Managing the Genetic Resource

Tree Improvement Delivery in Coastal Tree Species

Annette van Niejenhuis, RPF

Western Forest Products Inc.

OVERVIEW

- *Terminology*
- *The Tree Improvement Community in Coastal BC*
- *Our Client(s)*
- *The Regulations*
- *Management Techniques*
- *Our Success and Challenges*
- *Genetic diversity conservation for non-commercial species*

WFP Jordan River

Michael Stoehr, Ministry Douglas-fir Breeder

Jodie Krakowski, Ministry Researcher

Western Forest Products Inc.

TERMINOLOGY

<u>Forest tree improvement:</u> control of parentage combined with other forest management activities to improve the overall quantity and quality of wood products from forest lands

<u>Forest tree breeding:</u> tree breeding activities geared to solve a specific problem or produce a desired product

<u>Gain:</u> the percentage increase in a trait of interest of the selected population over the wild-stand population - recorded on SPAR (Seed Planning and Registry) as GW - genetic worth

Western hemlock - transfer limits test

WFP Gold River

Charlie Cartwright, Ministry Hemlock Breeder

Western Forest Products Inc.

Western redcedar crop

WFP Lost Lake orchards

Coastal Tree Improvement Program

Objective

- *to maximize the economic benefits from tree improvement investments for gains in wood quality, quantity, and pest tolerance consistent with land use planning* (Forest Genetics Council of BC)

Western Forest Products Inc.

Coastal Tree Improvement Program

- coordinated by Forest Genetics Council of BC through the Coastal Technical Advisory Committee and Coastal Species Committees
- led by Ministry Tree Improvement Branch Research Breeders
- administered by Ministry Tree Improvement Branch
- produced by Ministry Tree Improvement Branch and Industry seed orchards
- supported by research and development from Universities, Canadian Forest Service, Ministry, the forest industry, and private consultants and contractors.
- funded in part by provincial, federal, and other programs.

Sitka spruce

Controlled pollination

Sayward clonal trials

Western Forest Products Inc.

Western hemlock crop
WFP Lost Lake orchards

Coastal Tree Improvement Program
FGC and Co-ordination

- promote cooperation
- guide and facilitate planning
- acquire and provide resources (where needed) to implement plans
- advise Chief Forester on Forest Gene Resource Management Policies

Western Forest Products Inc.

Coastal Tree Improvement Program

Ministry Breeding Program

- provenance testing - transfer limits, superior provenance identification, etc
- progeny testing - superior family identification, transfer limits, etc

-- broad adaptability,

-- primary trait and secondary traits,

-- comprehensive testing

Sitka spruce Controlled pollination

Sayward clonal trials

Diane Tucker, WFP orchard worker

Western Forest Products Inc.

Western redcedar
Receptive female cones
WFP Lost Lake orchards

Coastal Tree Improvement Program

Ministry Tree Improvement Branch Administration

- maintain SPAR, the Seed Planning and Registry
- promote technical standards - quality, diversity
- recommend and implement legislation, guidelines

-- no GMO

-- seed lot effective population size

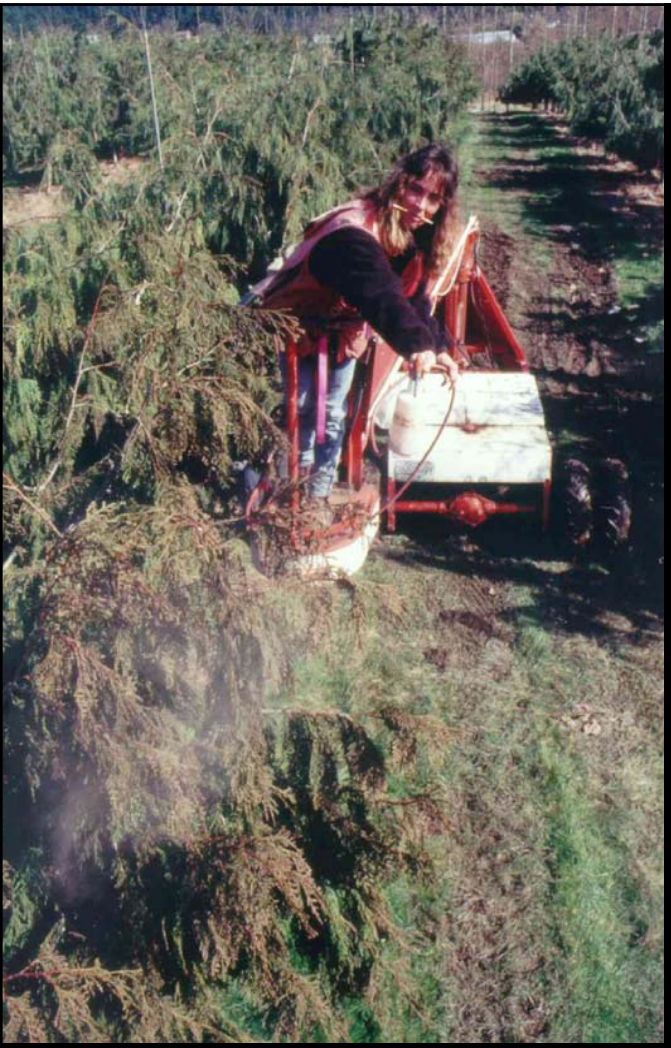
-- seed transfer limits

- extend information

-- seed quality assurance

-- pest management support

Western Forest Products Inc.



Western redcedar

Applying pollen

WFP Lost Lake orchards

Mal Kirk, WFP Orchard Technician

Coastal Tree Improvement Program

Production Facilities

Seed Planning Unit	Ministry Bowser *	Ministry Puckle Road	CANFOR Sechelt Seed Orchards*	Timberwest Mount Newton Seed Orchards	Western Forest Products Saanich Forestry Centre	Yellow Point Propagation
01 FDC M low	X	X	X	X	X	
02 Cw M low		X	X	X	X	X
03 Hw M low				X	X	
06 Ss M low					X	X
08 Pw M/SM		X	X	X		
09 Ba M				X		
11 Yc M					X	
19 Fdc SM		X				
23 Sx SM						
24 Hw M high		X		X	X	
27 Cw SM						
31 Fdc M high			X		X	
33 Cw M high						
36 Bg M low						X

Western Forest Products Inc.

Western redcedar orchard development

Saanich Forestry Centre

Paul Bertorelli, WFP Orchard Technician

Coastal Tree Improvement Program

Status by *Seed Planning Unit*

Seed Planning Unit (SPU): a combination of seed planning zone *and elevation band unique to each species reflecting its adaptability and defining its transfer limits*

Seed Planning Zone (SPZ): a broad zone generally following biogeoclimatic delineation, the Coast includes the Maritime and Submaritime SPZs.

Coastal Tree Improvement Program

Gain and Allowable Annual Cut

Western redcedar

Orchard development

Saanich Forestry Centre

Georgina Dampier, WFP Orchard Technician

Wang, E, and I Listar. 2000. Impact of the current and planned seed orchard program on timber flow in the Arrow TSA. Timberline Forest Inventory Consultants. 27 pp

http://www.for.gov.bc.ca/tip/treeseed/genetics_report_final.pdf

Tanz, J.S. 2001. Incorporating genetic gain in timber supply analysis. Cortex Consultants Inc. Forest Genetics Council. 15 pp.

http://www.fgcouncil.bc.ca/GenGain_XNote1_Web.pdf

Pedersen, L. 1999. Tree Improvement and Timber Supply Forecasting. BC Seed Orchard Staff Group Meeting, Vernon, 1999.

http://www.fgcouncil.bc.ca/pedeaddr.pdf

Western Forest Products Inc.

Gain and Allowable Annual Cut

- earlier free-growing (reduced liability)
- earlier green-up (reduced adjacency constraint)
- increased yield (reduced harvest age)
- ACE (Allowable Cut Effect)?

Western hemlock scarification trial
SL Hw 60164 - Three growing seasons in the field
WFP Port McNeill Dr. John Barker

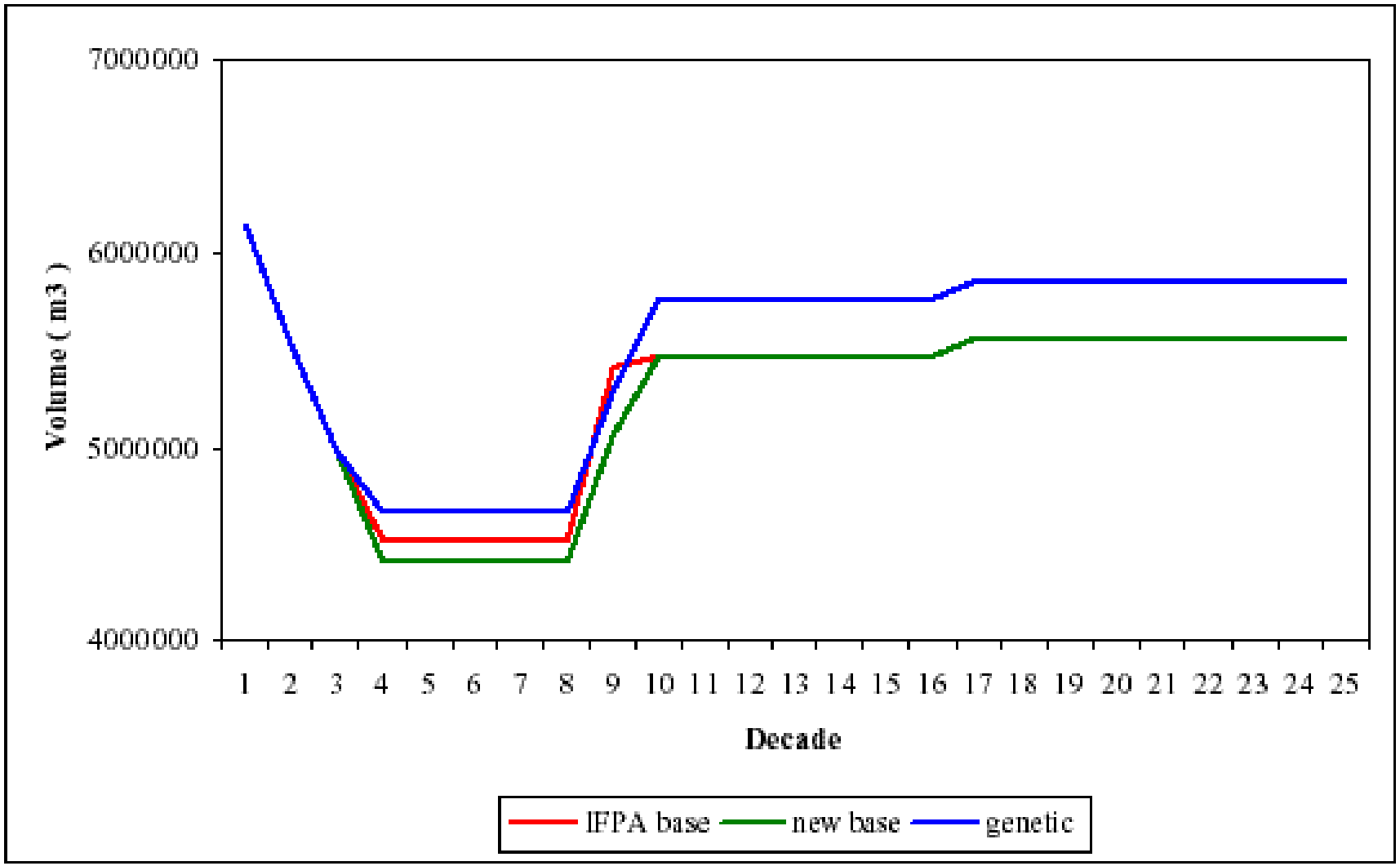


Figure 4. Timber harvest scenarios

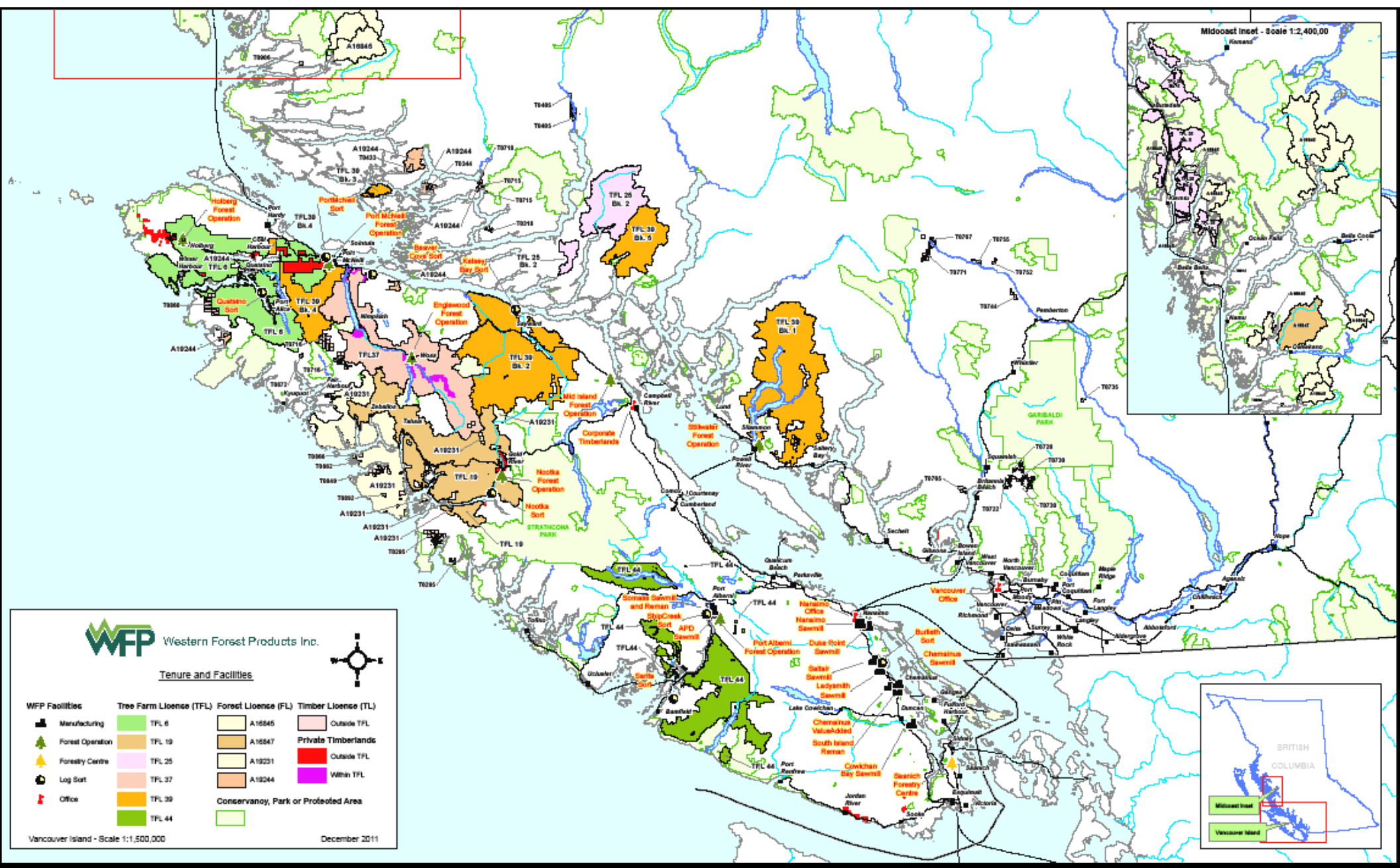
source: Wang and Listar, 2000, Arrow TSA

THE CLIENT(S)

- Objective is to meet the seed needs of Western Forest Products with high-gain well-adapted seed at a reasonable cost.
- Western Forest Products operates in Coastal BC only, from Port Alberni to the North Coast mainland
- Surplus seed is made available to other licensees.

Coastal Douglas-fir grafting
Saanich Forestry Centre
Cathy Cook, WFP Orchard Technician

Western Forest Products Inc.



Western Forest Products Inc.

Coastal Tree Improvement Program

Seed Needs

- by species
  - Western Redcedar
  - Douglas-fir
  - Western Hemlock
  - Yellow Cypress
  - Amabilis Fir**
  - Sitka spruce
  - White Pine**
- by seed planning zone
  - Maritime
  - Sub-maritime
- by elevation
- by latitude

Western redcedar progeny trial

Timberwest - Nanaimo

Dr. John Russell, Ministry Cedar Breeder

Western Forest Products Inc.

Seedling Extraction

Saanich Forestry Centre

Coastal Tree Improvement Pro

SPU	WFP Needs (000)	Gain
Fdc 0-900 m S	2,020	GW >10
Fdc > 900 m S	390	GW =5
Cw 0-700 m S	2,080	GW >11
Cw > 700 m S	610	B
Cw 0-600 m N	325	GW =2
Hw 0-600 m S	660	GW >7
Hw > 600 m S	640	GW <6
Hw 0-600 m N	165	GW <6
Ss 0-500 m WR	130	GWR 85
Pw All	50	GWR 50
Ba All	540	B
Yc All	700	GW +20
TOTAL	8,310	
Misc - Plc, Hm, Dr		

Western Forest Products Inc.

Coastal Tree Improvement Program

Sitka spruce
Transfer limits test
Dr. John King, Ministry Sitka Spruce Breeder (ret)

Orchard Management Techniques

- Phenology
- Supplemental Mass Pollination
- Controlled Pollination
- Pest Management
- Crop Harvest
- Cone Handling
- Seed Handling

Western Forest Products Inc.

Successes and Challenges

Coastal Tree Improvement Program

- Low elevation Fdc crops at >10%
- Low elevation Hw at > 15%
- Low elevation Ss Weevil Resistance at >85%
- Yc at ~20%
- Low elevation Cw at >10%

- Pw Blister rust resistance ~ 50%
- Ba seed production
- Yc rootability

- Costs

Douglas-fir Crop
Saanich Forestry Centre
Labeled and Tagged

Western Forest Products Inc.

Coastal Tree Improvement Program

Wild seed vs 1st Gen seed vs Advanced Gen seed

Tree planting
WFP Stafford Lake

Seedling Seed Price $6.40/k (Cw - wild) vs $131.40/k (Fdc - >7%)

- does any other silviculture activity cost so little and have such potential?

Performance

- probability of quantity or quality gain far outweighs probability of failure of orchard seed
- AAC value - 2% gain vs 2% reduction

Western Forest Products Inc.

SPECIES	ZONE	CC [%]	CC [ha]		SPECIES	ZONE	CC [%]	CC [ha]
ABIEAMA	CWH	9.8	106,635		ABIEAMA	MH	14.1	92,331
ABIEGRA	CWH	4.1	328		ABIELAS	MH	11.5	12,684
ACERCIR	CWH	7.5	2,008		ALNUVIR	MH	16.5	8,392
ACERGLA	CWH	11.1	1,056		CHAMNOO	MH	15.1	27,753
ACERMAC	CWH	6.1	2,460		PICESIT	MH	11.4	1,510
ALNURUB	CWH	8.2	20,982		PINUMON	MH	21.1	159
ALNUVIR	CWH	10.3	10,075		SALISIT	MH	14.1	1,916
ARBUMEN	CWH	2.0	24		TSUGHET	MH	13.1	24,429
BETUOCC	CWH	5.9	76		TSUGMER	MH	13.8	108,546
BETUPAP	CWH	8.1	703					
CHAMNOO	CWH	11.0	47,646					
CORNNUT	CWH	5.5	214					
CORYCOR	CWH	4.8	20					
CRATDOU	CWH	5.6	4					
MALUFUS	CWH	11.9	1,935					
PICESIT	CWH	11.8	48,562					
PINUCON	CWH	11.2	18,931					
PINUMON	CWH	8.7	660					
POPUBAL	CWH	7.1	4,405					
PRUNEMA	CWH	4.5	117					
PSEUMEN	CWH	7.8	46,624					
RHAMPUR	CWH	7.0	95					
SALILUC	CWH	7.4	298					
SALISCO	CWH	3.7	147					
SALISIT	CWH	7.5	1,914					
TAXUBRE	CWH	11.3	2,840					
THUJPLI	CWH	10.2	123,628					
TSUGHET	CWH	10.0	315,019					
TSUGMER	CWH	11.1	19,990					

Hamann, A., Smets, P., Aitken, S. N. and Yanchuk, A. D. 2005. An ecogeographic framework for *in situ* conservation of forest trees in British Columbia. Can. J. For.Res. 35:2553-2561

http://genetics.forestry.ubc.ca/cfcg/in-situ-stats.html

Western Forest Products Inc.

Summary

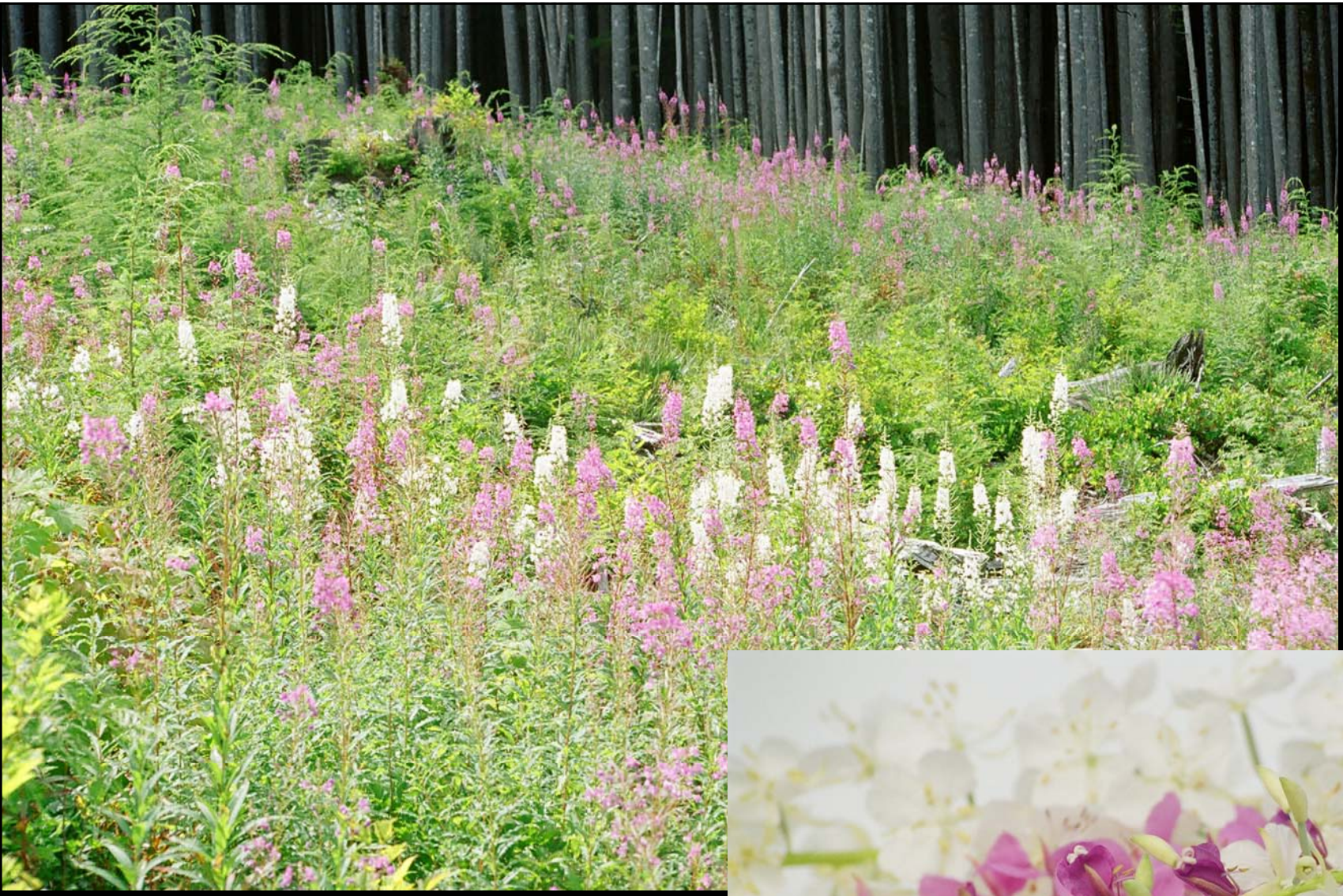
- many various contributors to success
- enviable success in support
- enviable success in many breeding programs
- remaining challenges - Pw, Ba
- orchards aggressively incorporating identified clones for gain
- orchards managing crops for gain
- surplus seed available on SPAR
- necessary for High Yield Timber Management
- genetic diversity conservation in place

Yellow cypress clonal trial

WFP Jordan River

Drs. John Barker and John Russell

Western Forest Products Inc.



Thank-you

Western Forest Products Inc.