

# Forest Genetics Council of BC: Seed Planning Structure

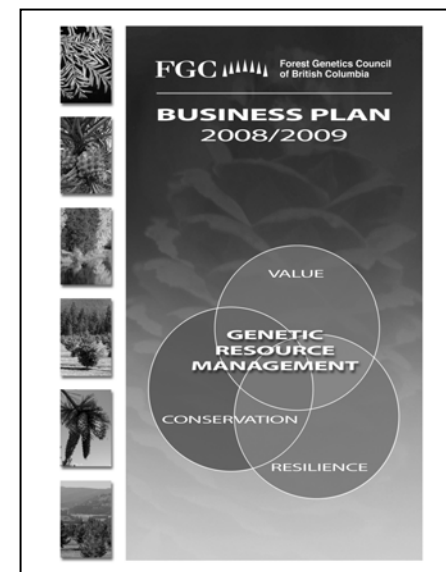
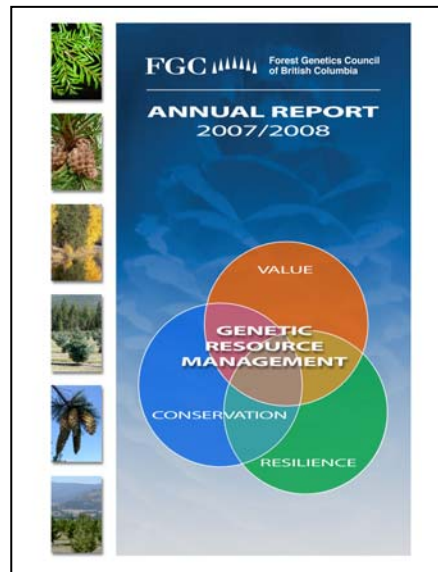
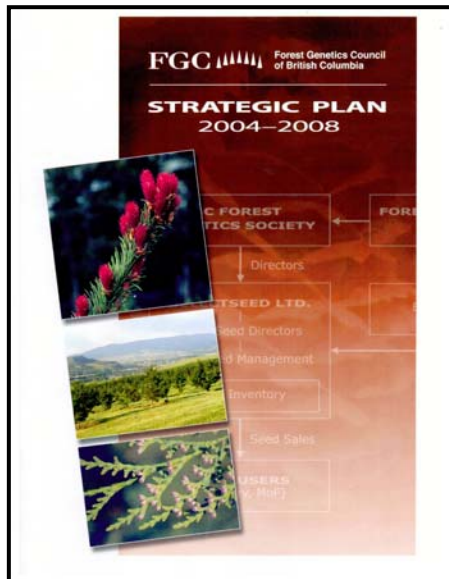
***Jack Woods***  
***Program Manager***  
***Forest Genetics Council***  
***of BC***



# Some words on the FGC

## ▲ Purpose

- ▲ Business planning for the FIA Forest Genetic Conservation and Management program
- ▲ Policy advice to the Provincial Chief Forester
- ▲ Cooperative planning for coordinated and efficient program delivery



## FGC Goal and objectives

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Lead the cooperative management of tree genetic resources in BC.....

- ▲ 75% select seed use by 2013
- ▲ Average GWg of 20 by 2020
- ▲ Support genetic conservation research and cataloguing
- ▲ Coordinate stakeholder activities and secure resources

## ▲ Membership:

- ▲ Industry (coast / interior – orchard owner / seed user)
- ▲ Ministry of Forests
- ▲ BC Timber Sales
- ▲ Canadian Forest Service
- ▲ Universities



**Predictions are difficult;  
especially about the future...**

*Niels Bohr*

# Ranking priorities

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- ▲ Definition: Seed Planning Unit (SPU)....a species / seed zone / elevation band combination where seed can be transferred without limitation
  - ▲ i.e. Spruce / Nelson seed zone / 1000 – 1500m
- ▲ Over 90 SPUs in the province
- ▲ Not all SPUs are equal with respect to expected return on investments
  - ▲ Fdc Maritime zone 0-700m – high value
  - ▲ BI Quesnel Lakes high elevation – low value

## Ranking priorities (con't.)

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- ▲ FGC ranks SPUs based on
  - ▲ Amount planted
  - ▲ Mean annual increment
  - ▲ Expected genetic gains
  - ▲ Rotation length
  - ▲ Timber-supply adjacency constraints
  
- ▲ Top-ranked SPUs receive investment for
  - ▲ Breeding programs
  - ▲ Seed orchards

## Top ranked Seed Planning Units

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- ▲ Douglas-fir maritime 0-700m
- ▲ Redcedar maritime 0-600m
- ▲ Spruce Nelson 1000-1500m
- ▲ Etc.....50 SPUs analyzed in FGC plans
  - ▲ 40 receive some level of breeding and seed orchard investment



## Provincial objectives break down to individual SPUs

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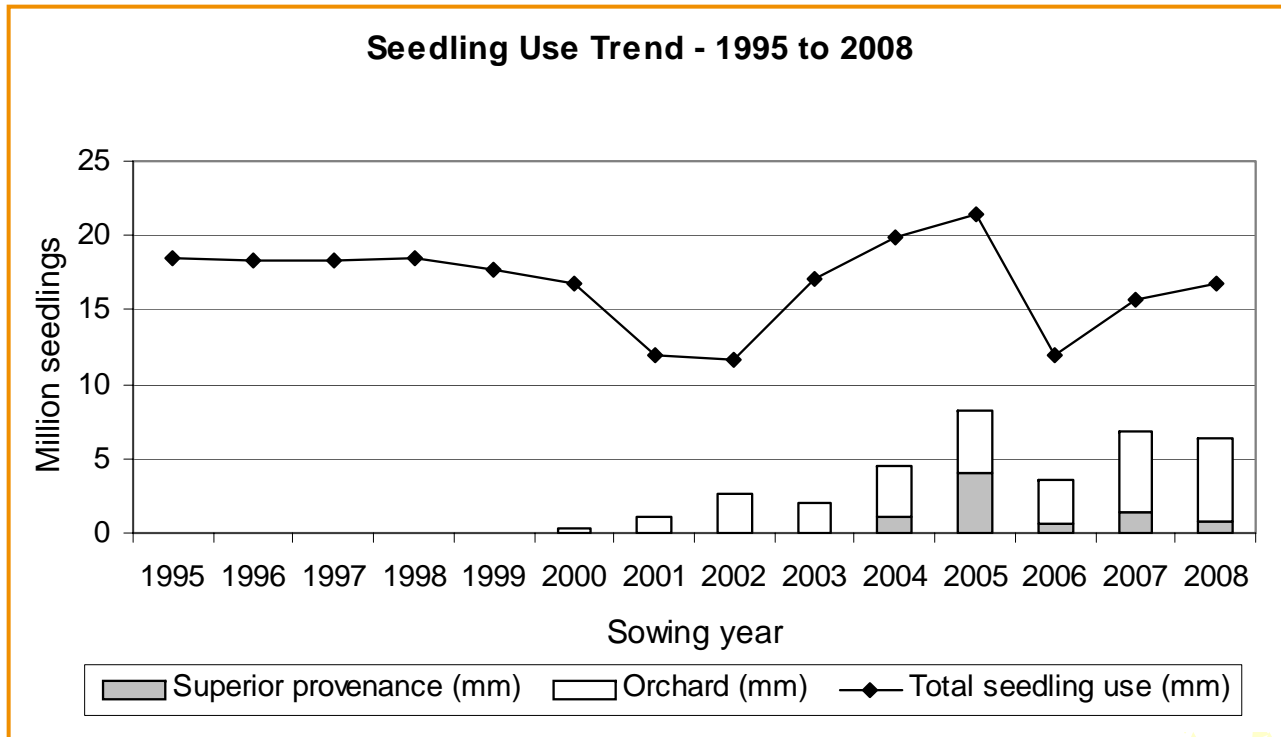
- ▲ For SPUs deemed worthy of breeding and seed orchard investments, the question is: **How much orchard capacity is needed to:**
  - ▲ Provide a secure supply of seed
  - ▲ Allow orchards to be upgraded and replaced
    - ▲ Example: how much orchard capacity is needed to supply Pli seed for the Bulkley Valley 700-1200m SPU?



# First part of the question.....

▲ How many seedlings are grown?

▲ Pli Bulkley Valley 700-1200m

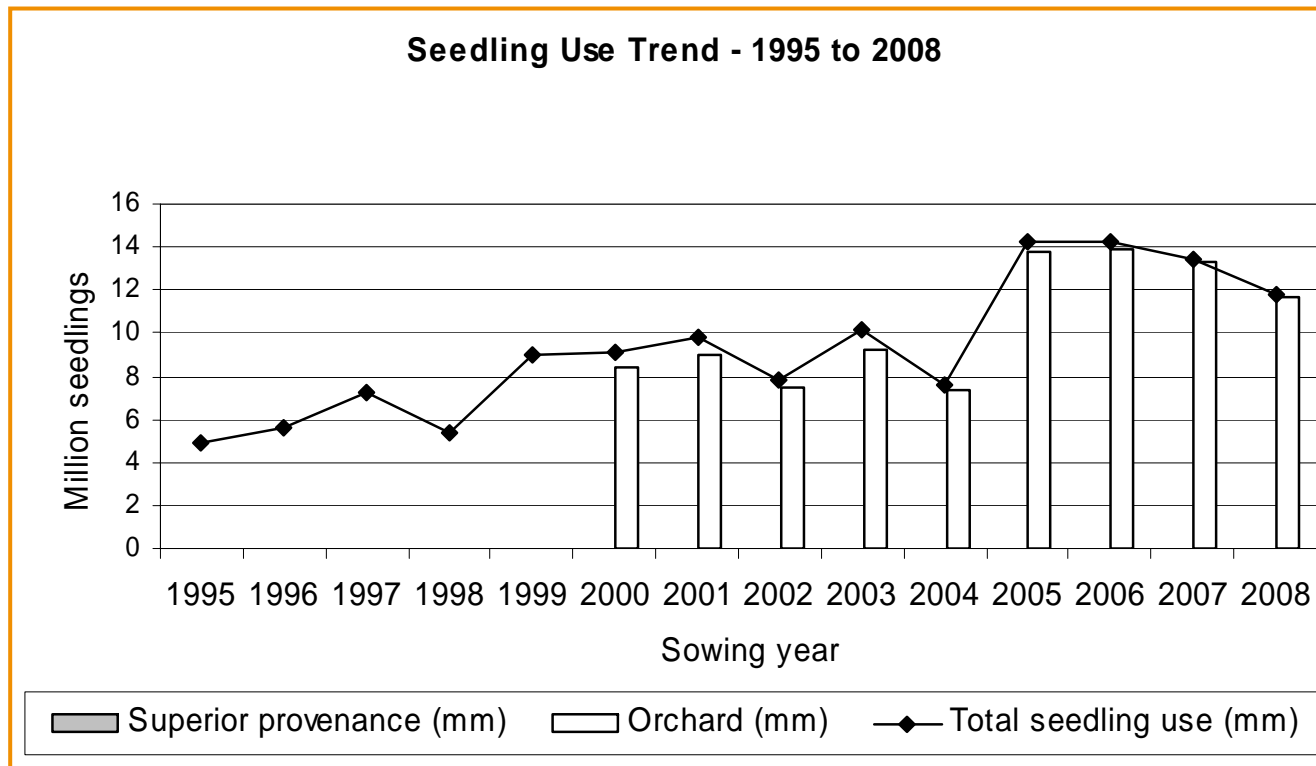


**5-year average  
= 17.2 million**

Data from SPAR

## Jack Woods:

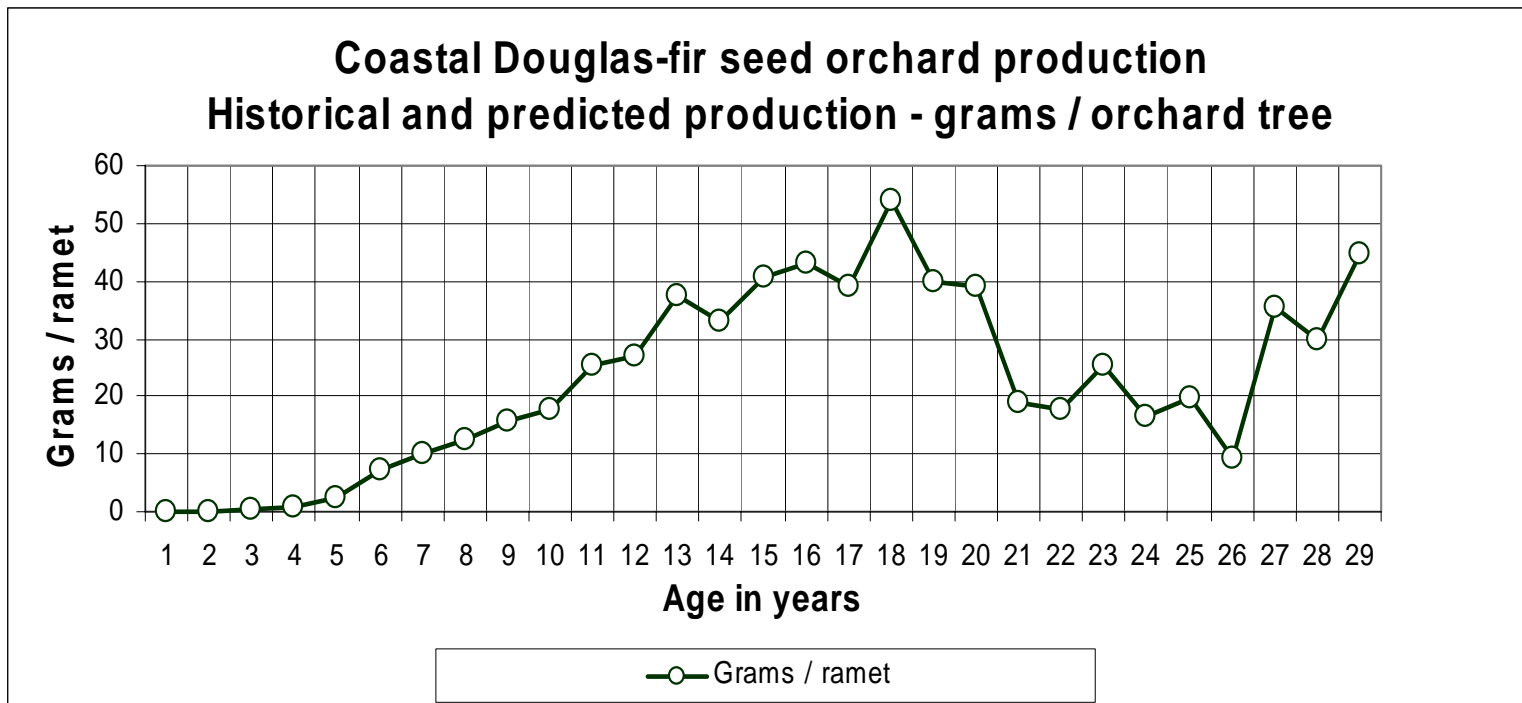
This type of map is developed from provenance test information



Data from SPAR

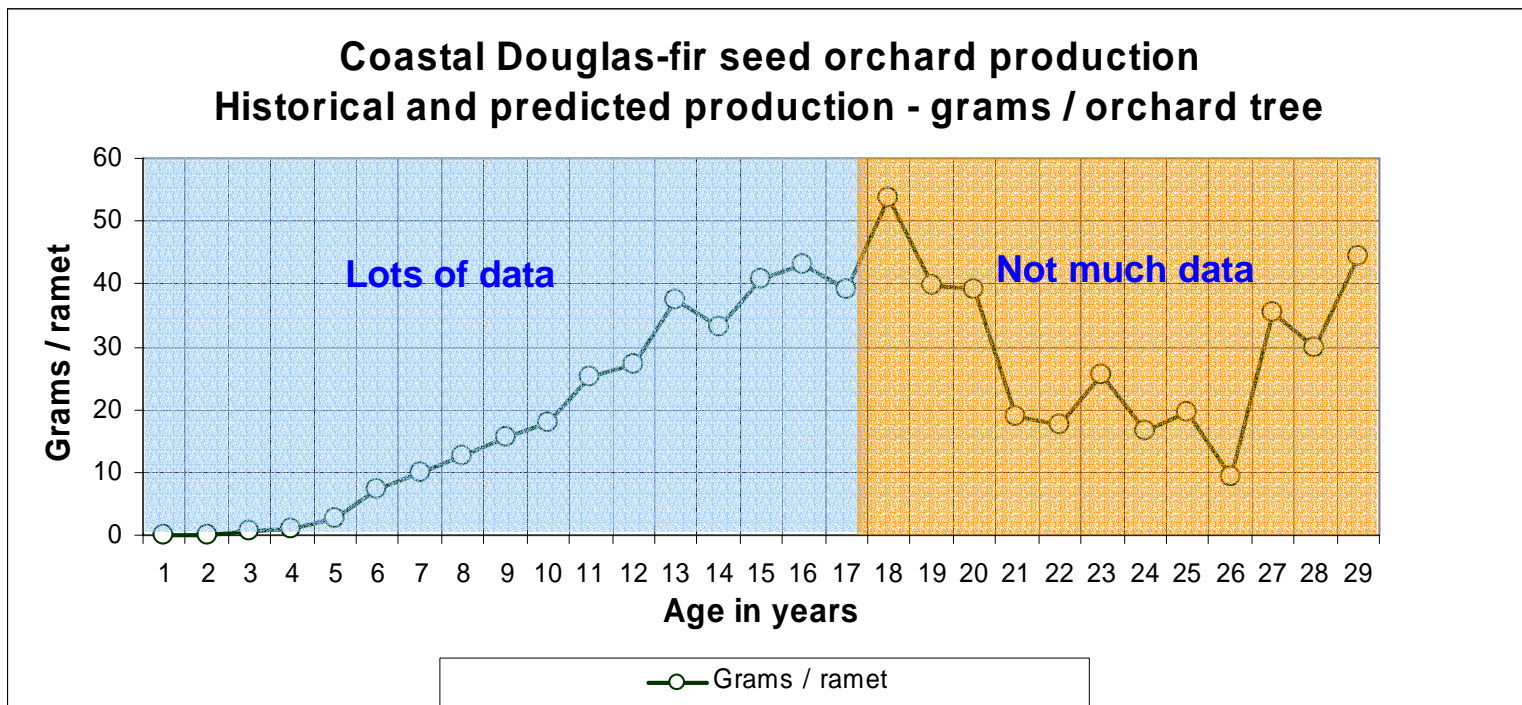
# Second part....how much seed does an orchard ramet produce?

- ▲ Highly variable by year and site
- ▲ Increases over the life of the ramet
- ▲ Orchard management inputs matter



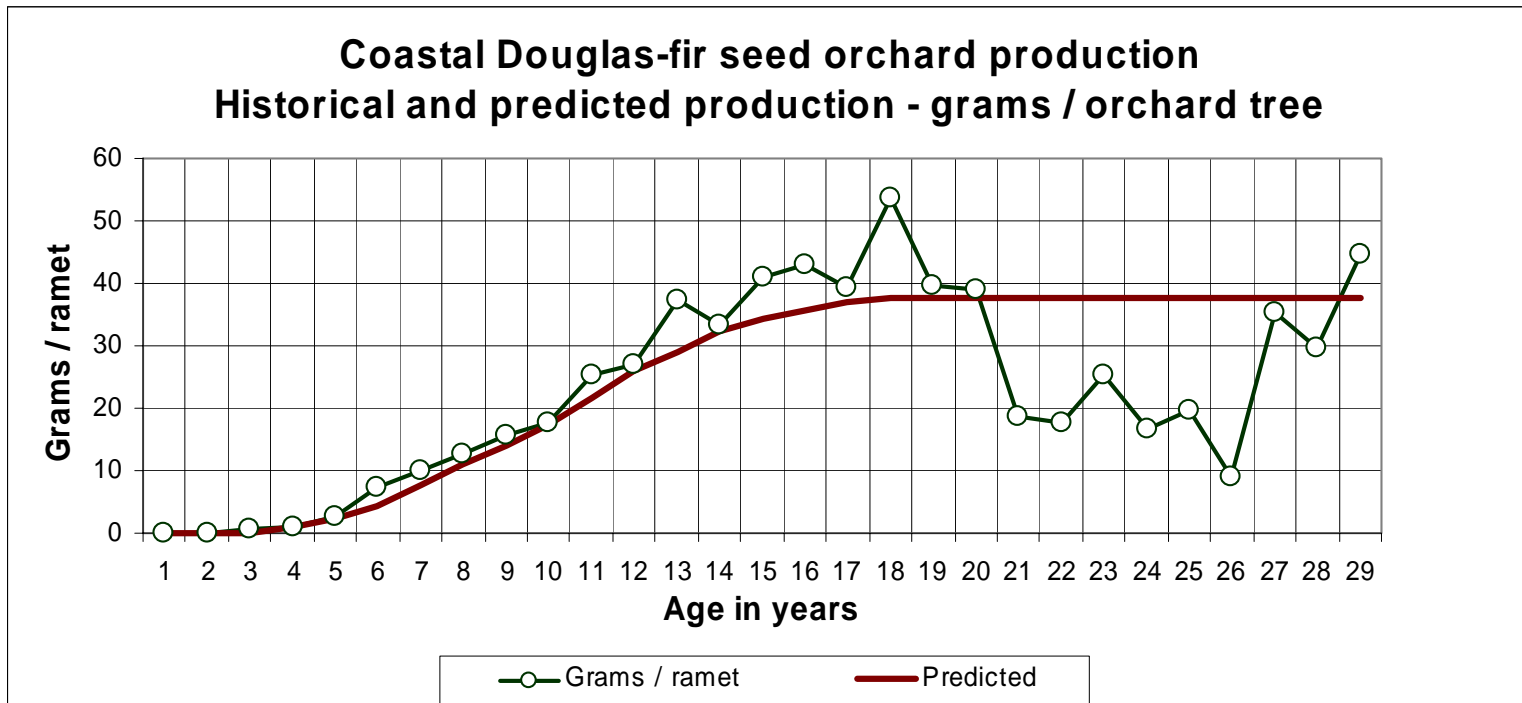
# Second part....how much seed does an orchard ramet produce?

- ▲ Data quality and amount vary by age and species



# Second part....how much seed does an orchard ramet produce?

- ▲ A best-guess smoothed production curve is applied



## Third part....what seedling recovery factor should be used?

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- ▲ Determine a seedling recovery factor to convert kg of seed to seedlings grown
- ▲ Recommended factor from the Tree Seed Centre is a good starting point, but...
  - ▲ With more expensive orchard seed, there is an ASSUMPTION that the seedling recovery will **increase**
  - ▲ Factors used for orchard planning are lower (fewer seeds per seedling) than TSC recommendations or general use



## Some seedling recovery factors used

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- ▲ Pli 1.25 seeds/seedling
- ▲ Fdc 1.79
- ▲ Fdi 1.79
- ▲ Sx 2.2
- ▲ Lw 2.0
- ▲ Pw 2.5
- ▲ Cwr 3.0

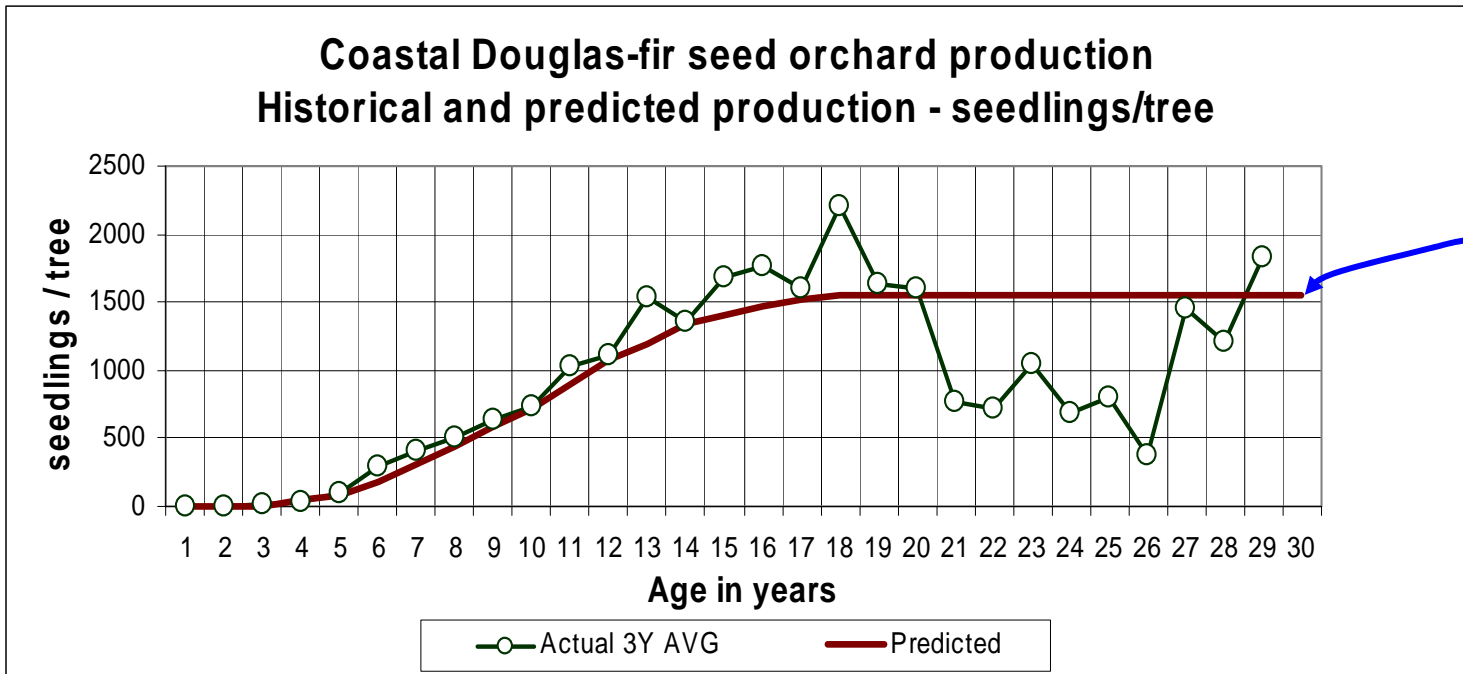




# Using the recovery factor, the curve is changed to seedlings / ramet

- ▲ A mature-ramet production level is applied for orchard-size planning

*1550 seedlings per orchard tree per year*



## Put it together to estimate needed orchard capacity

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- ▲ Example for Fdc Maritime zone 0-700m
- ▲ Calculate the number of ramets of orchard capacity needed to meet demand

12.3 million average annual demand /  
1550 seedlings worth of seed per year =

7909 ramets of orchard capacity

## This assumes everything works and orchards are always mature....

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- ▲ Therefore, another factor is needed, as
  - ▲ Orchards are young and don't produce at capacity for a long time
  - ▲ Orchards need to be changed to incorporate new parent trees from breeding programs that offer higher gain
  - ▲ Stuff happens....like trees dying, pests, wind, etc.



## How big should the “orchard expansion factor” be?

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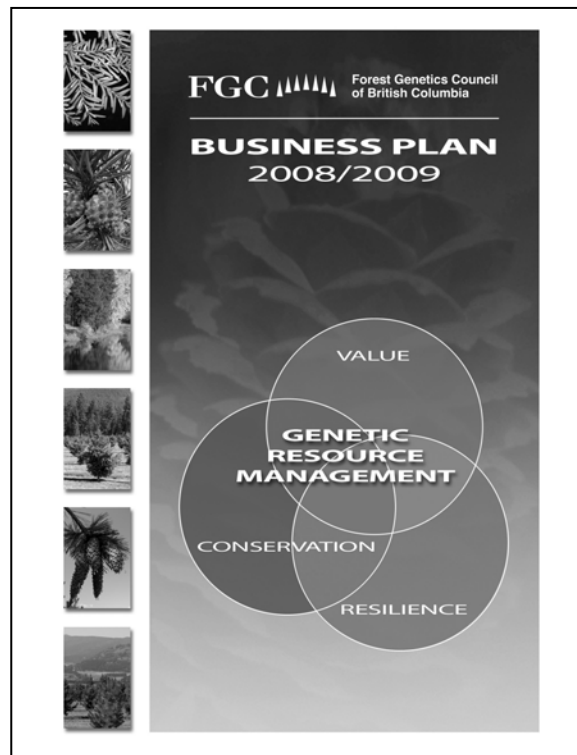


- ▲ Species vary in seed production reliability
- ▲ Factors used in FGC Species Plans
  - ▲ Sx 1.25
  - ▲ All other species 1.3
- ▲ This means that target orchard capacity is 1.3 times the number of ramets needed to meet demand at full ramet production

# Species plans provide information

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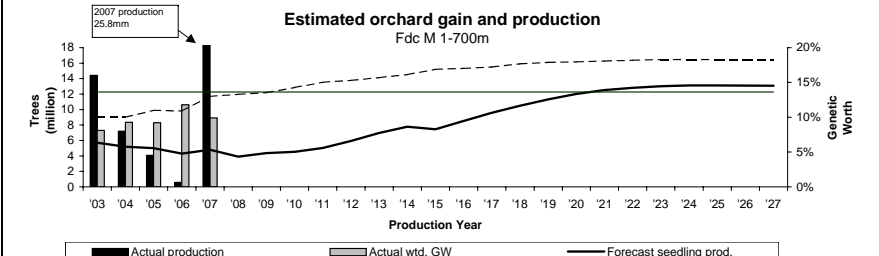
- ▲ Information helps with communication among orchard managers, breeders and seed users





# Useful information in species plans

SPU # 1	Douglas-fir	Maritime	1 - 700m																		
Breeding and Orchard Production																					
Program category: <b>Advanced-generation</b>		Seedling need (million): <b>12.3</b> * Includes Georgia Lowlands (GL) filename: 01FdcM low June 27/08																			
STRATEGY: Full-sib F1 diallel tests planted 1975 to 1985; OP tests 1986 and 1987; F2 design using small sublines with forward selections from all F1 test series; currently over 1/2 established. Focus on stem volume while maintaining stem form and wood density. Upgrade orchards as information and selections allow.																					
TRAITS		Primary: Stem volume	Secondary: Wood density, stem form																		
TESTING AND PRODUCTION: Production Year (July 1 to June 30) - (Cone harvest year shown)																					
	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	'23	'24	'25	'26	'27	
Parents in progeny test:																					
Open pollin.	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	
Polycross	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	
Clonal																					
F1	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	
F2	360	360	360	360	360	360	360	360	360	360	360	360	360	360	360	360	360	360	360	360	
F3	80	80	80	80	160	160	160	220	220	220	300	300	300	300	300	300	300	300	300	300	
Production forecast (million plantables)																					
Orchards (#, owner)	1.1	1.1	0.8	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
134 TW (Mt Newton)	0.4	0.4	0.4	0.4	0.4	0.5	Orchard retired - year approximate														
149 MoFR (Bowser)	0.6	0.6	0.6	0.6	0.7	0.8	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1	
154 TW (Mt Newton)	0.5	0.6	0.7	0.7	0.8	0.9	1.0	Orchard retired - year approximate													
162 MoFR (Bowser)	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
166 WFP	0.0	0.0	0.1	0.2	0.3	0.4	0.6	0.8	0.9	1.1	1.2	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	
405 WFP	0.4	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
177 Canfor (Sechelt)	0.6	0.6	0.7	0.8	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
183 TW (Mt Newton)	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.3	1.4	1.5	1.5	1.5	1.6	1.6	1.6	1.6	
197 TW (Mt Newton)	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.0	
404 TW (Mt Newton)	0.0	0.0	0.0	0.1	0.2	0.4	0.7	1.0	1.3	1.6	2.0	2.4	2.7	2.9	3.0	3.1	3.1	3.1	3.1	3.1	
199 MoFR (Saarich)																					
Vegetative prod.: Somatic embliings																					
Estimated gain in primary trait																					
Orchards (#, owner)	12%	12%	15%	16%	16%	16%	16%	16%	16%	16%	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%	
134 TW (Mt Newton)	16%	16%	12%	16%	16%	16%	16%	16%	16%	16%	15%	15%	15%	15%	16%	16%	17%	17%	17%	17%	
149 MoFR (Bowser)	11%	11%	11%	12%	12%	13%	13%	13%	15%	15%	15%	15%	15%	16%	16%	17%	17%	17%	17%	17%	
154 TW (Mt Newton)	15%	15%	15%	15%	15%	15%	15%	14%	14%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	
162 MoFR (Bowser)	11%	11%	11%	11%	11%	12%	14%	14%	14%	14%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	
166 WFP	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	
405 WFP	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	
177 Canfor (Sechelt)	13%	13%	14%	14%	14%	14%	14%	15%	15%	15%	15%	16%	16%	16%	17%	17%	17%	17%	17%	17%	
183 TW (Mt Newton)	17%	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%	19%	19%	19%	19%	19%	19%	19%	
197 TW (Mt Newton)	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	
404 TW (Mt Newton)	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	
199 MoFR (Saarich)																					
Vegetative prod.: Somatic embliings																					
Total Production	3.9	4.4	4.5	5.0	6.0	7.0	7.8	7.4	8.5	9.6	10.5	11.3	12.0	12.5	12.8	13.0	13.1	13.1	13.1	13.1	
Total gain	13%	14%	14%	15%	15%	16%	16%	17%	17%	17%	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%	

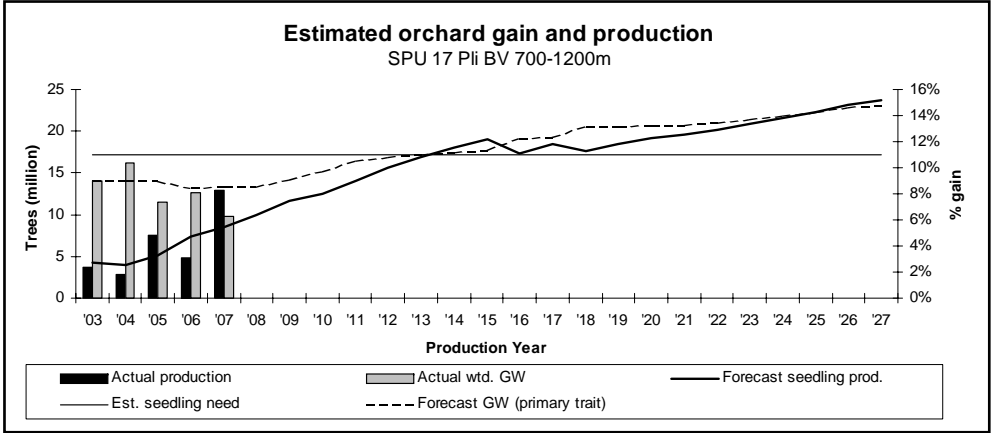


01FdcM low June 27/08	Douglas-fir	Maritime	1 - 700m	SPU # 1						
Conservation -- Seed Orchards -- Seedling use										
<b>GENE CONSERVATION STATUS</b>										
<b>Conservation statistics</b>										
Seed planning unit (SPU) area			4,634,859	ha						
Area protected within SPU			360,774	ha						
Percentage of SPU area protected			8%							
Estimated genetic reserves with >5000 mature trees based on botanical sample data			>9							
Confirmed genetic reserves with >5000 mature trees based on forest inventory data			98							
<b>Conservation status</b>										
Current in-situ protection status: <b>Very well protected</b>										
Probability of maintaining > 3 protected areas with adequate population size given natural disturbance regimes: <b>Very high</b>										
For further information visit <a href="http://www.genetics.forestry.ubc.ca/cfgc/">http://www.genetics.forestry.ubc.ca/cfgc/</a>										
<b>ORCHARD STATUS</b>										
Orchard location	Orchard #	# of parents	Mean Breeding Value	# of ramets currently established	Final orchard size (# ramets)	Target seed production at maturity (Kg / yr)	Target seedling production (mm / yr)			
TW (Mt Newton)	134	77	16%	1,418	976	32.9	1.51			
MoFR (Bowser)	149	35	16%	487	1,008	34.0	1.56			
TW (Mt Newton)	154	78	13%	826	700	23.6	1.09			
MoFR (Bowser)	162	41	15%	1,083	1,946	65.7	3.02			
WFP (SFC)	166	61	16%	262/439	535	18.1	0.83			
WFP (SFC)	405	48	19%	945	951	32.1	1.47			
Canfor (Sechelt)	177	29	17%	900	900	30.4	1.40			
TW (Mt Newton)	183	74	14%	900	900	30.4	1.40			
TW (Mt Newton)	197	40	18%	758	1,000	33.8	1.55			
TW (Mt Newton)	404	35	19%	1,352	750	25.3	1.16			
MoFR (Saarich)	199	95	20%	0	2,000	67.5	3.10	Planning stage		
Total ramets			8,669	11,666	Total production	18.08				
Vegetative propagation					Steckings/Embliings	0.0				
					Total production	18.1				
<b>Seed and Nursery Factors</b>					<b>Estimate of Required Orchard Capacity</b>					
Expected avg. annual seedling production per ramet = 1.550					Annual planting (million seedlings)					12.3
Seed weight (seeds/gram) = 82					Planned over-production factor					1.3
Seedling recovery factor (seedlings/seed) = 0.56					Ramets required					7,909
Seedling recovery factor (seeds/seedling) = 1.79					Ramets required with over-capacity					10,281
					Projected necessary expansion					0
<b>SEEDLING USE AND SEED IN STORAGE</b>										
Average 5-year seedling use from SPAR (2004 - 2008)					12.3	million				
Estimated years of class-A seed in storage					2.5	years				
Seedling Use Trend - 1995 to 2008					Seed in Storage by GW class					
Notes:										

# How to use species plans to help with seed inventory planning

How many kg of seed do I need per year?

How much orchard seed is or will be available to me?



Species plan says lots

Species plan says not enough

Confirm availability with orchard owner

Do I have enough wild seed in inventory?

No

Yes

Purchase orchard seed

Purchase or collect wild seed (but not too much)

# The world is not always predictable...

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- ▲ Seed demand in an SPU can do only three things
  - ▲ Go up
  - ▲ Go down
  - ▲ Remain the same
- ▲ Seed demand never remains the same 😊
- ▲ Rising demand means more orchards or more wild seed use
- ▲ Falling demand means storing seed, roguing orchards and increasing gain



# Contacts

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- ▲ Telephone: 250-748-9579
- ▲ Jwoods.fgc@shaw.ca
- ▲ <http://www.fgcouncil.bc.ca/>
  
- ▲ Tree Improvement Branch website
  - ▲ Species plans are posted

