Updating the Seed Planning and Registration System (SPAR) framework for Genetic Worth:

New Traits and New Acronyms!

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Background

- ‘Genetic gain’ is the percentage increase in a certain trait of trees grown from select (or Class A) seed, over Class B seed.
- Genetic gain of a seed lot is expressed as “Genetic Worth” or “GW”
- The GW of each seedlot is recorded in the Seed Planning and Registry System (SPAR).
- Until now, SPAR has included GW scores (for orchard seed lots) for volume growth, wood density, and selected disease and pest resistance, i.e. for disease and pests… ‘GW-R’ scores
  - white pine blister rust resistance
  - Sitka spruce weevil resistance
  - lodgepole pine, for western gall resistance and comandra blister rust.
- But ‘GW-R’ values on SPAR weren’t that ‘user friendly’

Challenges up to now (and ongoing…)

- Identifying pathogens (i.e., a new pathogen in Cwr),
- Finding the right test environment for screening,
- Identifying what to screen for (mechanisms of resistance),
- Setting a ‘benchmark’ for wild stand seed,

With climate change, we are seeing more pests and diseases

FIRM and FGC want to better report on progress with pest and disease resistance improvement

Why change GW traits, codes and scores now?

- More trials are being infected (good, and bad)
- We have some 1) advanced analytical methods, and 2) better inoculation techniques, so that we can better score damage and mortality
- Our aim, with the change to GW codes and scores is to create:
  - a framework for expanding traits under improvement
  - a scoring system for disease and pests resistance that is more consistent across species and traits, and perhaps reflective of final stand performance.

The new codes

- All traits will have a **three letter acronym**
- The first letter denoting whether GW is related to:
  - Growth (G)
  - animal damage (A)
  - wood properties (W)
  - Insect resistance, damage or mortality (I)
  - disease resistance, damage or mortality (D).
- The second and third letters denote the actual trait that was measured and selected (see upcoming Table)
- For disease and insect resistance the Provincial Forest Health acronyms have been adopted

The new scores

- All GW scores will be positive, to reflect the overall improvement (for disease and pests)
  - Reduction of damage or mortality is expressed as "% of trees not damaged or dead "
  - At a particular reference point (10-20 years)
  - The usual benchmark for wild-stand seed is 50% damage/mortality
  - (NCSU Tree Improvement Coop uses this too!) - so 100% is good (almost too good!), and 50% is what we get doing nothing! (IN GENERAL, ACROSS THE LANDSCAPE)
- E.g., lodgepole pine and gall rust resistance
  - DSG 69% indicates the seedlot has increased resistance to western gall rust of 19% over wild-stand seed - i.e., 19% added to the benchmark resistance of 50%, gives the total of 69%

Retired GW Code	New GW Code	Trait	Species associated with codes (June 2018)	Score
R	**AD**	Deer browse	**Cw**	Percent of crown retention, based on lack of deer browsing (50-100%)
-	**DFS**	dothistroma needle blight	**Pli**	Percent of crown retention (50-100%)
-	**DFU**	Cedar leaf blight	**Cw**	Percent of crown retention (50-100%)
-	**DFW**	Swiss needle cast	**Fdc**	Percent crown retention (50-100%)
R/M	**DSB**	White pine blister rust	**Pw**	Percent of trees not dead by 10-20 years (50-100%)
R	**DSC**	Comandra blister rust	**Pli**	Percent of trees not dead by 10-20 years (50-100%)
R	**DSG**	Western gall rust	**Pli**	Percentage of trees without stems galls (50-100%)
G	**GVO**	volume growth	**Cw, Dr, Fdc, Fdi, Hw, Lw, Pli, Sx, Yc**	% volume growth, at rotation (m3 over wild stand seed) (>5%+)
R	**IWS**	White pine terminal weevil	**Ss, Sx**	% of trees free from weevil attack (30-100% in Ss; 50-100% in Sx)

Screen shot of SPAR –Sitka spruce

· Application Home

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Result Pages: **1** 2 3 [Next]

Potential Trees displayed in thousands; Seedlot Quantity is displayed in grams; Vegetative Lot Quantity is displayed in thousands of cuttings. **203** rows returned

Lot No.	SPZ	Genetic Class	Genetic Worth	Germ %	Species	Agency	Mean Elev.	BEC	Orchard / Location	Coll. Year	Potential Trees	Quantity	
63006	M*	A	IWS+87	98	SS	ISTIM 00	101	CWHxm1	195 - YELLOW POINT	2008	99.8	517	Details
63007	M*	A	IWS+87	96	SS	YPPROP 00	106	CWHxm1	195 - YELLOW POINT	2010	3	17	Details
63283	M*	A	IWS+87	95	SS	BCTS 00	120	CWHxm1	172 - SAANICHTON	2010	65	361	Details
63283	M*	A	IWS+87	95	SS	WFP 11	120	CWHxm1	172 - SAANICHTON	2010	2096.1	11641	Details
63210	M*	A	IWS+87	93	SS	BCTS 00	77	CWHxm1	172 - SAANICHTON	2009	266.3	1706	Details
40438	GL*	B+	IWS+64	98	SS	BCTS 00	75	CDFmm	Big Qualicum	1993	33	169	Details
40438	GL*	B+	IWS+64	98	SS	WFP 11	75	CDFmm	Big Qualicum	1993	223.7	1146	Details
45004	GL*	B+	IWS+64	94	SS	TWFC 04	25	CDFmm	Big Qualicum	1998	69	381	Details
40437	GL*	B+	IWS+64	86	SS	MOF 01	25	CDFmm	Big Qualicum	1993	.2	2	Details
40437	GL*	B+	IWS+64	86	SS	TWFC 04	25	CDFmm	Big Qualicum	1993	2.2	17	Details
63526	M*	A	GVO+06	96	SS	TAAN 00	81	CWHvh3	192 - WFP-QCI SO	2014	360.6	2200	Details
63526	M*	A	GVO+06	96	SS	WFP 11	81	CWHvh3	192 - WFP-QCI SO	2014	34.4	210	Details
06574	M*	A	GVO+02	98	SS	BCTS 00	95		142 - LOST LAKE	1988	885.7	4349	Details
06574	M*	A	GVO+02	98	SS	MOF 01	95		142 - LOST LAKE	1988	534.4	2624	Details
06769	M*	A	GVO+02	97	SS	HUSBY 00	95		142 - LOST LAKE	1989	80.7	418	Details
06769	M*	A	GVO+02	97	SS	MOF 01	95		142 - LOST LAKE	1989	577	2987	Details
06822	M*	A	GVO+02	97	SS	IFP 00	88		118 - NOOTKA	1990	557.3	2546	Details

For lodgepole

plication Home · He

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Lot No.	SPZ		Genetic Class / Worth	Germ %	Species	Agency	Mean Elev.	BEC	Orchard / Location	Coll. Year	Potential Trees	Quantity	
62412	PG*	A	DSG+69 GVO+05	98	PLI	BCTS 00	796	SBSdw 3	352 - SKIMIKIN	2016	7.5	61	Details
63682	PG*	A	DSG+69 GVO+05	98	PLI	BCTS 00	796	SBSdw 3	352 - SKIMIKIN	2016	42.2	325	Details
63682	PG*	A	DSG+69 GVO+05	98	PLI	MOF 28	796	SBSdw 3	352 - SKIMIKIN	2016	28.9	223	Details
63597	PG*	A	DSG+62 GVO+03	98	PLI	BCTS 00	804	SBSdw 3	352 - SKIMIKIN	2015	13.1	114	Details
63716	PG*	A	DSG+62 GVO+03	92	PLI	BCTS 00	776	SBSdw 3	352 - SKIMIKIN	2017	55.7	580	Details
63630	PG*	A	DSG+53 GVO+17	97	PLI	MOF 28	885	ICHw k2	237 - KETTLE RIVER	2016	2.4	17	Details
63732	PG*	A	DSG+53 GVO+17	96	PLI	WFM 10	882	ICHw k2	237 - KETTLE RIVER	2017	168.3	1532	Details
63549	CP*	A	GVO+21	96	PLI	MOF 27	835	SBSdw 3	241 - SORRENTO	2015	27.6	232	Details
63737	CP*	A	GVO+21	96	PLI	MOF 27	833	SBSdw 3	241 - SORRENTO	2017	38.3	305	Details
63733	CP*	A	GVO+21	94	PLI	LAKEML 00	829	SBSdh1	238 - KETTLE RIVER	2017	14.1	148	Details

Seedlot Number:	62412	**Registered:**	Yes - 2018-08-06 - Active
Species:	PLI - lodgepole pine		
Genetic Class/Worth	A DSG+69 GVO+05		
Collection Year:	2016		

Source Information

Orchard No:	352 - SKIMIKIN		
Tested Parent Trees:	Yes	**Heritage:**	Yes
BGC Zone/Subzone/Variant:	SBS dw 3	**BEC Version:**	10

Area of Use

Seed Planning Zone(s):	BVP CPP PG PGN	SeedMap
Elevation Range: Min-Max (m)	700 - 1400	
Latitude Range: Min-Max	No Limit	
Area of Use Comment:		

For Coastal Doug-fir

Lot No.	SPZ		Genetic Class / Worth	Germ %	Species	Agency	Mean Elev.	BEC	Orchard / Location	Coll. Year	Potential Trees	Quantity	
63721	M*	A	GVO+20 WWD-02	91	FDC	MISSIO 00	248	CWHdm	199 - SAANICH	2017	1.6	54	Details
63650	M*	A	GVO+19 WWD-02	96	FDC	MISSIO 00	288	CWHdm	199 - SAANICH	2016	.7	20	Details
63649	M*	A	GVO+18 WWD+04	98	FDC	MISSIO 00	337	CWHdm	199 - SAANICH	2016	1.1	25	Details
63611	M*	A	GVO+17 WWD-02	96	FDC	TWFC 04	208	CWHdm	197 - MT. NEWTON	2015	472.2	10571	Details
63648	M*	A	GVO+17 WWD-01	96	FDC	MISSIO 00	250	CWHdm	199 - SAANICH	2012	1.9	49	Details
63672	M*	A	GVO+17 WWD-01	96	FDC	WFP 11	257	CWHdm	405 - SAANICHTON	2016	453.2	10251	Details
63488	M*	A	GVO+16 WWD-01	97	FDC	PRCF 00	306	CWHdm	199 - SAANICH	2014	58	1365	Details
63688	M*	A	GVO+16 WWD-02	96	FDC	ISTIM 00	236	CWHdm	197 - MT. NEWTON	2016	169.9	3967	Details
63688	M*	A	GVO+16 WWD-02	96	FDC	TWFC 04	236	CWHdm	197 - MT. NEWTON	2016	1397.5	32630	Details
63610	SM	A	GVO+16	96	FDC	MOF 29	578	CWHms2	181 - SAANICH	2012	56.1	1370	Details

A potential new performance measure

- With a percentage value for all ‘resistance’ scores, we can:
  - Calculate the difference (in %) over wild-stand seed (with a global value of 50%) much like we do for GVO
- E.g.,
  - For Ss, with an IWS (spruce weevil) 87% (with a benchmark of 30%), we collect 57 ‘bonus points’ (%)
  - For Pl, for DSC (comandra) of 70%, we collect 20 bonus points

A potential new performance measure cont

Things to consider:

1. ‘Add up’ where we are right now
2. Not all species currently have pest issues
3. We’re working on a lot of pest/disease problems, but no analysis quite yet (with breeding values, etc)
4. Think about a target date (just like for GVO)
5. We can’t be over 100% for diseases/pest, and 85-90% should be our limit (like Ss)
6. Pest pressure will change, and new diseases emerge especially with climate change (moving target!)
7. New diseases/pests will come!!!

A potential new performance measure? cont

Currently:

- "Increase the use of seed with a genetic gain for pest resistance to 50% of select seed sown by 2035."

Maybe the FGC should consider a statement like:

- *"For species with significant pest and disease pressures, X% improvement over wild stand seed", by 20XX?*

As with anything developed new in the system, please report out anything that looks strange, or needs improvement!