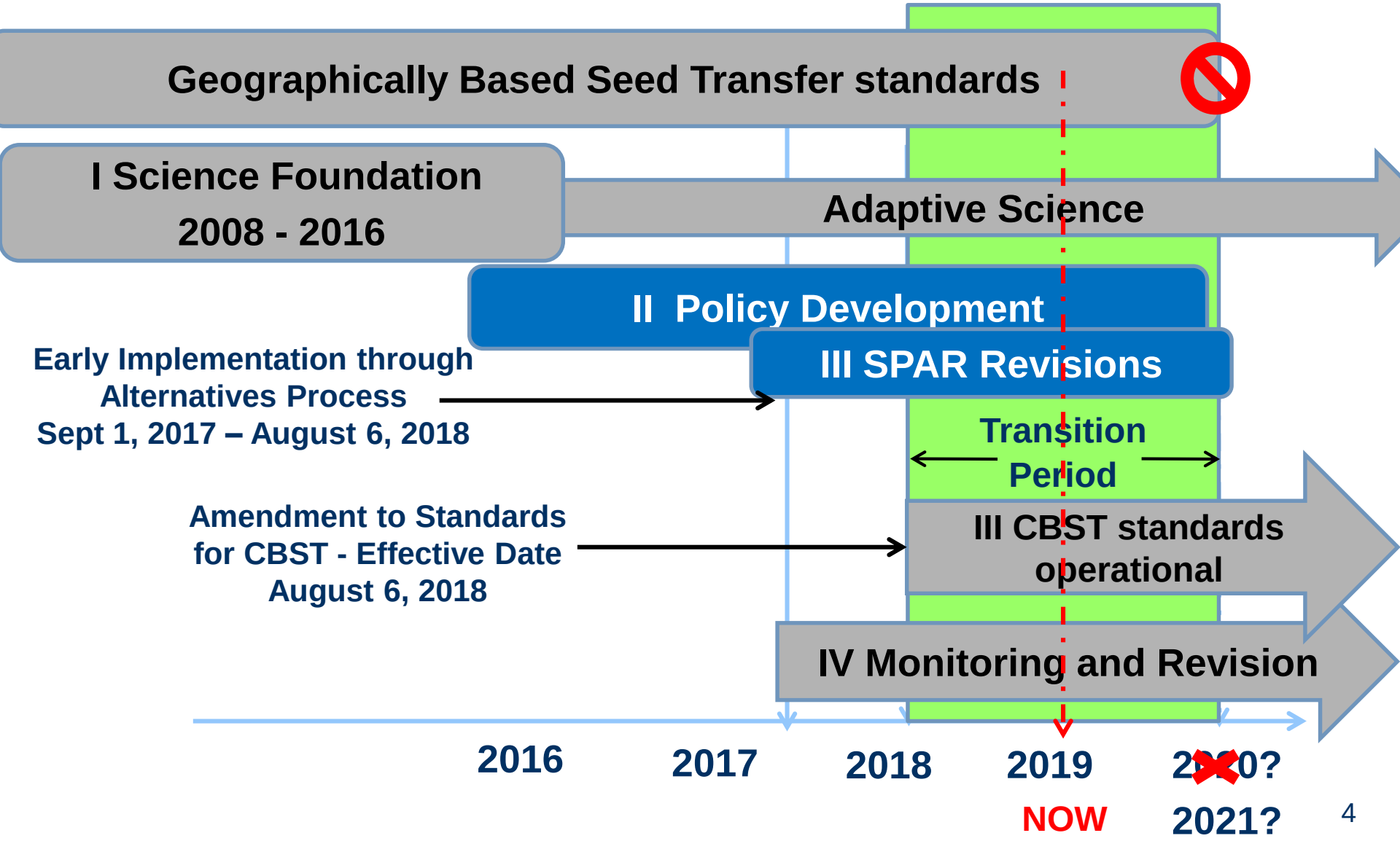
Since April 5, 2018, Geographic Based Seed Transfer (GBST) and Climate Based Seed Transfer (CBST) are both useable under the *Chief Foresters Standards for Seed Use* – during a transition period.

CBST Uptake to Date

- For 2018 Sowing (using a request for a CBST Alternative) – about **2% of seedling requests**
- For 2019 Sowing (as an option under the Chief Foresters Standards for Seed Use), so far:

Funding Source	Seedling Use	Percent with Subject To=CBST
BCT	BCTS Reforestation	73%
FTM	FFT Reforestation	82%
FTM	FES Carbon	90%
LFP	Licensee Reforestation	33%
All	All	58%

CBST Policy Timeline



Planned CBST Data and SPAR Updates

April 2019 * minor fixes (address critical orphaned BECvariants)

* improvements to grand fir transfer fxn

April 2020 * refinements to CBST Areas of Use (new climate data, add 2 yrs into future, climate variable weighting?, updates for BEC 11 and 12 (13 and 14?).

April 2021 * likely the first chance to remove GBST, and add further transition provisions

Finding Mitigation Options

- Our focus turns to finding the right policy options, establishing seed trading arrangements, and planning new orchards (and seed planning units).
- Species Specific Mitigation Options and General Mitigation Options to be considered
- Will likely need several rounds of impact and gap analysis to inform the options

Impact Assessment and Gap Analysis

TOOLS AVAILABLE:

1. CBST compared to GBST – Impact Assessment Excel Workbook
2. CBST Seed Supply and Demand Excel Workbook (Gap Analysis)
3. Interactive pdf maps of CBST areas of use for existing seed orchard source BEC variants
4. Spatial (shape) files of CBST areas of use will also be available

Impact Assessment and Gap Analysis

- Initial DRAFT ***Provincial Species Reports and Summaries*** now available
- Provides a starting point for your own analysis
- Need to understand data assumptions and limitations of the tools (and Provincial Summaries)
- Additional functionality to tools planned (GVO filter, forecasts and sensitivity analysis)
- Standards, inventory and planting data to be updated in April 2019 and April 2020

Data Assumptions and Limitations

- Planting data is 5.8 years (2013 to Nov 2018)
- Inventory data from SPAR at April 2018
- Inventory only allocated to BEC variants suitable under CBST, weighted by proportion of BECvar in the CBST area of use
- Surplus and deficit analysis assumes use of CBST only (does not account for fact that seed use will continue under GBST to address gaps)

IMPACT ASSESSMENT TOOLS

- Compare CBST to GBST

- Geographically Based Seed Transfer (GBST)
  - Seed sources (seedlots) are migrated geographical distances **(geographic space)**
  - Seed deployment Areas of Use (GBST AOU) in place prior to April 5, 2018
  - Seed Planning zones (Class A and B); Seed Planning Units (Class A)
  - Latitude/longitude and elevation (and within BEC zone) transfer limits
- Climate Based Seed Transfer (CBST)
  - Seed sources (seedlots) are migrated climatic distances **(climate space)**
  - Seed deployment Areas of Use (CBST AOU) in place on, or after April 5, 2018
  - BEC Variant (I have a Cutblock; I have a Seedlot)
  - Class A and B share the same seed deployment maps

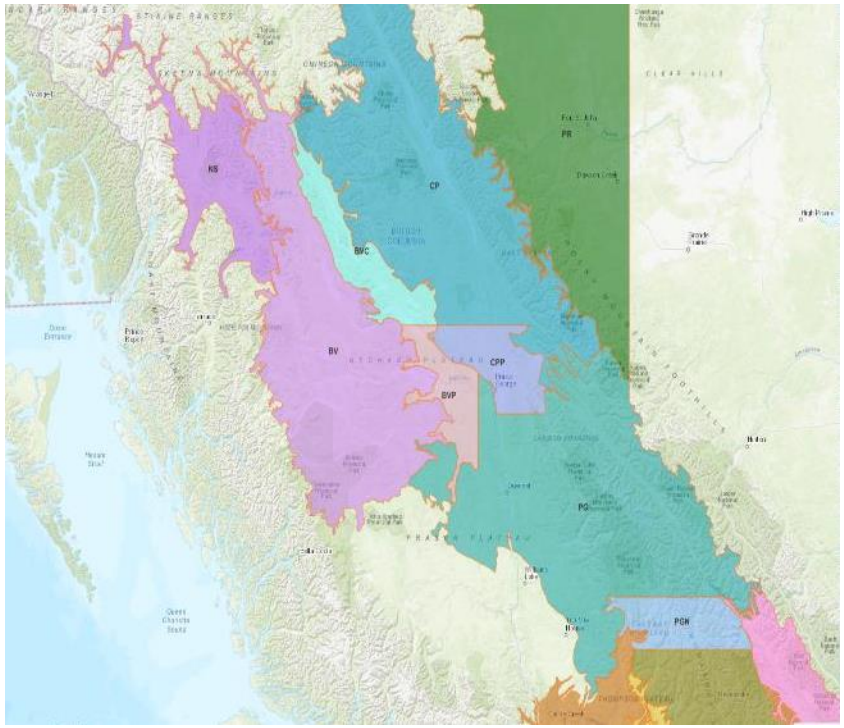
GBST Standards: Seed deployment (transfer) based on GBST Areas of Use

Seed deployed within geographically based seed transfer areas of use (GBST AOU). Areas of use are derived from:

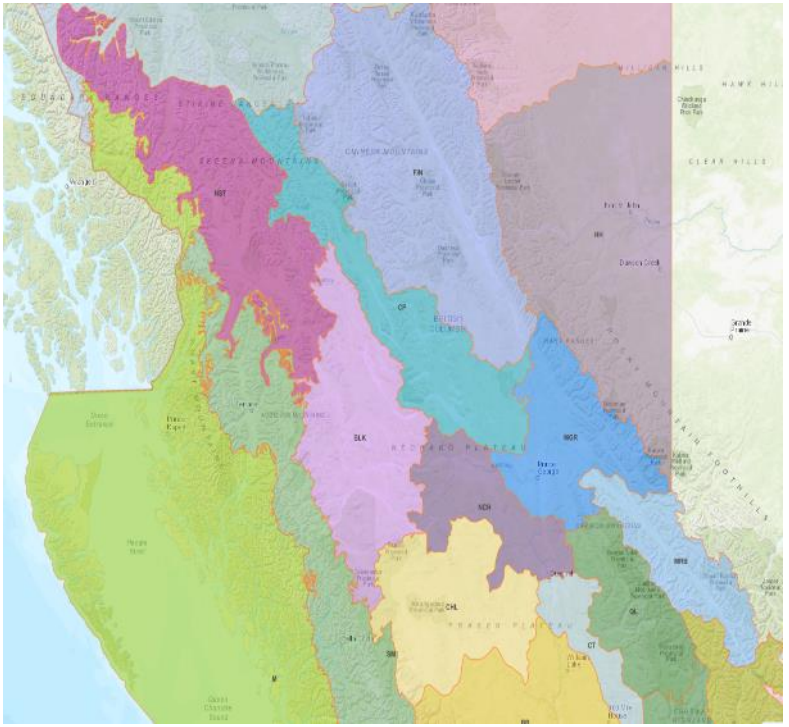
- Seed planning zones (SPZ-A and or SPZ-B)
- Seed planning units (SPU-A only)
- Latitude and longitude (Class B only)
- Elevation
- BEC zone class B only

GBST Standards:
GBST Area of Use for Class A and B

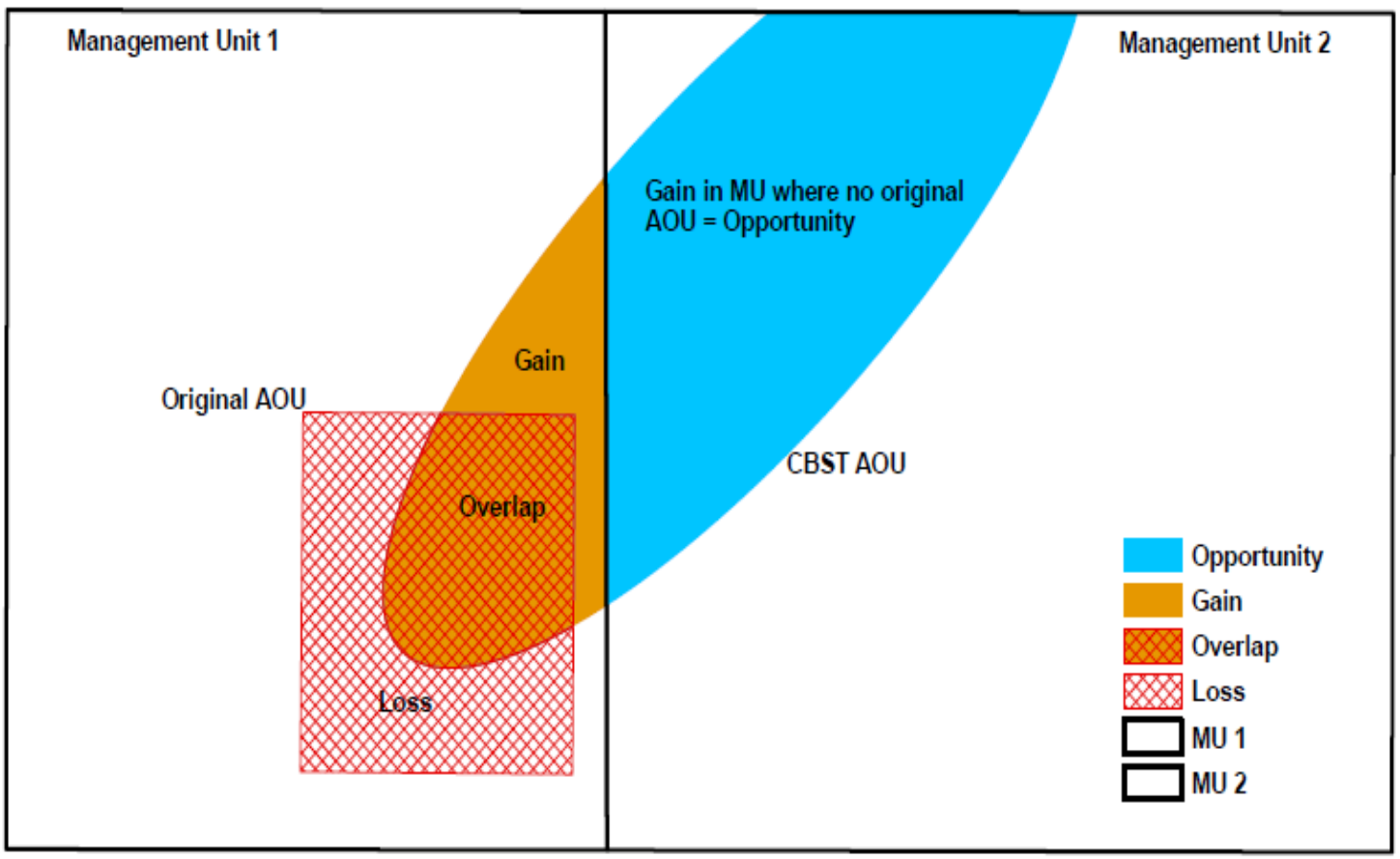
Genetic Class A – orchard



Genetic Class B – natural stand



CBST Compared to GBST



Impacts:

Areas of Loss, Overlap and Gain,

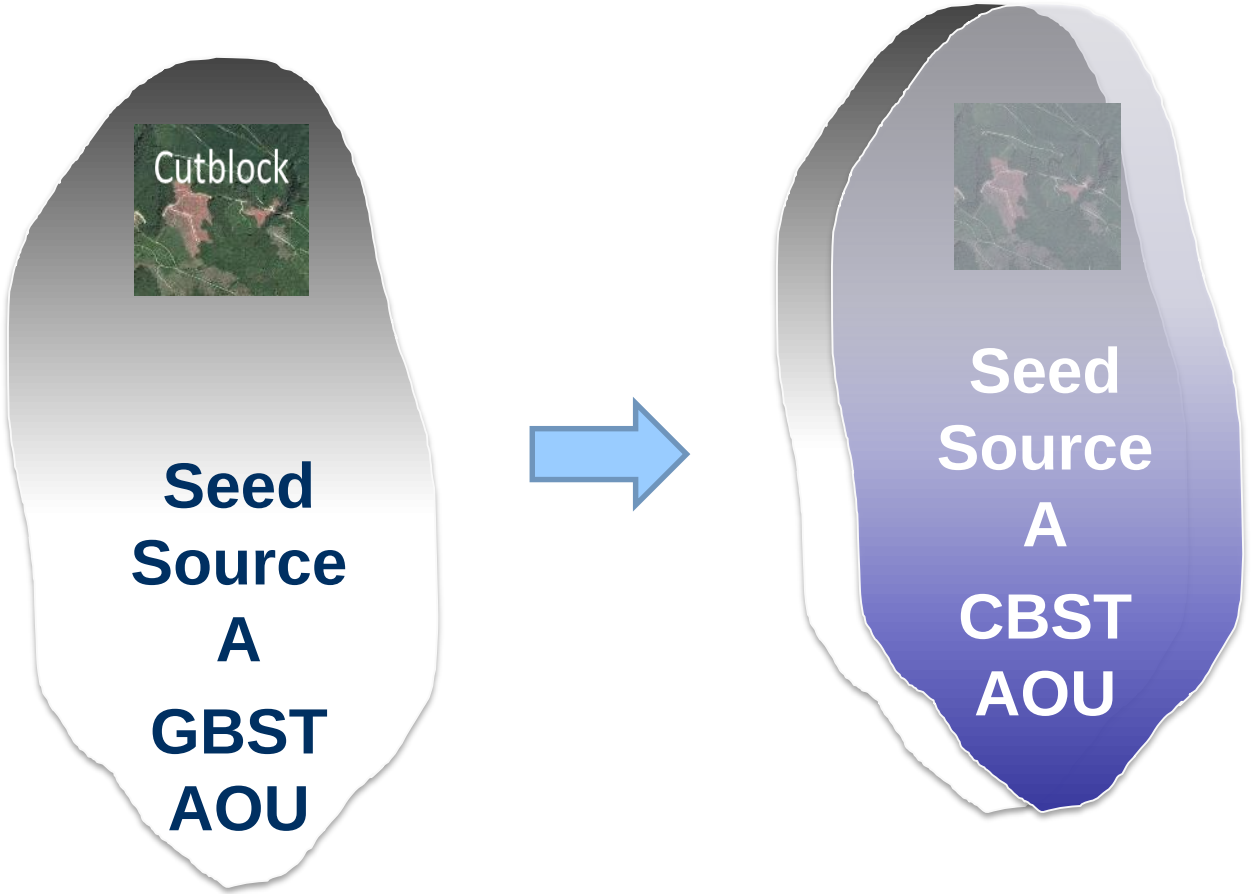
Plus

Opportunity

<u>New</u> (alternate) seed sources moving in

During Transition: GBST with optional use of CBST

Scenario 1: Low impact under CBST

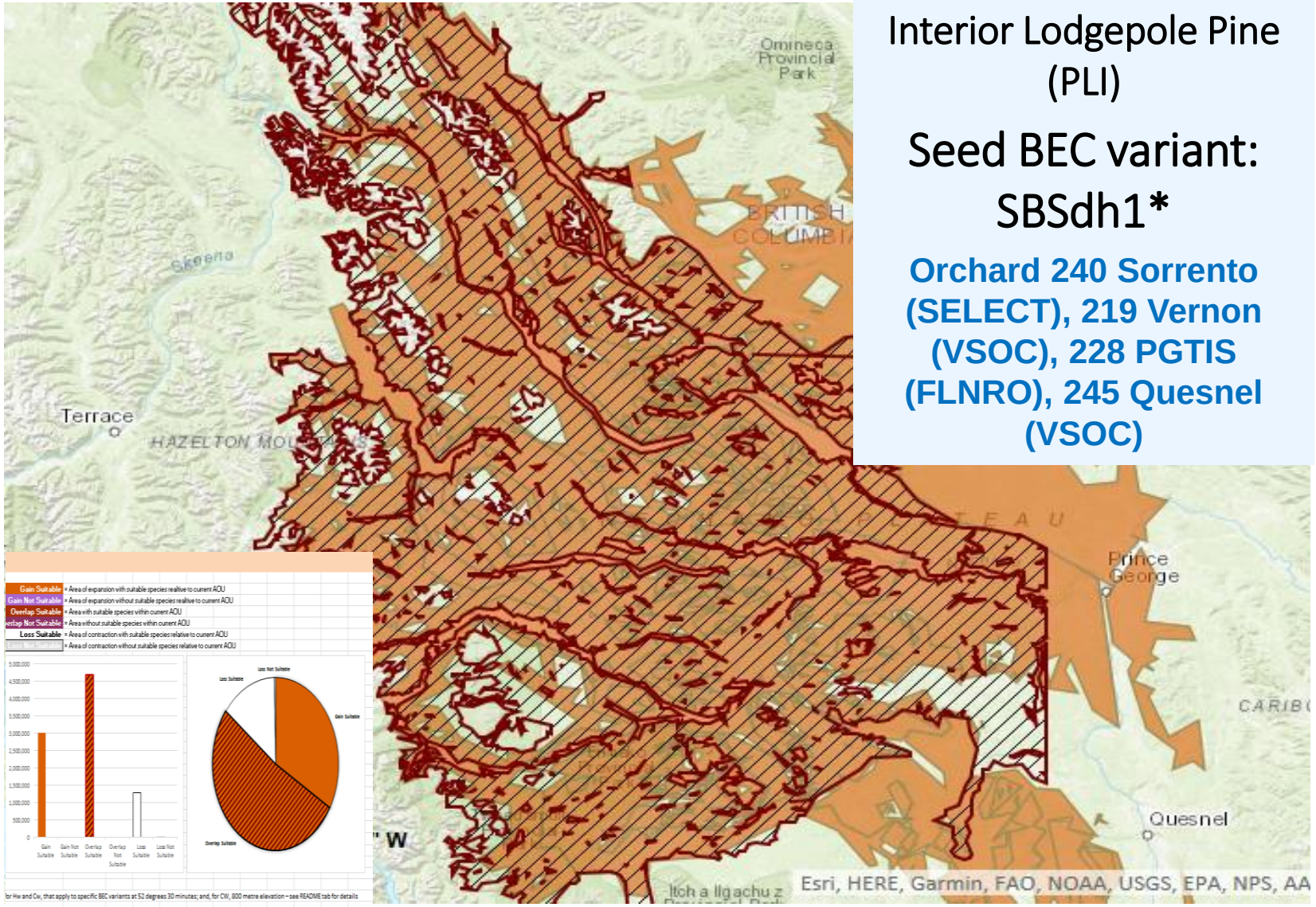


Seed Source A deployed (transfer) under GBST and CBST

Impact: Low

large 'area of overlap' (hectares) in seed use.

Scenario 1: Low Impact under CBST



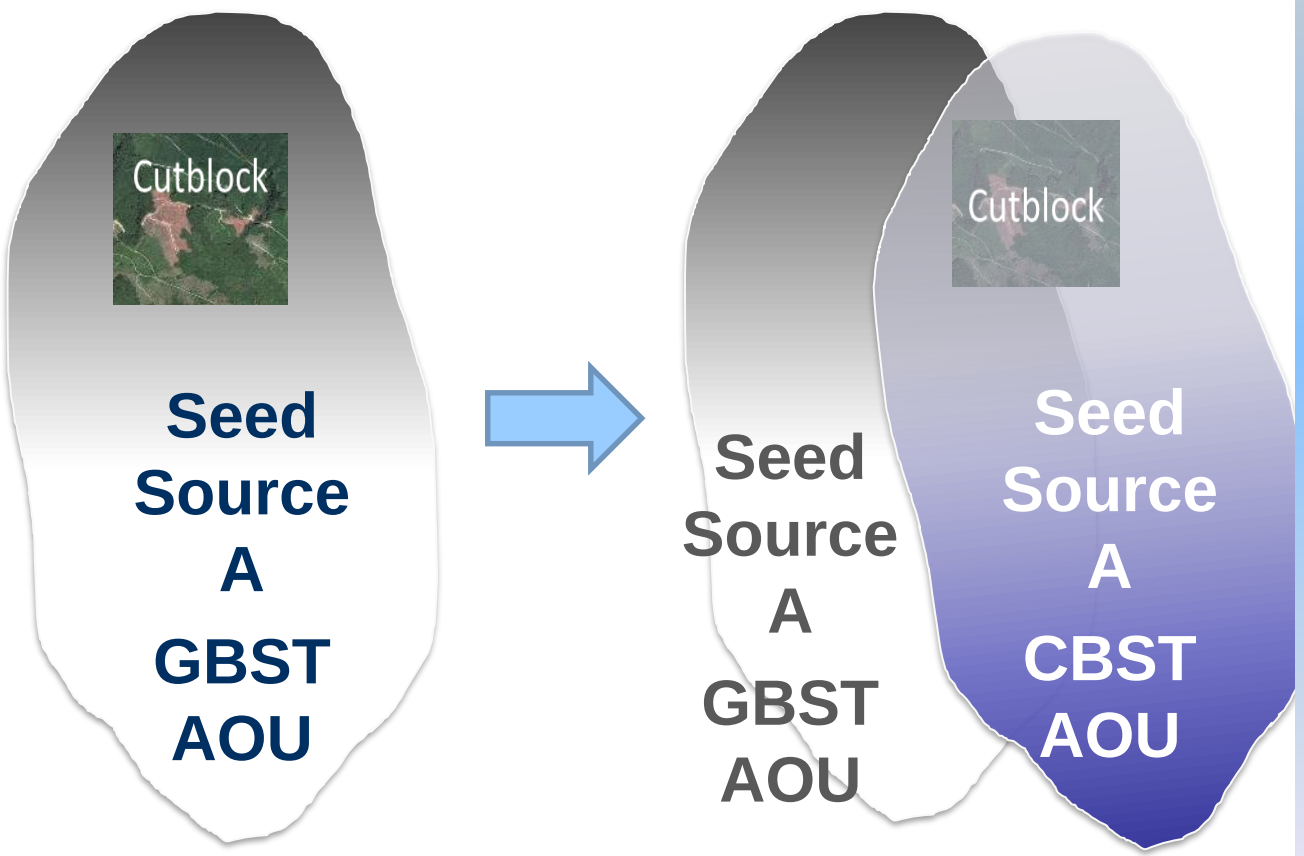
Interior Lodgepole Pine (PLI)

Seed BEC variant: SBSdh1*

Orchard 240 Sorrento (SELECT), 219 Vernon (VSOC), 228 PGTIS (FLNRO), 245 Quesnel (VSOC)

During Transition: GBST with optional use of CBST

Scenario 2: Moderate impact under CBST



Seed Source A deployed (transfer) under GBST and CBST

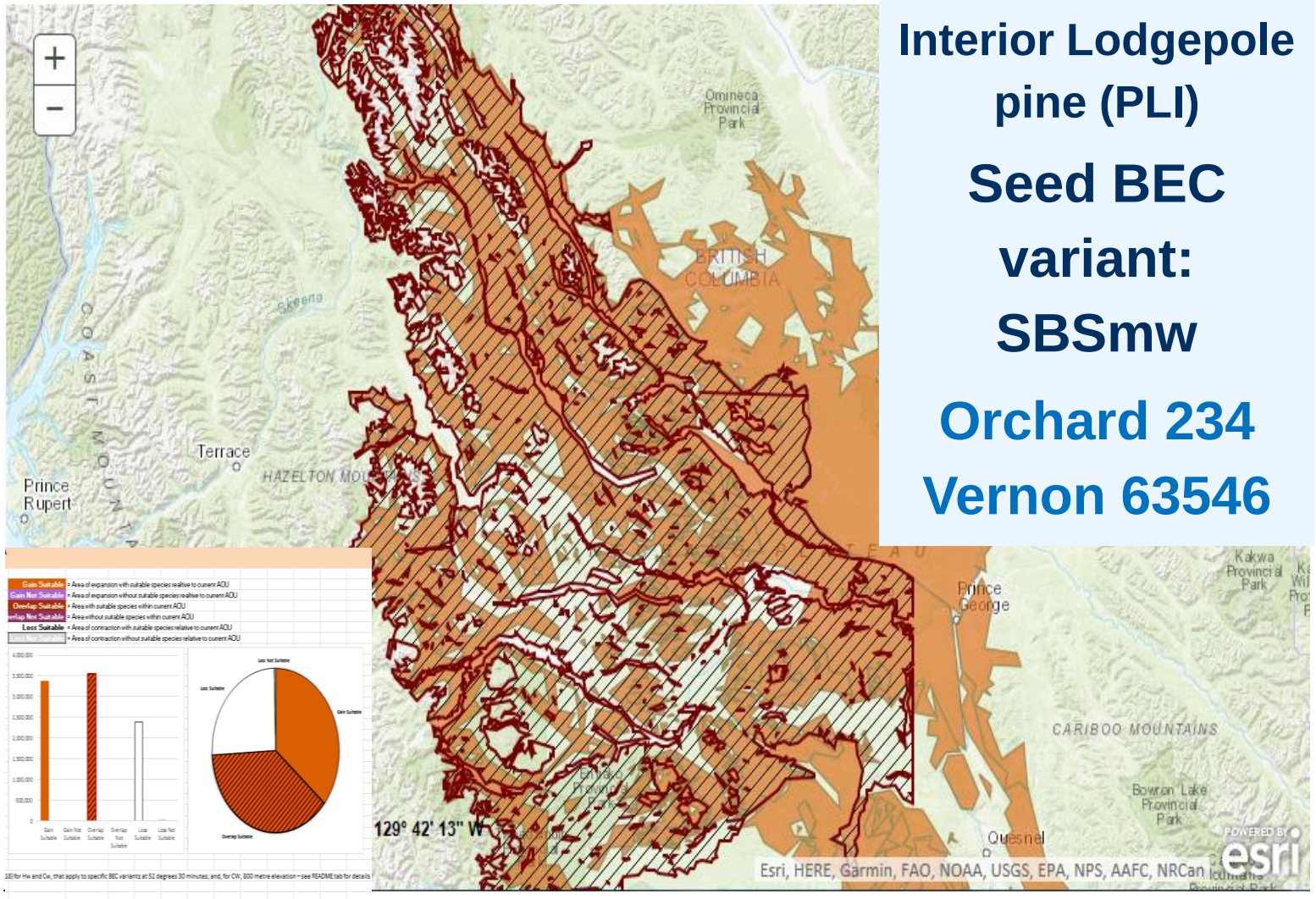
Percentage of hectares impacted:

GBST AOU: 34%-67%

CBST AOU*: 50-100%

*** Gain plus overlap = reduction / expansion in area under CBST.**

Scenario 2: Moderate Impact under CBST

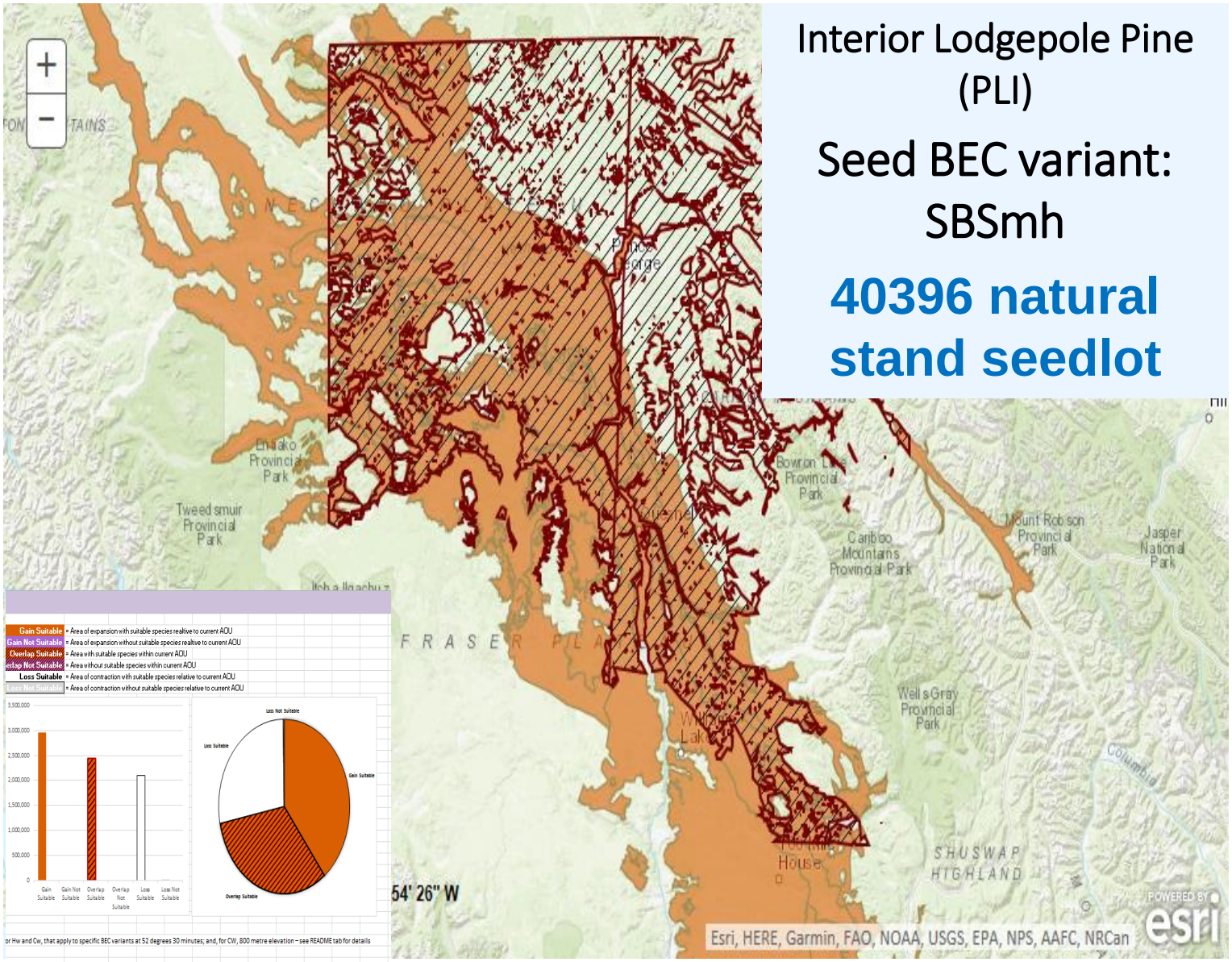


Interior Lodgepole pine (PLI)

Seed BEC variant: SBSmw

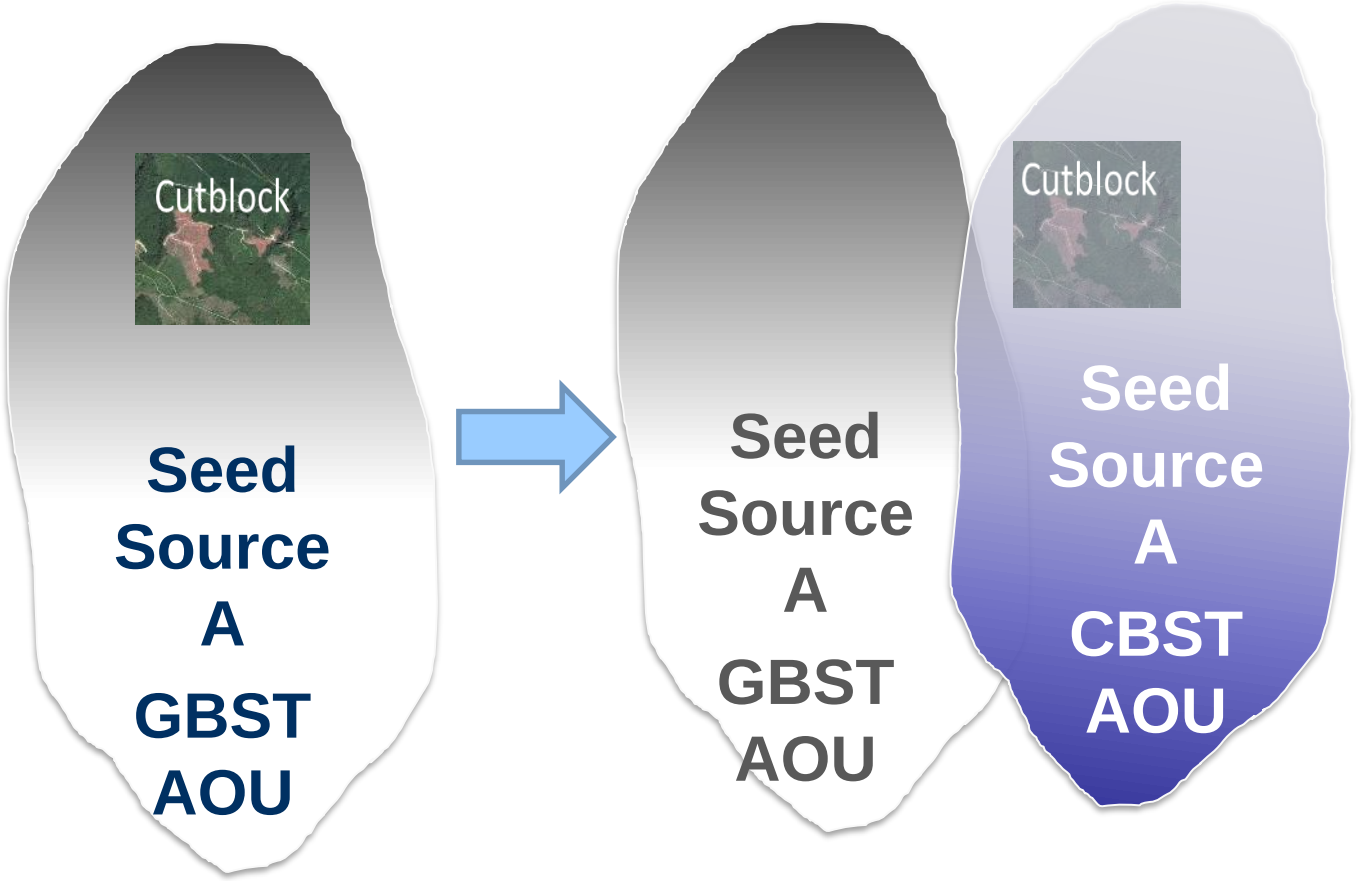
Orchard 234 Vernon 63546

Scenario 2: Moderate Impact under CBST



During Transition: GBST with optional use of

Scenario 3: High impact under CBST



Seed Source A available under GBST and CBST.

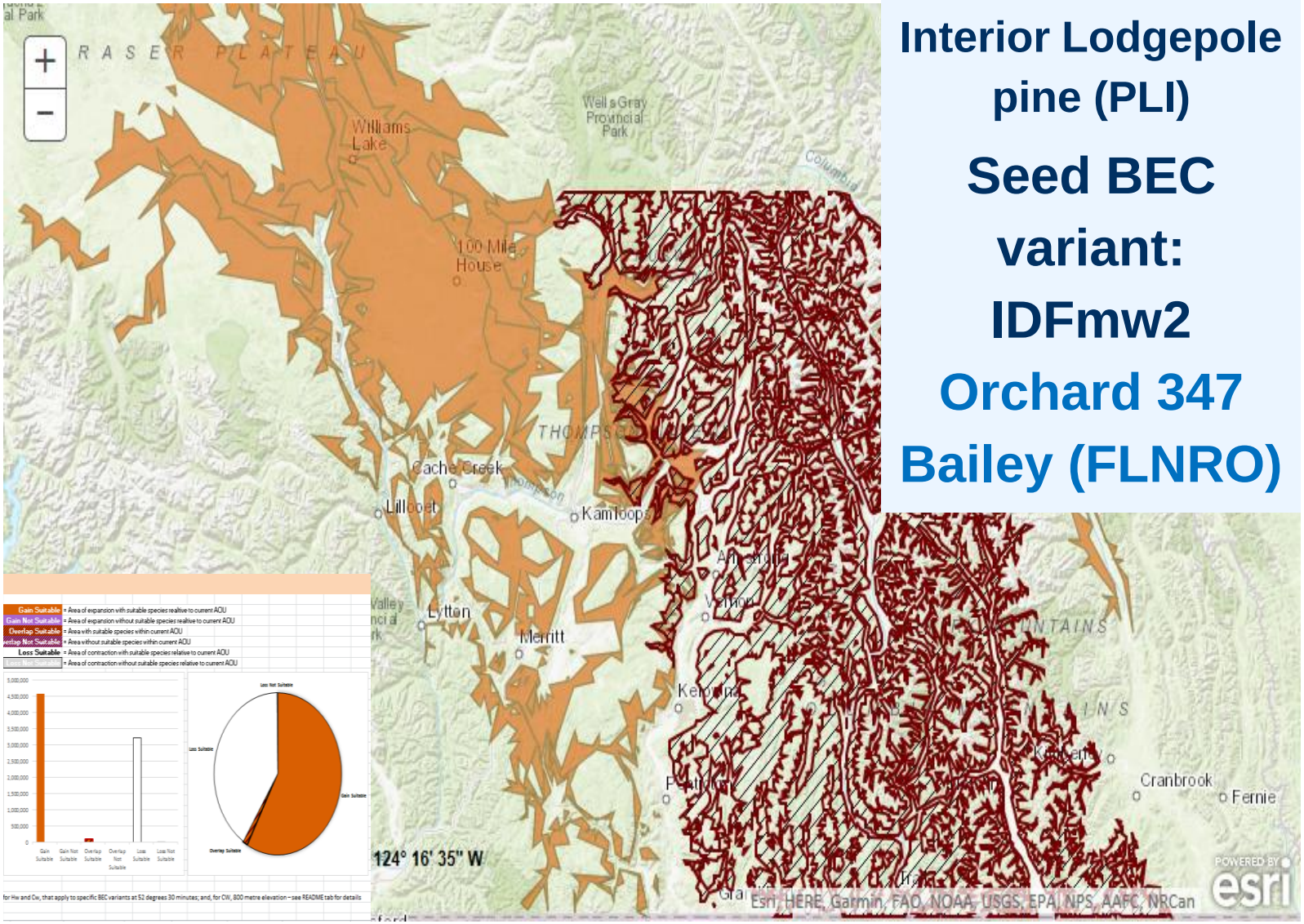
Minimal 'area of overlap' between GBST AOU and CBST AOU.

GBST AOU: 34%-67%

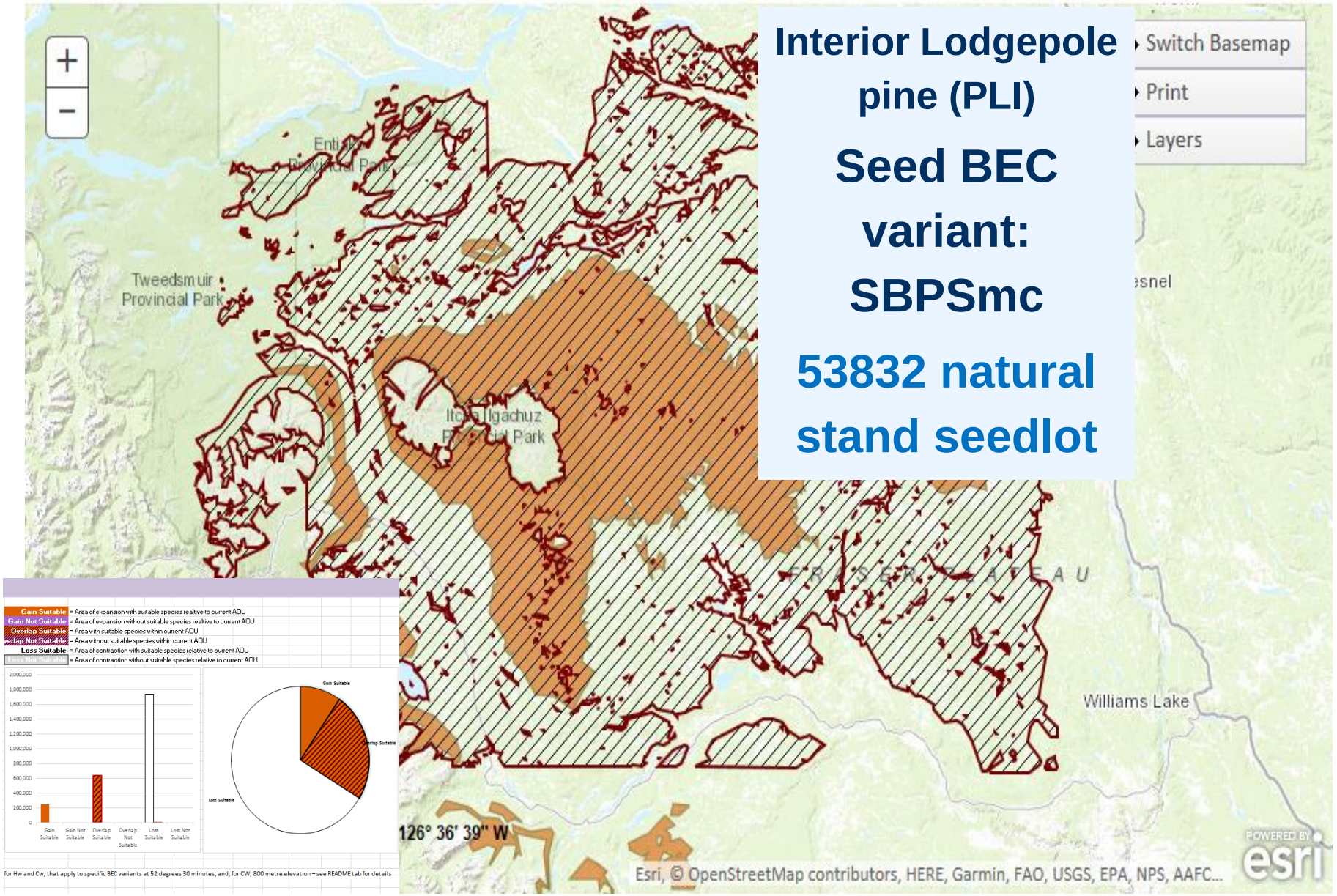
CBST AOU*: 50-100%

*** Gain plus overlap = reduction / expansion in area under CBST.**

Scenario 3: High Impact under CBST



Scenario 3: High Impact under CBST

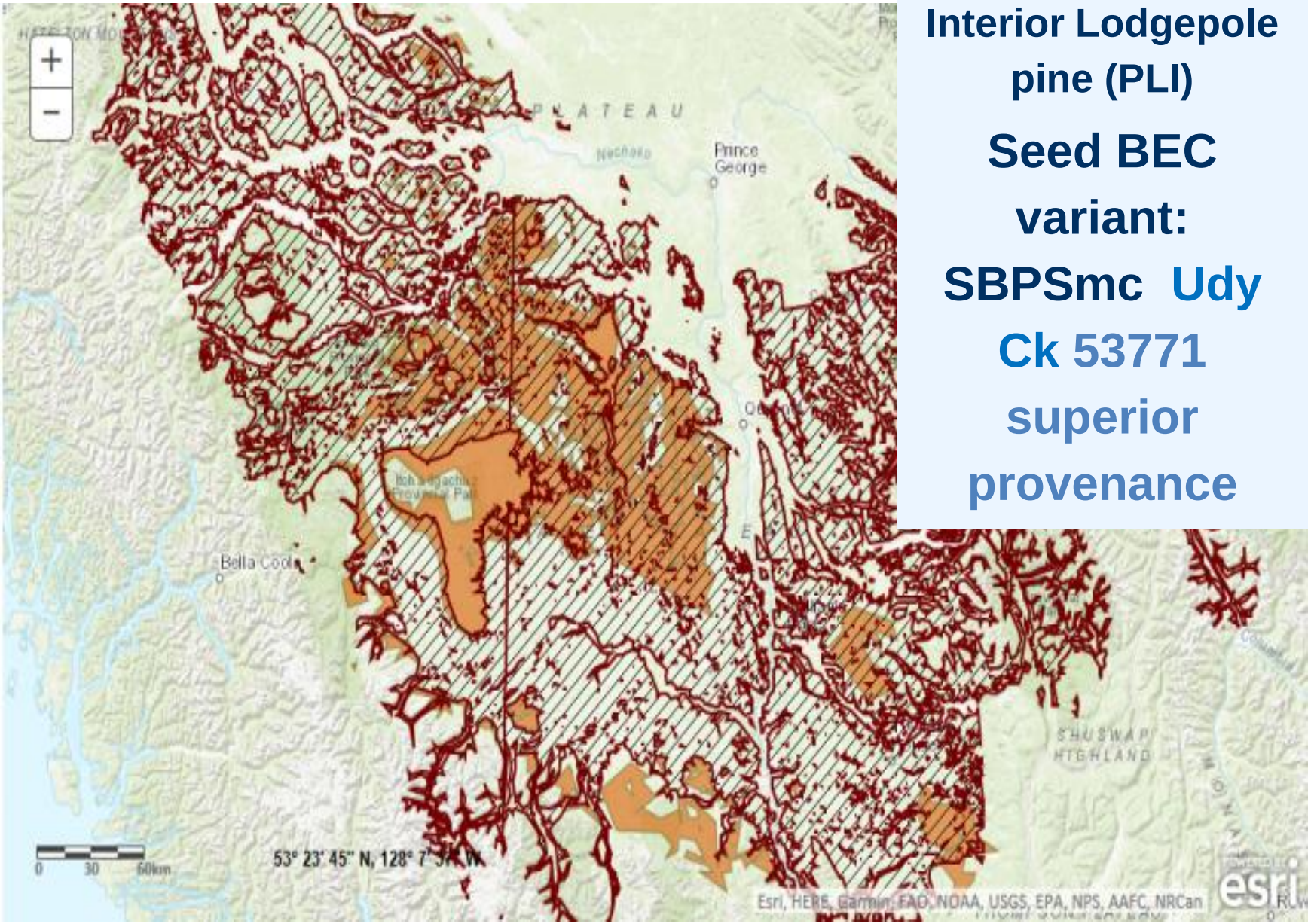


Interior Lodgepole pine (PLI)

Seed BEC variant: SBPSmc

53832 natural stand seedlot

Scenario 3: <u>High</u> Impact under CBST



Interior Lodgepole pine (PLI)

Seed BEC variant: SBPSmc Udy Ck 53771 superior provenance

GAP ANALYSIS TOOLS

- Seed Surpluses and Deficits

CBST Impact and Gap Assessment

Seed Supply/Demand workbook - Planting History [RESULTS, 5.8 year average (2013-2017]

Planting History (5.8 year annual average)

Version 5.0	Not-Suitable	Suitable	Total
Planted =	429,434	4,625,567	5,055,000
	8%	92%	Deploy BEC →

Management_Unit: Arrowsmith TSA, Fraser TSA, GBR North TSA, GBR South TSA, Kalum TSA, Kingcome TSA, Mid Coast TSA, North Coast TSA

Species: CW, DR, FDC, FDI, HW, LW, PLI, PW

Class: A, B, B+

GVO: 6_19, ge_20, le_5

	2,983	0	2,983
	22,562	414,249	436,811
	17,021	0	17,021
	414	80,548	80,962
	269	8,584	8,853
	11,901	0	11,901
	3,972	893,648	897,621
	0	306,313	306,313
	0	1,805	1,805
	12,649	2,193,843	2,206,492
	35,192	599,946	635,138
	0	126,631	126,631
	0	0	0
	28	0	28
	74,092	0	74,092
	248,351	0	248,351

Not-Suitable	65,934	24,895	338,605	
Stuitable	264,905	160,832	4,199,829	
Source BEC↓↓↓	330,839	185,727	4,538,434	

Sum of Planted_tot	Column Labels			
Row Labels	CW_CWHvh1-A C\	CW_CWHvh3-A C\	CW_CWHvm1-A C\	Grand Total
CDFmm	19		2,964	2,983
CWHdm	22,562		414,249	436,811
CWHds1	4,669		12,352	17,021
CWHmm1	414		80,548	80,962
CWHmm2	269		8,584	8,853
CWHms1			11,901	11,901
CWHvh1	129,804	3,972	763,844	897,621
CWHvh2	7,398	32,397	266,518	306,313
CWHvh3	0	1,805	0	1,805
CWHvm1	127,703	12,649	2,066,140	2,206,492
CWHvm2	26,919	8,273	599,946	635,138
CWHwh1	0	126,631		126,631
CWHwh2		0	0	0
CWHws2			28	28
CWHxm1	4,299		69,793	74,092
CWHxm2	6,783		241,568	248,351
Grand Total	330,839	185,727	4,538,434	5,055,000

INSTRUCTIONS | README | Planting History | Inventory (Plant) | Inventory (Area) | Inventory (Plant & Area) | I&For

CBST Impact and Gap Assessment

Seed Supply/Demand workbook – Inventory (Plant & Area) [Seed allocation area-weighted across BEC variants]

Inventory distributed based on the proportion of trees planted historically by Management Unit then distributed by deployment BEC area within that M

Version 5.0

Total In Inventory =	**40,974,000**	Source BEC↓↓↓	9,318,200	1,152,300	30,503,500

Deploy BEC →

Inventory*P*A	Sum of Inventory*P*A / Row Labels	CW_CWHvh1-A C	CW_CWHvh3-A C	CW_CWHvm1-A C	Grand Total
0	CDFmm	0		0	0
4,248,925	CWHdm	0		4,248,925	4,248,925
0	CWHds1	0		0	0
1,046,823	CWHmm1	0		1,046,823	1,046,823
956,591	CWHmm2	0		956,591	956,591
0	CWHms1			0	0
3,074,475	CWHvh1	928,348	0	2,146,128	3,074,475
2,296,344	CWHvh2	418,802	904,068	973,475	2,296,344
866,376	CWHvh3	123,549	110,828	631,998	866,376
19,911,889	CWHvm1	7,704,194	0	12,207,694	19,911,889
8,050,569	CWHvm2	0	0	8,050,569	8,050,569
261,182	CWHwh1	143,307	117,875		261,182
260,827	CWHwh2		19,530	241,297	260,827
0	CWHws2			0	0
0	CWHxm1	0		0	0
0	CWHxm2	0		0	0
	Grand Total	**9,318,200**	**1,152,300**	**30,503,500**	**40,974,000**

Management_Unit: Arrowsmith TSA, Fraser TSA, GBR North TSA, GBR South TSA, Kalum TSA, Kingcome TSA, Mid Coast TSA, North Coast TSA

Species: BA, CW, DR, FDC, FDI, HW, LW, PLI

Class: A, B

GVO: 6_19, ge_20

INSTRUCTIONS | README | Planting History | Inventory (Plant) | Inventory (Area) | Inventory (Plant & Area) | I&For

CBST Impact and Gap Assessment

Seed Supply/Demand workbook – Surplus Deficit (Plant & Area)

[Remaining after seed allocation]

Version 5.0				Not-Suitable	-65,934	-24,895	-338,605	
				Stuitable	9,053,295	991,468	26,303,671	
Total Surplus/Deficit =	-429,434	36,348,433	35,919,000	Source BEC↓↓↓	8,987,361	966,573	25,965,066	
			Deploy BEC →	Sum of Difference I*P*A	Column Labels			
	Not-Suitable	Suitable	Surplus/Deficit	Row Labels	CW_CWHvh1-A C\	CW_CWHvh3-A C\	CW_CWHvm1-A C	Grand Total
	-2,983		-2,983	CDFmm	-19		-2,964	-2,983
	-22,562	3,834,676	3,812,114	CWHdm	-22,562		3,834,676	3,812,114
	-17,021		-17,021	CWHds1	-4,669		-12,352	-17,021
	-414	966,275	965,861	CWHmm1	-414		966,275	965,861
	-269	948,008	947,739	CWHmm2	-269		948,008	947,739
	-11,901		-11,901	CWHms1			-11,901	-11,901
	-3,972	2,180,827	2,176,855	CWHvh1	798,544	-3,972	1,382,283	2,176,855
		1,990,031	1,990,031	CWHvh2	411,404	871,671	706,957	1,990,031
		864,570	864,570	CWHvh3	123,549	109,022	631,998	864,570
	-12,649	17,718,045	17,705,396	CWHvm1	7,576,491	-12,649	10,141,554	17,705,396
	-35,192	7,450,623	7,415,431	CWHvm2	-26,919	-8,273	7,450,623	7,415,431
		134,551	134,551	CWHwh1	143,307	-8,756		134,551
		260,827	260,827	CWHwh2		19,530	241,297	260,827
	-28		-28	CWHws2			-28	-28
	-74,092		-74,092	CWHxm1	-4,299		-69,793	-74,092
	-248,351		-248,351	CWHxm2	-6,783		-241,568	-248,351
				Grand Total	8,987,361	966,573	25,965,066	35,919,000

Management_Unit: Arrowsmith TSA, Fraser TSA, GBR North TSA, GBR South TSA, Kalum TSA, Kingcome TSA, Mid Coast TSA, North Coast TSA

Species: CW, DR, FDC, FDI, HW, LW, PLI, PW

Class: A, B, B+

GVO: 6_19, ge_20, le_5

Inventory (Area) | Inventory (Plant & Area) | I&Forcast (Plant & Area) | Surplus Deficit (Plant) | Surplus Deficit (Area) | **Surplus Deficit (Plant & Area)** | Surp-Def Forcast(Plant & Area)

CBST Impact Assessment and Gap Analysis - Species Summaries

- Part A – List of Orchard Seed Sources for the species
- Part B – Impacts compared to GBST
- Part C – Gaps – orphans, deficits and surpluses
- Part D – DRAFT Species Specific Mitigation Options

- Eg. Interior Lodgepole Pine Summary

Part A

PLI Orchard Seed sources:

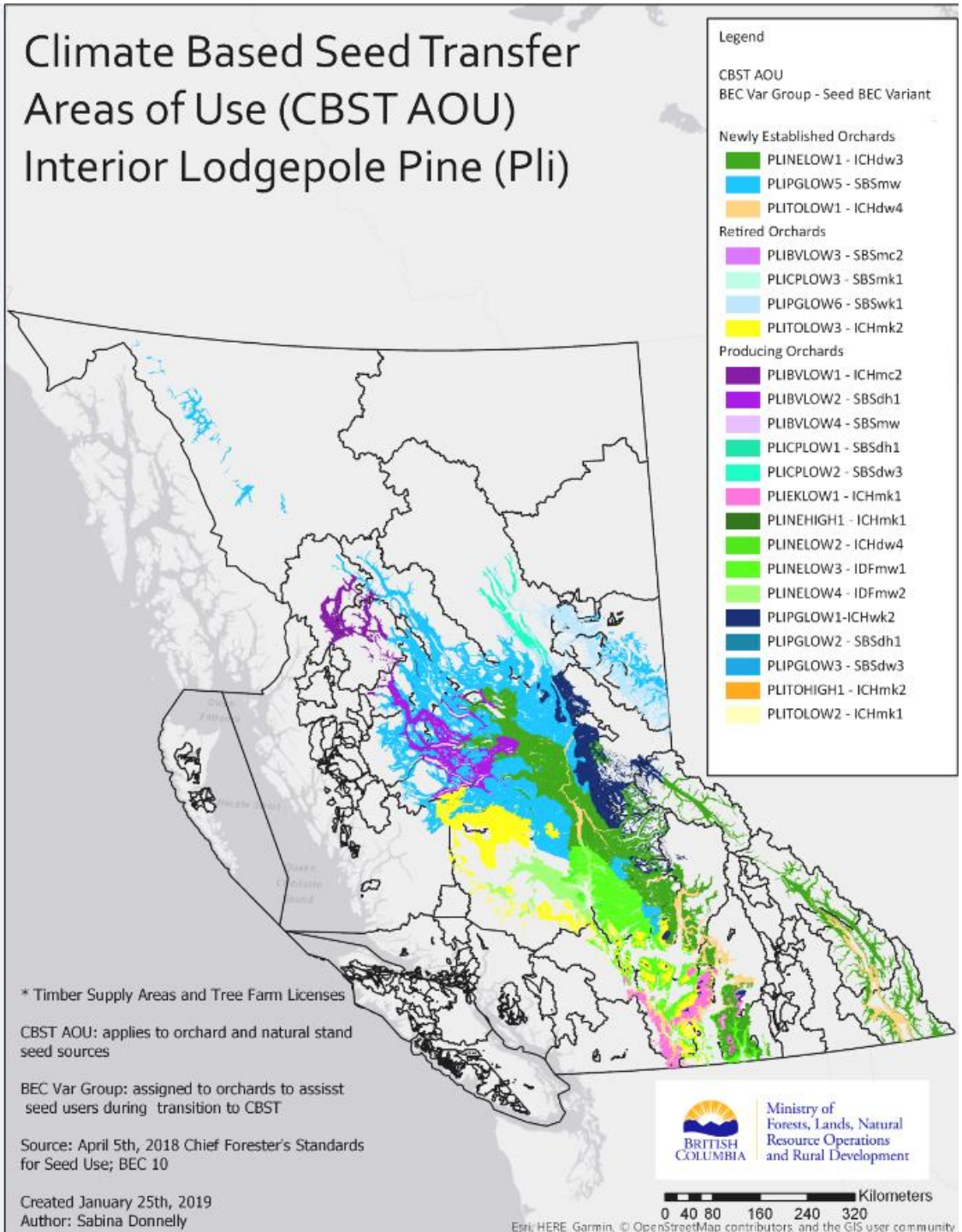
Sorted by:

Seed BEC Variant

[assigned under CBST]

There are 11 Seed BEC Variants assigned to PLI orchard seed sources.

Seed BEC Variant (assigned under CBST)	**BECvar Group** (link to GBST for transition purposes)	**Orchards**
ICHdw3	PLINELOW1	307 Kalamalka (FLNRO)
ICHdw4	PLINELOW2	337 GRANDVIEW (PRT)
	PLITOLOW1	350 Skimikin (FLNRO)
ICHmc2	PLIBVLOW1	230 Kalamalka (FLNRO)
ICHmk1	PLIEKLOW1	340 Bailey (FLNRO)
	PLINEHIGH1	349 Skimikin (FLNRO)
	PLITOLOW2	338 Kettle River (KRSO), 311 Grandview (PRT)
ICHmk2	PLITOHIGH1	339 Eagle Rock (TOLKO) 308 Grandview (PRT) [PLITOLOW]
ICHwk2	PLIPGLOW1	237 Kettle River (KRSO)
IDFmw1	PLINELOW3	313 Grandview (PRT)
IDFmw2	PLINELOW4	347 Bailey (FLNRO)
SBSdh1	PLIBVLOW2	240 Sorrento (SELECTSD), 219 Vernon (VSOC), 228 PGTIS (FLNRO), 245 Quesnel (VSOC)
	PLICPLOW1	238 Kettle River (KRSO)
	PLIPGLOW2	220 PGTIS (FLNRO)
SBSdw3	PLICPLOW2	241 Sorrento (SELECTSD), 218 Vernon (VSOC)
	PLIPGLOW3	352 Skimikin (FLNRO) [rust resistant]
SBSmw	PLIBVLOW4	234 Vernon (VSOC)
	PLIPGLOW5	244 Quesnel (VSOC), 236 Vernon (VSOC), 222 Vernon (VSOC)

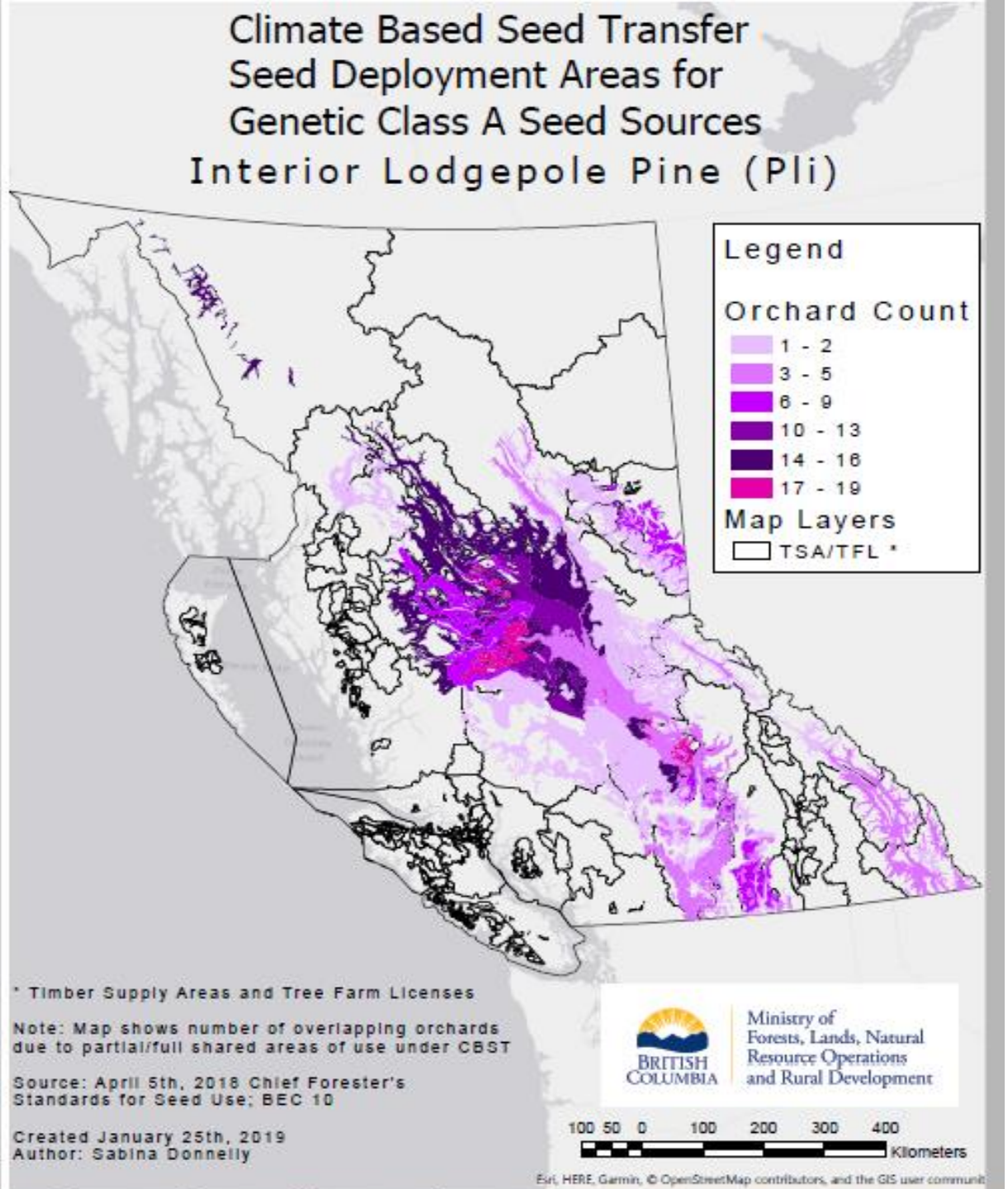


Climate Based Seed Transfer Areas of Use (CBST AOU)

Interior Lodgepole Pine (PLI)

BECvar Group

link to GBST and FGC species plans for transition purposes



CBST Seed Deployment Areas

Interior Lodgepole Pine (PLI)

Orchard Count

PLI CBST Areas of Use [number of orchards]

Part B – IMPACTS Relative to GBST

- The area of use (AOU) for Pli orchard seed under GBST (hectares)
  - is **reduced by 66%** under CBST
  - balanced by a **gain** in new area of **81%**
  - **33%** of the area **overlaps** (unchanged)
  - Provincially, the new CBST Area of Use is **114% of the GBST area of use for Pli.**

Part B – IMPACTS Relative to GBST

- Orchards assigned to the SBSdw3 (PLIPGLOW3 and PLICPLOW2) and IDFmw2 (PLINELOW4) are the hardest hit by a loss (67-100%) in deployment area
- Orchards assigned to the ICHmk1, IDFmw2, ICHdw3, ICHmk2, and SBSdh1 have the largest expansion in deployment area

NB: Orchards assigned to the IDFmw2 have both a significant loss and significant expansion (moving into new areas), and a minimal area of overlap (3%)

Part C – Gaps - Deficits

Seed Deficits under CBST

Genetic Class	Annual Planting	Seed Deficit	Seed Deficit / Annual Planting	CBST Suitable Seed Sources	CBST Non Suit Seed Sources	Plantation BEC Variants with Deficits CBST Suitable Seed Sources	Plantation BEC Variants with Deficits CBST Non-Suitable Seed Sources
	Pot'l trees	*Pot'l trees*	*%*	*%*	*%*		
Class A	31,033,413	-10,254,832	33	20	80	SBSmc2	SBSmc2, SBSwk1, MSdm2, IDFdk1, SBSdk
Class B and B+	62,166,326	-2,515,446	4	0	100	none	BWBSmw, BWBSmk, BWBSwk2
Class A, B and B+	93,199,739	-3,058,185	3	**0**	100	none	BWBSmw, BWBSmk, BWBSwk2, ESSFdk1, ICHdw1

Seed Deficit Class A: 10.3M 33% of historical annual planting (PLI)

[1] These PLANTATION BEC variants represent approximately 80% or more of the total seed deficit

Part C – Gaps - Surpluses

Seed Surpluses under CBST

Genetic Class	Annual Planting	Seed Surplus	Seed Surplus / Annual Planting	Plantation BEC Variants representing the **largest** net surplus seed inventories
	Pot'l trees	*Pot'l trees*	*%*	
Class A	31,033,413	13,713,987	44	SBSdw3, SBSmc1, SBSdw1, SBSdw2
Class B and B+	62,166,326	2,424,978,974	3901	ESSFmv1, SBSmc2, SBSmc3, MSxv
Class A, B and B+	93,199,739	2,545,001,261	2731	ESSFmv1, SBSmc2, SBSmc3, MSxv

[1] These PLANTATION BEC variants represent approximately 80% or more of the total seed surplus

Seed Surplus Class A: 13.7M

44% of historical annual planting (PLI)

Part C – Gaps - Orphans

Orphans under CBST

CBST Orphan	BEC variant(s) identified as a CBST Orphan	CBST Orphan without a
Seed Source (seedlot)	BWBSdk, BWBSmk, BWBSmw, BWBSwk2, ESSFmv1, ESSFmv3, ESSFmvp, ICHmw, MSdk2, SBSmk2, SBSwk3	seed deployment area
Plantation (cutblock)	BWBSmk, BWBSmw, BWBSwk2, BWBSwk3, CDFmm, CWHws1, ICHdw1, ICHmc2, ICHmw4, ICHvk1, ICHwc, ICHxw, PPxh3, SBSmk	seed procurement area

- Most of the Plantation BEC variant orphans can be removed by lowering genetic suitability by one unit (except for red underlined BECvars).
- This is currently being reviewed by the geneticists and if acceptable will be incorporated into the Standards in April 2019.

Pli Specific Mitigation Options

- Use GBST to meet seed deficits during transition
- With number of MUs impacted by CBST buying and selling seed will be needed to realign to CBST
- Explore seed sources from Alberta to address BWBSmk and BWBS wk2 deficits
- Consider alternate species in NE BC

General Mitigation Options

- Extend transition period
- Consider development of seed optimization tools
- Ongoing CBST Alternative process, post transition period
- New Seed Orchard design and establishment

Future CBST Implementation

- Implementation of selected Mitigation Options
- End to the transition period
- Coordination with the Climate Informed Species Selection (CISS) Tool, led by RPB.
- Monitoring and evaluation


KEEP
CALM
AND
CARRY
ON

www.gov.bc.ca/climatebasedseedtransfer

Forest Improvement and Research Management Branch

Policy and Planning Section

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