STAND MANAGEMENT COOPERATIVE
ANNUAL REPORT
JANUARY-DECEMBER 2010

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CONTENTS

Stand Management Cooperative
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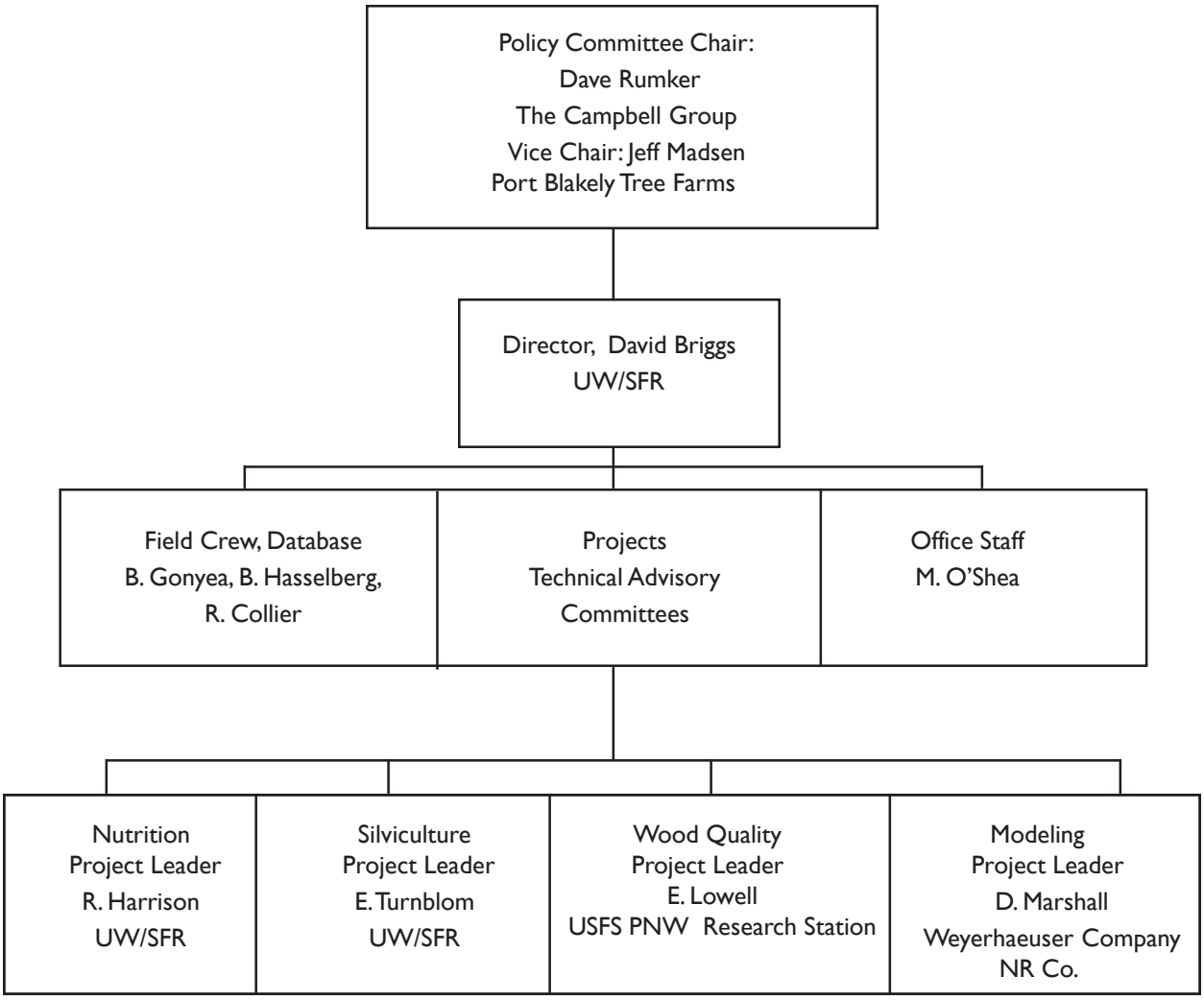
MISSION AND ORGANIZATION

Mission

To provide a continuing source of high-quality information on the long-term effects of silvicultural treatments and treatment regimes on stand and tree growth and development and on wood and product quality.

Organization

The SMC is composed of forest industry, state, provincial, and federal agencies, suppliers, and universities and other institutions who commit resources and expertise to the mission. The voting Policy Committee, composed of a representative from each member organization controls policy with the goal of establishing the highest possible technical standards in carrying out its mission. Technical Advisory Committees (TACs) in Silviculture, Nutrition, Wood Quality, and Modeling, comprised of leading scientists, have been created to develop plans for research projects that are approved by the Policy Committee. The SMC is headquartered at the School of Forest Resources, University of Washington, which provides administration and staffing.



Database

The database was updated and sent to members who had requested it in June.

- At the end of the 10/11 field season, the database contained data from 527 installations which contain 7,742 plots which have been measured 33,531 times. This translates into to 289,284 trees which have been measured a total of 1,670,086 times.
- Presently there are 147 active installations of Types I through V. These installations hold 3,485 plots, which in aggregate have been measured 8,386 times. These plots contain 110,293 trees which have in total been measured 566,902 times.
- The remaining data are either inactive installations of the old Regional Forest Nutrition Research Program (RFNRP) or active/inactive special contract installations with SMC members.

Graduate Students: The SMC had 7 graduate students in residence during 2010:

- **Kevin Ceder** (PhD, Turnblom**)**
  - ✓ Developing dynamic models for understory vegetation development in young, managed Douglas-fir and western hemlock forests. Also working on Type III performance report
  - ✓ Support: NCASI, UW McIntire-Stennis, SMC (Type III performance report)
- **Jeff Comnick** (PhD, Turnblom)
  - ✓ Developing performance reports of SMC Type II installations
- **Paul W. Footen** (MS, Harrison)
  - ✓ Carryover effects of nitrogen fertilizer
  - ✓ Support: TA & Corkery Family Chair support
- **Austin Himes** (MS, Harrison)
  - ✓ Paired tree fertilization trials tracking N15 isotope
  - ✓ Support: TA, Corkery, NSF CAFS
- **Rapeepan Kantavichai** (PhD, Briggs)
  - ✓ Modeling the annual biomass increment as affected by thinning and growing environment (temperature, precipitation, soil, water balance) using x-ray densitometer data from the trees from the four Type II installations harvested for the acoustic non- destructive testing study.
  - ✓ Support: TA, Corkery, Precision Forestry Cooperative, NSF CAFS
- **Kim Littke** (PhD, Harrison)
  - ✓ Analysis of soil characteristics of paired tree fertilization trials.
  - ✓ Support: TA, Corkery, AGENDA 2020 and CAFS.
- **Nai Saetern (MS Briggs)**
  - ✓ Developing performance reports for the SMC Type I installations
  - ✓ Support: TA, Corkery
- **Nick Vaughn** (PhD, Turnblom)
  - ✓ Using full wave Lidar data for species identification
  - ✓ Support: RA (NCASI Douglas-fir/Loblolly Pine Life-Cycle Study of Management Regimes), Corkery

2010 HIGHLIGHTS

New Members

- International Forestry Consultants as a land managing organization member
- Agrotain International as a supplier member

Budget

- Cumulative SMC funding from all sources since 1985 reached $20.8 million of which 62% was member dues and contracts, 18% external grants, and 20% institutional contributions.
- Total 2010 income from all sources was $1,150,627 of which
  - Member dues and contracts, $478,823 and $23,886 respectively, totaled $502,709 (43.7% of total income), a 24% decrease due to a 20% general dues cut voted in 2009 and higher cuts in place by some members as a result of the depressed economy.
  - Institutional Funding = $156,334 (13.6% of total income) which includes $21,000 from the BC Ministry of Forests Research Branch for measurement and treatment costs associated with SMC Installations in BC.
  - External Research Grants = $491,584 (42.7% of total income) of which $160,738 was from external grants and $330,846 from the University of Washington for student support.

2009/10 Field Season Summary

- 67 installations (310 plots) received full measurment as follows
  - Type I: 12 installations (163 plots) re-measured; 13 installations (25 plots) thin check
  - Type II: 2 installations (10 plots) re-measured
  - Type III: 6 installations (57 plots) re-measured; 1 installation (1 plot) thin check; 2 installations (24 plots) prune check
  - Carryover: 5 installations (14 plots) re-measured
  - GGTIV: 3 installations (66 plots) re-measured
  - Type V: 11 installations installed, measured and fertilized; 28 installations re-measured

Summer Field Crew (Paul Footen, Kim Littke, Gonzalo Thienel)

- GGTIV 3 installations (66 plots) planted in 1966 for understory vegetation survey
- Type I: 3 installations (29 plots) for understory vegetation and habitat survey
- Type III 1 installaiton (6 plots) for understory vegetation and habitat survey

Technology Transfer

- 10 peer reviewed publications plus 3 accepted
- Updates of ORGANON and CONIFRS models
- Sponsored a workshop on forest carbon
- NSF Center for Advanced Forestry Systems annual meeting
- SMC Strategic Planning Committee meeting
- SMC Wood Quality TAC meeting
- SMC Spring and Fall Policy Committee meetings

SMC MEMBERS AND POLICY COMMITTEE REPRESENTATIVES

Land Managing Organizations

Bureau of Land Management	George McFadden
The Campbell Group	Dave Rumker
Cascade Timber Consulting	Bill Marshall
Forest Capital Partners	Scott Ketchum, Bruce Ripley
Green Diamond Resource Co.	Randall Greggs
Hampton Affiliates	Dennis Creel
Hancock Forest Management	Dean Stuck
Lone Rock Timber Company	Jake Gibbs
Longview Timberlands, LLC.	Rick Brooker
Olympic Resource Management	Scott Holmen
Oregon State Department of Forestry	Jeff Brandt, Tod Haren
Pacific Denkman	Allen Staringer
Plum Creek Timber Company	Connor Fristoe/Steve Wickham
Port Blakely Tree Farms L.P.	Mike Mosman/Jeff Madsen
Quinault Department of Natural Resources	Jim Plampin
Rayonier Forest Resources	Candace Cahill
Renewable Resources, LLC	Harry Bell
Roseburg Resources	David Walters
Stimson Lumber Company	Margaret Banks
TimberWest - Coast Timberlands	John Mitchell
Washington State Department of Natural Resources	Scott McLeod
West Fork Timber Company	Gene McCaul/Scott Swanson
Weyerhaeuser NR Company	Greg Johnson

Analytic Organizations

FORSight Resources, LLC	Karl Walters
ImageTree Coorporation	Mark Hanus
Jim Flewelling Biometrics Consultant	Jim Flewelling
Mason, Bruce & Girard	Ellen Voth/Chuck Stith

Suppliers

AGROTAIN	Ben Thompson
Agrium	Alan Levy
Dyno Nobel	Greg Godfrey
J.R. Simplot	Terry Kendall
King County Department of Natural Resources	Roberta King/Peggy Leonard

Institutions

B.C. Ministry of Forests, Research Branch	Louise de Montigny
Canadian Wood Fibre Center	Cosmin Filipescu/RossKoppenaal
Oregon State University	Doug Maguire
University of British Columbia	Bruce Larson
University of Washington	David Briggs
U.S. Forest Service PNW Research Station	Charley Peterson

TECHNICAL ADVISORY COMMITTEES

Modeling Project

Project Leader, David Marshall
Weyerhaeuser Company
David Briggs, University of Washington
Burt Dial, Hancock Forest Management
Jim Flewelling, Biometric Consultant
Sean Garber, Roseburg Resources
Dave Hamlin, Campbell Group
Greg Johnson, Weyerhaeuser Company
Dave Lortz, Campbell Group
Fred Martin, Washington Dept. of Nat. Res.
John Paul McTague, Rayonier
Bob Meurisse, USFS PNW Region
Erin Smith-Mateja, USFS PNW Region
Eric Turnblom, University of Washington
Larry Wiechelman, Quinault Dept. of Nat. Res.

Wood Quality Project

Project Leader, Eini Lowell, USFS PNW Research Station
Jamie Barbour, USFS PNW Research Station
Neris Biciunas, Rayonier Forest Products
Jeff Brandt, Oregon Department of Forestry
David Briggs, University of Washington
Brian Carbaugh, The Campbell Group
Marilyn Cherry, Oregon State University
Jeff DeBell, Washington Dept. of Nat. Res
Burt Dial, Hancock Forest Management
Cosmin Filipesu, Canadian Forest Service, Wood Fibre Center
Jim Flewelling, Biometric Consultant
Sean Garber, Roseburg Resources
Jake Gibbs, Lone Rock Timber Co.
Jim Goudie, B.C. Ministry of Forests
Tod Haren, Oregon Department of Forestry
Connie Harrington, USFS PNW Research Station
Rob Harrison, University of Washington
Denny Hill, The Campbell Group
Glenn Howe, Oregon State University
Barbara Lachenbruch, Oregon State University
Greg Johnson, Weyerhaeuser Company
Ross Koppenaal, Canadian Forest Service, Wood Fibre Center
Jeff Madsen, Port Blakely
Doug Maguire, NWTIC, Oregon State Univ.
Doug Mainwaring, Oregon State University
Louise de Montigny, B.C. Ministry of Forests
David Marshall, Weyerhaeuser Company
George McFadden, BLM
Dave Rumker, Campbell Group
Eric Turnblom, University of Washington
Dave Walters, Roseburg Forest Products
Steve Wickham, Plum Creek Timber Company

Silviculture Project

Project Leader, Eric Turnblom,
University of Washington
Margaret Banks, Stimson Lumber
David Briggs, University of Washington
Jeff Brandt, Oregon Dept. of Forestry
Rick Brooker, Longview Timberlands LLC
Robert Curtis, USFS PNW Research Station, retired
Brian D'Anjou, B.C. Ministry of Forests
Louise de Montigny, B.C. Ministry of Forests
Candance Cahill, Rayonier Forest Resources
Sean Garber, Roseburg Resources
Jake Gibbs, Lone Rock Timber Co.
Steve Gravelle, Plum Creek Timber Co.
Randall Greggs, Green Diamond Resource Co.
David Hann, Oregon State University
Tod Haren, Oregon Dept. of Forestry
Connie Harrington, USFS PNW Research Station
Rob Harrison, University of Washington
Denny Hill, The Campbell Group
Keith Jayawickrama, NWTIC, Oregon State Univ.
Greg Johnson, Weyerhaeuser Company
Scott Ketchum, Forest Capital partners, LLC
Eini Lowell, USFS PNW Research Station
Steve Loy, Hancock Forest Management
Jeff Madsen, Port Blakely Tree Farms
Gene McCaul, West Fork Timber Co.
Peter Marshall, University of British Columbia
Scott McLeod, Washington Dept. of Nat. Resources
Jim Plampin, Quinault Dept. of Nat. Res.
Jim Vander Ploeg, Hancock Forest Management
Bruce Ripley, Forest Capital partners, LLC
Allen Staringer, Pacific Denkmann
Steve Wickham, Plum Creek Timber Co.

Nutrition Project

Project Leader, Rob Harrison,
University of Washington
David Briggs, University of Washington
Louise de Montigny, B.C. Ministry of Forests
Bob Edmonds, University of Washington
Sean Garber, Roseburg Resources
Barbara Gartner, Oregon State University
Jake Gibbs, Lone Rock Timber Co.
Randall Greggs, Green Diamond Resource Co.
Andy Hiegel, Hancock Forest Management
Denny Hill, Campbell Group
Scott Holub Weyerhaeuser Company
Greg Johnson, Weyerhaeuser Company
Jeff Madsen, Port Blakely Tree Farms LP
Doug Maguire, Oregon State University
Brian Sharer, Hancock Forest Management
John Shumway, USFS PNW Research Station
Eric Turnblom, University of Washington
Steve Wickham, Plum Creek Timber Co.

2010 BUDGET

FINANCE COMMITTEE

David Briggs, SMC Director; **Conner Fristoe**, Plum Creek Timber Co; **Randall Greggs** Green Diamond Resource Co.; **Greg Johnson**, Weyerhaeuser NR Co.; **Jeff Madsen**, Port Blakely Tree Farms; **Gene McCaul**, Murray Pacific; **Scott McLeod**, Washington DNR; **Megan O'Shea**, SMC; **Dean Stuck**, Hancock Forest Management; **Dave Walters**, Roseburg Resources.

FUNDING FORMULA

2010 dues were calculated from the following formula

Approved Fall 2004 for implementation in 2006

If acres <= 100,000, dues = $6,137 + 0.035675 Acres
If acres > 100,000, dues = $12,274 + 0.035675 Acres
Dues cap = $79,517

INCOME (TABLE 1)

Member Dues & Contracts ($502,709, 43.7% of total income, Figure 1)

- Member dues were $478,823 due to a 20% dues reduction, for 2010 only, as voted at the Fall 2009 meeting. The full decrease was actually 24% as ODF, TimberWest and WA DNR had larger cuts. BLM paid full dues but is split with "dues" shown equal to that of the largest other member with the remaining balance recorded under special contract income.

- Special contract income was $23,886 composed of $3,500 with King County and the balance of BLM dues.

Institutional Funding ($156,334, 13.6% of total income, Figure 1)

- The BC Ministry of Forests Research Branch contributed $21,000 to support measurement and treatment costs associated with SMC Installations in BC. Other institutional members provided the equivalent of about $135,344 in the form of salaries of scientists, facilities, and administrative support.

External Research Grants ($491,584, 42.7% of total funding, Table 2, Figure 1)

- Funding from external grants ($160,738) support graduate students and some SMC staff time thereby producing savings in the SMC budget.

- University of Washington student support ($330,846)

Total funding from all sources was $1,150,627 which increased the cumulative total since 1985 to $20.8 million (Figure 2). This does not include substantial in-kind time contributed by members participating on SMC committees nor donations of expertise and materials by supplier members.

Table 1: Income

Table 1. 2010 Financial Support			
Cooperator	**Amount**		**% dec**
Formula dues:			
Bureau of Land Management	$	63,614	20%
Campbell Group	$	19,134	20%
Cascade Timber Consulting	$	13,929	20%
Forest Capital Partners	$	13,938	20%
Green Diamond.Resource Co.	$	16,869	20%
Hampton Affiliates	$	6,668	30%
Hancock Forest Management	$	25,085	20%
International Forestry Consultants, Inc	$	6,092	20%
Lone Rock Timber Company	$	13,296	20%
Longview Timberlands LLC	$	28,496	20%
Olympic Res. Mgt/Pope Res.	$	13,767	20%
Oregon Dept. Forestry	$	27,517	27%
Pacific Denkman	$	5,338	20%
Plum Creek Timber Co.	$	22,142	20%
Port Blakely Tree Farms	$	13,892	20%
Quinault Dept. Nat. Res	$	6,710	20%
Rayonier Forest Resources	$	19,666	20%
Renewable Resources, LLC	$	7,034	20%
Roseburg Resources.	$	18,296	20%
TimberWest-Coast Timberlands	$	27,968	25%
Stimson Lumber	$	14,775	20%
Washington Dept. Nat.Res.	$	24,581	50%
West Fork Timber Co. LLC	$	6,405	20%
Weyerhaeuser NR Co.	$	20,614	
Total	**$**	**478,823**	24%
Member Contracts, Grants, Adjustments.	$	23,886	
Subtotal	**$**	**502,709**	**43.7%**
Less in-kind credits (GGTIV)	$	-	
Net Cash Contributions	$	502,709	
Institutional Contributions			
B.C. Ministry of Forests	$	21,000	
Oregon State University	$	10,000	
University of Washington	$	105,334	
USFS PNW Research Station	$	20,000	
Subtotal	**$**	**156,334**	**13.6%**
External Research Grants	**$**	**491,584**	**42.7%**
TOTAL	**$**	**1,150,627**	**100.0%**

Figure 1: Sources of 2010 SMC Funds

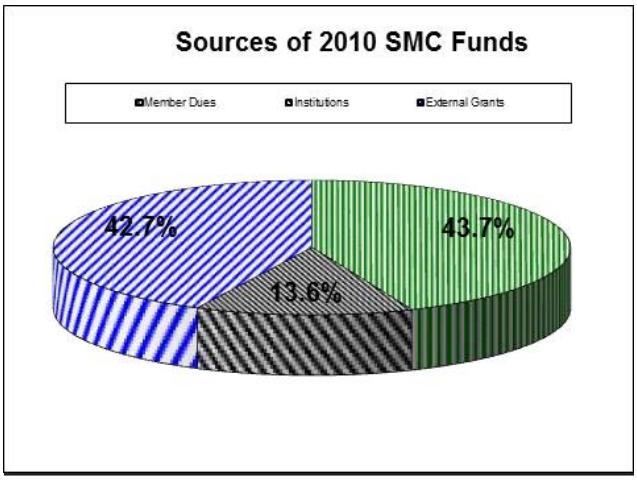


Table 2. 2010 SMC External Grants and UW Student Support

Table 2. External Support: $ Received in 2010				
Source	**Amount**		**Period**	**PI**
Non-UW				
NCASI (Fall River)	$	24,000	2010	Harrison
NCASI (LCA of management regimes)	$	15,004	2010	Briggs
Data Gathering for Updated Logging Residue Ratios	$	121,734	2010	Turnblom
Subtotal	$	160,738		
UW				
Gessel Fund	$	-	2010	
Corkery Family Chair	$	61,401	2010	
UWTA	$	269,445	2010	
Subtotal	$	330,846		
Total	**$**	**491,584**		

Figure 2. Cumulative SMC Funding: 1985-2010

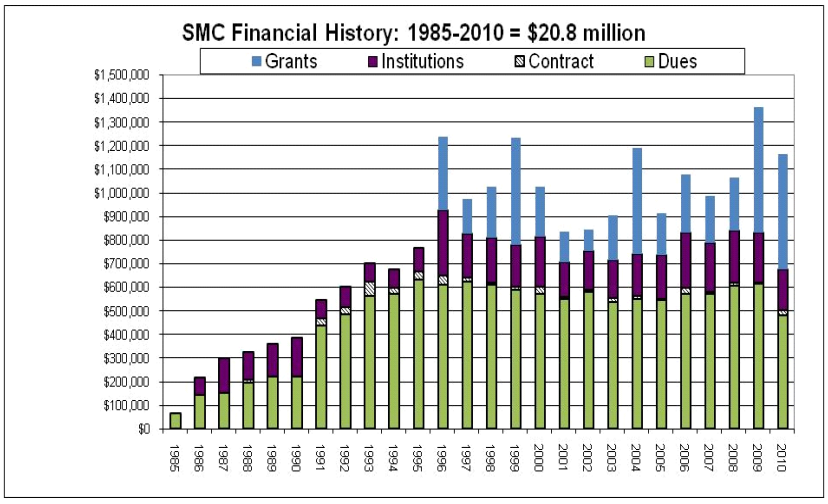
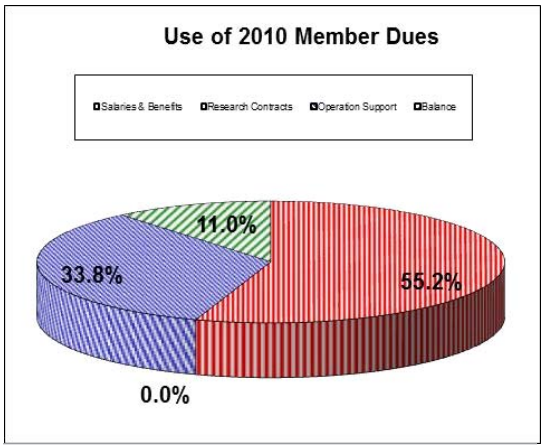


Table 3: Balance Sheet

Table 3. 2010 BUDGET		
INCOME	**Amount**	**%**
Formula Funding	$ 478,823	80.9%
Contracts	$ 23,886	0%
Subtotal	$ 502,709	85.0%
In-kind credits	$ -	0.0%
Net Cash Contributions	$ 502,709	85.0%
2009 Ending Balance Forward	$ 89,029	15.0%
Total Funds Available	**$ 591,738**	100.0%
EXPENSES	**Amount**	**%**
Salaries	$ 260,170	44.0%
Benefits	$ 66,310	11.2%
Travel	$ 55,426	9.4%
Equipment & supplies	$ 12,014	2.0%
Contract Services	$ 23,982	4.1%
Tuition	$ 0	0.0%
Subtotal	**$ 417,901**	70.6%
Indirect	108,678	18.4%
Total Direct & Indirect	**$ 526,580**	89.0%
Research Contracts	$ -0.	0%
Total Expenditures	**$ 526,580**	89.0%
2010 Ending Balance	$ 65,159	.0%
Total Funds Available	**$ 591,738**	100.0%

Figure 3: 2010 SMC Expenditures



BALANCE SHEET (TABLE 3)

- The balance from 2009 was $89,029, a result of cost cutting to create a buffer for the impact of the 2010 dues cuts This surplus was created by taking actions in mid-2009 in anticipation of a serious budget shortfall in 2010 due to the depressed economy. These cuts included
    - ✓ Lay off one of our two database management staff.
    - ✓ Cut summer salary for the Director from 1.5 to 0.5 months and for the Nutrition and Silviculture Project Leaders from 2.5 to 2.0 months.
    - ✓ Cut salaries for the remaining staff were by 7.7%.
    - ✓ Cut all other expenditures as much as possible.
- Operating funds, including the 2009 balance, were $591,738 compared to $624,889 in 2009 (Table 3).
- Salaries and benefits, 55.2% of available funds (Figure 3), include the permanent SMC staff, hourly helpers and occasional student support. Most of the salary expense along with a large share of travel and supplies supports field measurement activities and the associated database management.
- The salary and benefits shown are the net amount after charges to grants and the Precision Forestry Cooperative for work done by SMC staff.
- A summer field crew was hired, with expenses split between the Corkery Family Foundation Chair, external grants, the Precision Forestry Cooperative and the SMC.
- Vote at the Fall 2009 meeting was to achieve an ending 2010 balance of $20,000; the actual ending balance was $65,159 (11% of available funds, Figure 3) to create a buffer for the impact of a possible continuation of dues cuts into 2011.

FIELD WORK AND DATABASE REPORTS

FIELD INSTALLATION DESCRIPTIONS

Stand Management Cooperative

TYPE I	Established between 1986 and 1994 in juvenile (age 7-15) Douglas-fir and western hemlock plantations with uniform stocking ranging from 300-680 stems per acre. Established before the onset of substantial inter-tree competition. At establishment, some plots were systematically thinned to 50% or 25% of the existing trees per acre. Seven plots constitute a common core on all installations and are following pre-defined thinning regimes based on Curtis' relative density. At some installations counterparts to some of the core plots received best tree rather systematic thinning and others have either pruning or fertilization treatment. 38 installations, of which 30 are Douglas-fir, 322 plots, and 8 are western hemlock, 56 plots.
TYPE II	Established between 1986 and 1991 in Douglas-fir plantations that were approaching commercial thinning stage and considered to approximate the expected future condition of the Type I installations. Five plots, one unthinned control and four following thinning regimes based on Curtis' relative density constitute the treatments. Originally 12 installations, 60 plots; currently 6 installations, 30 plots.
TYPE III	Planted between 1985 and 2001 with the best current regeneration practices at 100, 200, 300, 440, 680, and 1210 stems per acre. Plantings were at least 3 acres per spacing to provide experimental material for future research. A control measurement sample plot was established in each spacing. In the three widest spacings additional plots were established to create a matrix of density and pruning (pruned with unpruned "followers" with pruning to either 50% live crown removal or pruned to 2.5 inch top) treatments. In the three dense spacings a matrix of thinning treatments; early/light, early/heavy, late/light, late/heavy, and a late one time, was established based on relative spacing. 47 installations; of which 38 are Douglas-fir, 6 are western hemlock, and 3 with a 50/50 mix of Douglas-fir and western hemlock. Collectively they have 564 plots.
Carryover	Planted in 1997-1999 on plots of the former Regional Forest Nutrition Research Program after harvesting to assess if fertilization of the previous stand affects development of its successor. 7 installations, 17 plots.
GGTIV	"Genetic Gain/Type IV" Planted in 2005 and 2006. A Douglas-fir genetic gain and spacing trial collaboration with Northwest Tree Improvement Cooperative. Planting spacings are 7x7, 10x10, and 15x15. Genetic levels are elite, unimproved and intermediate stock. Vegetation control levels are current practice and complete until crown closure. . Temperature and precipitation gages and lysimeters at each installation. 6 installations, 132 plots in the Grays Harbor breeding zone.
LTSP	"Long-term site productivity" Sites at Fall River, WA; Matlock, WA; Mollalla, OR. Collaboration with USFS PNWRS, OSU, and companies.
Type V	Paired-tree study consisting of two treatments, 0 and 224 Kg N/ha to study effects on growth and yield, carbon, and wood quality. Stratified by parent material, vegetation zone, slope location. Each installation has 20 tree pairs. Temperature and precipitation gages and lysimeters at each installation. 73 installations

PHASE I	Unthinned natural stands of Douglas-fir and western hemlock. Installations were established in 1969-70, received as many as 4 fertilization treatments, and were measured for 20 years. Completed in 1990. 117 installations, 702 plots.
PHASE II	Thinned natural stands of Douglas-fir and western hemlock. Installations were established in 1971-72, received as many as 4 fertilization treatments, and were measured for 20 years. Completed in 1992. 43 installations, 266 plots
PHASE III	Young thinned plantations of Douglas-fir and western hemlock, and low site quality stands of Douglas-fir. Installations were established in 1975, received as many as 4 fertilization treatments, and were measured for 20 years. Completed in 1996. 29 installations, 234 plots
PHASE IV	Pre-commercially thinned (300 trees/acre) plantations of Douglas-fir and western hemlock, and Douglas-fir stands of naturally low stocking. Installations were established in 1980, received as many as 4 fertilization treatments, and were measured for 20 years Completed n 2000. 34 installations, 306 plots
PHASE V	Single-tree screening trials in young noble fir and Pacific silver fir stands; established 1986-1988. One fertilizer application. Completed in 1991. 22 installations.

FIELD WORK

Field Crew Personnel: Bob Gonyea, Field Coordinator, Bert Hasselberg, Field Technician.

Table 1 indicates the number of times that plots on the different types of installations have been measured through the 10/11 field season.

Table 1. Number of times that plots have been measured by installation type; through the 10/11 field season.

# of Meas	Type I[1]		Type II[1]		Type III[2]		Carryover[3]		GGTIV[2]		Type V[3]	
	# plots	%	# plots	%	# plots	%	# plots	%	# plots	%	# inst	%
1	2	1%			4	1%					39	53%
2	0	0%			16	5%			66	50%	34	47%
3	0	0%			18	6%			66	50%		
4	7	2%	6	8%	24	8%						
5	28	7%	9	15%	59	19%	2	7%				
6	176	47%	28	47%	102	33%	0	0%				
7	88	23%	11	18%	63	20%	6	21%				
8	62	16%	5	8%	4	1%	9	31%				
9	11	3%			14	5	9	31%				
10	3	1%			6	2	3	10%				
11												
12												
Total	378	100%	60	100%	310	100%	29	100%	132	100%	73	100%

1. Number of full measurements at establishment and every 4th year thereafter
2. Number of full measurements at establishment, every 2 years until 30 ft in height, & every 4 years thereafter
3. Number of full measurements at establishment and annually thereafter

Table 2 summarizes the number of field installations and plots visited during the past three field seasons along with the planned visits for the 11/12 season. In total, 67 installations (310 plots) received full measurement in the 10/11 field season.Visits to installations for other work such as thinning trigger checks and thinning if needed, foliage samples, etc. brought the total number of visits to 114 installations (375 plots). The plot counts do not include the tree pair plots within the Type V installations).

Table 2. Field activity workload 08/09 through 10/11 and 11/12 plan

Installation	Activity	2008/2009		2009/2010		2010/2011		2011/2012 Plan	
		No. Inst.	No. Plots	No. Inst.	No. Plots.	No. Inst.	No. Plots	No. Inst.	No. Plots
Type I	**Full Measurement**	**11**	**111**	**8**	**75**	**12**	**163**	**7**	**71**
	Thin check	19	30 1	2	21	13 25	1	0	16
	Thinned	7 8		7	9	6 13			
	Fertilized	1 3							
	Pruned								
	Stem analysis								
	Foliage samples			1	6				
Type II	**Full Measurement**					**2**	**10**	**2**	**10**
	Thin check								
	Thinned								
	Stem analysis								
Type III	**Full Measurement**	**6**	**78**	**9**	**78**	**6**	**57**	**9**	**104**
	Thin check		11	2	4	1	1	2	2
	Thinned	4	5 2		4	2	2		
	Pruned measured	2 12		2	12 2	24		2	15
	Pruned	2 11							
	Stem analysis								
Carryover	**Full Measurement**	**5**	**14**			**5**	**14**		
Type IV GGT	**Full Measurement**	**3**	**66**	**3**	**66**	**3**	**66**	**3**	**66**
Type V	Plot installation & Initial Meas.	**28**	**a**	**28**	**a**	**11**	**a**		
	Fertilized	28	a	28	a 11	a			
R	e-measurement			**6**	**a**	**28**	**a**	**73**	**a**
	Foliage samples			6	b 28	b 2		8	b
Contracts	**Full Measurement**	**1**	**6**	**3**	**31**			**3**	**31**
	New								
Total	**Full Measurement**	**54**	**275**	**57**	**250c**	**67**	**310c**	**94**	**282c**
	All activity	**89**	**355c**	**138**	**306c**	**114**	**375c**	**111**	**315c**

Notes:
a = individual trees; approx. 20 tree pairs per installation
b = 6 control and 6 fertilized trees foliage sampled per installation
c = does not include Type V trees

Summer Field Crew

The crew consisting of graduate students Paul Footen, Kim Littke, and Gonzalo Thienel measured

- GGTIV 3 installations (66 plots) planted in 1966 for understory vegetation survey
- Type I: 3 installations (29 plots) for understory vegetation and habitat survey
- Type III 1 installations (6 plots) for understory vegetation and habitat survey

2010 SMC summer crew members Paul Fotten and Gonzalo Thienel

The salaries and expenses for the summer field crew students were paid by UW funds, primarily the Corkery Family Chair, some of the staff time was paid through the NSF CAFS grant, and expenses for instrumentation were paid by AGENDA 2020 and CAFS funds.

DATABASE

Database Person: Randol Collier, Senior Computer Specialist

At the end of the 10/11 field season, the database contained data from 527 installations which contain 7,742 plots which have been measured 33,531 times. This translates into to 289,284 trees which have been measured a total of 1,670,086 times.

Presently there are 147 active installations of Types I through V. These installations hold 3,485 plots, which in aggregate have been measured 8,386 times. These plots contain 110,293 trees which have in total been measured 566,902 times.

The remaining data are either inactive installations of the old Regional Forest Nutrition Research Program (RFNRP) or active/inactive special contract installations with SMC members.

National Science Foundation Industry-University Cooperative Research Centers (I/UCRC) Center for Advanced Forest Systems (CAFS)

The UW proposal to join CAFS was approved in February 2009. We received $70,000 NSF/CAFS funding in 2009 and again in 2010. This level is contingent on the total amount of funding in each year from UW industry supporters who wrote letters that they wished to join the UW CAFS site; the total support must exceed $300,000 for UW to receive the $70,000 from NSF.

In 2009 three projects were initiated and continued through 2010 with one essentially finished. In 2010 one new project was.

A. CONTINUING PROJECT: Understanding Site-Specific Factors Affecting the Nutrient Demands and Response to Fertilizer by Douglas-fir

INVESTIGATOR(S): UW Faculty (Rob Harrison, David Briggs, and Eric Turnblom) OSU faculty (Doug Maguire, Doug Mainwaring)

PROJECT DESCRIPTION: This project is a paired-tree fertilization study designed to measure general response to N fertilization and identify specific site characteristics that may predict productivity and response. The primary objectives of the proposed study are to evaluate the potential for response of 15-25 year-old stands to N fertilization within a given vegetation/geology type. Secondary objectives include being able to predict potential response from site and stand variables such that cooperators would be able to focus scarce fertilization resources into sites most likely to respond. A third objective would be provide a field laboratory for additional work. Studies of forest fertilization in the Pacific Northwest, which is a major timber-producing region for the United States, are now relatively rare and these studies have the potential to answer some extremely important questions about forest fertilization impacts.

EXPERIMENTAL PLAN: Research installations will be located across the major geologic parent materials/soils and climate zones in the western Douglas-fir region of Oregon and Washington. Stands will be 15-25 yr-old Douglas-fir plantations not previously fertilized. The experimental design (at an "installation") is a randomized complete block with two treatments and nominally 12-15 paired tree blocks at each location. The experimental unit consists of a 1/50th acre circular plot centered on a single subject tree (Figure 1). Each block will consist of two experimental units selected to make the paired tree block as uniform as possible. Even though these 'blocks' will not be physically contiguous, the matching of similar trees will reduce variation, thereby increasing the probability of detecting differences. A small difference in response should be detectable by this design. At each location up to 36, but not less than 24, 1/50th acre circular plots will be established on a 50 foot square grid starting from a well defined and marked reference point (Figure 1). Trees will be paired based on similarity of DBH, height to live crown, height, competition (basal area), and known environmental gradients. Treatments consist of N applied as urea at two levels: 0 lbs N/acre and 200 lbs N/acre broadcast as urea. The following site properties/ parameters will be sampled for each installation, where possible and/or available: 1) site index, 2) LAI, 3) slope, aspect, slope shape, 4) age, 5) elevation: 6) precipitation.

HOW THIS PROJECT IS UNIQUE: This project is different from current SMC projects in that similar fertilization studies have not been carried out in the region. By cooperating and installing a large number of research studies, the hope of being able to predict site-specific response to fertilization, may be realized.

POTENTIAL MEMBER COMPANY BENEFITS: Forest products companies are funding most of the costs of this study. The SMC has not conducted major field studies specifically on forest fertilization for over a decade, primarily because of the costs of the studies involved and a focus on other study priorities, but also from a lack of consensus on what designs would provide the best information for cooperators. Shifting actual forest fertilization to the highest-responding sites in the region could give a much bigger "bang-for-the-buck", including an estimated 50% increase in productivity with the same amount of fertilizer currently applied by selecting highly responsive stands and avoiding unresponsive ones.

EXPECTED DELIVERABLES: The primary deliverables of this study are the creation of a network of studies as proposed above. This matrix of studies will cover the major range of company-owned production lands, as each site is selected based on company preference as well as fitting into the overall study plan.

PROJECT TIMELINE: Year 1 & 2 (field sampling, laboratory analyses, preliminary summary statistics); Years 3-5 (modeling, RA).

PROJECT BUDGET: 2009 and 2010 allocation ➔ $25k each year used for costs of field personnel and instrumentation to set up installations.

PROGRESS: By combining CAFS funding with $25k/yr from AGENDA 2020, sixty paired tree fertilization trial installations (Type V have been created with soil samples collected, temperature and precipitation gages and lysimeters at 10cm and 50cm depth have been installed).

B. PROJECT TITLE: Modeling the Effects of Intensive Plantation Silviculture on Wood Density and Stiffness

INVESTIGATOR(S): David Briggs, University of Washington, Eini Lowell, USFS PNW Research Station; Cosmin Filipescu and Ross Koppenaal, Canadian Wood Fibre Cenre

PROJECT DESCRIPTION: Information concerning the effect of intensive plantation silviculture and genetics on wood properties of PNW conifers is sparse and piecemeal which has precluded integration of wood quality with growth and yield models to improve understanding and predictions. Furthermore, traditional techniques to measure wood properties in standing trees are time consuming and expensive which has precluded routine collection of this information for monitoring the effects of silviculture, obtaining inventory assessments of quality, and other uses. However, recent development of nondestructive testing (NDT) testing technology, such as acoustic, resistance, and near-infrared spectroscopy (NIRS) methods, presents the opportunity to obtain indirect measures of wood stiffness, density, and other properties from standing trees that would enable such pre-harvest wood quality modeling, inventory, and planning activities. This project focuses on (1) using acoustic velocity to estimate wood stiffness, a critical property of lumber and veneer products, (2) using resistance to measure wood density which is strongly linked to quality of traditional wood products and the carbon and energy content of wood, and (3) using NIRS to predict physical (density), mechanical (modulus of elasticity, modulus of rupture), and chemical content (e.g. cellulose and lignin) properties.

EXPERIMENTAL PLAN: Five Levels of Growing Stock (LOGS) thinning trial sites, age 60-75 along a N-S gradient were selected for this study. The LOGS study was initiated in 1961 and provides a record of more than 50 years (Curtis 2006). It was chosen in part because this long time frame spans rotation lengths used by many landowners and provides a baseline for comparisons with younger plantations being grown today. Each site has 3 replications of 8 thinning treatments plus an unthinned control. At each site, 15 trees were sampled from each of the control, 70% basal area retention, and 30% basal area retention thinning plots; a total of 135 trees per site and 540 trees for the study. Acoustic velocity over a 1m distance at breast height

was measured at three locations around the circumference of each sample tree. A 20% (3 tree) subsample of the sample trees on each plot were drilled with a Resistograph and an increment core was taken close to the resistance bore. The increment cores were sent to the USDA Forest Service Southern Research Station for X-ray densitometry and NIR analysis.

HOW THIS PROJECT IS UNIQUE: : The focus on NDT methods to indirectly measure wood properties in standing trees. If using NDT to measure wood properties in standing trees is successful, it will pave the way for further improvements and adoption of NDT tools as part of routine forest management, inventory, and planning procedures.

POTENTIAL MEMBER COMPANY BENEFITS: Knowledge of how much volume (or biomass) inventory exists with a specific range of size and wood property characteristics over space and time is becoming an important aspect of pre-harvest decision support for silvicultural planning and monitoring, harvest scheduling, and marketing for traditional timber products, carbon credits and bio-fuels on a forest estate. This project is aimed at providing wood property assessment tools and models that can be routinely implemented to improve decision support systems.

FUNDING: **2009:** University of Washington PFC $7,000; NSF CAFS 10,738 **2010** USFS PNW Research Station $35,000; University of Washington $5.000; NSF CAFS 14,262 **2011** USFS PNW Research Station $5,000; Canadian Wood Fibre Centre $32000; University of Washington $*5000*

PROGRESS: 2009 study design and acoustic testing on 3 sites. **2010** completion of field data collection, cores sent for analysis, some preliminary results presented. **2011** core analyses completed. Analyses underway, 3 publications anticipated.

C. NEW PROJECT: Biomass Growth and Yield of Intensively Managed Coastal Douglas-fir Plantations

INVESTIGATOR(S): D. Briggs, R. Harrison, E. Turnblom, Rapeepan Kantavichai (PhD student); University of Washington, School of Forest Resources

PROJECT DESCRIPTION: Because of growing interest in forest productivity as it related to carbon, bio-energy there has been a shift of interest in obtaining accurate estimates of above-ground biomass (ABGB) of Douglas-fir trees. However, current methods for estimating ABGB are crude and produce large errors at the local level. This study focuses on developing models bole biomass, the largest component of ABGB, based on local site conditions. The specific objective is to develop models of annual ring biomass growth of intensively managed Douglas-fir plantations that include effects of silvicultural treatments and the local growing environment (soil, precipitation, temperature).

EXPERIMENTAL PLAN: 12 trees were harvested as part of a product recovery study from 5 Douglas-fir thinning trial plots on 4 sites. A cross section disk was taken at the stump and at approximately every 16 (sawmilling tree) or 17 (veneer milling tree) feet on along the stem; typically 5-7 disks/tree. A sample from each disk was taken for x-ray densitometry yielding the width and density of earlywood and latewood of every ring at each disk height. The data set permits reconstruction of earlywood, latewood and total biomass of each annual growth sheath of each tree. Monthly total precipitation, mean maximum and mean minimum temperature data since planting was obtained on the 800m grid at each site from the PRISM climate mapping project (PRISM 2007, Daly et al. 2008). Combining the climate data with local soil data allows calculation of monthly water balances over the same time frame. A statistical model to predict stemwood biomass growth in terms of the climate, water balance, treatment and stand variables is being developed.

HOW THIS PROJECT IS UNIQUE: The data set from multiple points along trees experiencing a wide range of silviculture and climate regimes provides a unique opportunity to build an integrated wood density-volume-biomass modeling system. The wood density and biomass models are also models for carbon and energy content since a kg of dry wood is 50% carbon and 20 MJ/kg energy.

POTENTIAL MEMBER COMPANY BENEFITS: Markets for carbon sequestration and bioenergy offer new opportunities for forest landowners to add value to their forest lands. However, current methods to obtain estimates of carbon and energy, which are related to dry weight (biomass) rather than volume as in traditional log products, or components of a tree or stand have been shown to produce large errors. These errors are a result of (1) old biomass equations that that use allometry with only dbh or dbh and height or (2) use of a species average wood density to convert volume to dry weight. Both methods ignore effects of age, silvicultural treatment, and site specific factors (soil, temperature, precipitation). Success of this study would provide improved predictions of biomass, carbon, and energy productivity of trees in a stand which will be for integrated planning for carbon, energy, and traditional log markets. The model will also facilitate life-cycle assessment of the carbon and energy balance of alternative management regimes.

MILESTONES: 2006-2009. All field data collection and x-ray densitometry done on prior studies. **2010.** Biomass increments calculated, all data integrated and basic model developed.

EXPECTED DELIVERABLES - LONGTERM: Models to predict biomass, carbon, and energy production by trees at the local level. Potential to integrate with growth and yield models to simulate development of biomass, carbon and energy components of stands to assist in forest planning.

EXPECTED DELIVERABLES – ONE YEAR: PhD dissertation

PROJECT TIMELINE: 2010. Create biomass increment database integrated with climate and other data, develop biomass increment model. **2011.** Complete biomass increment model, write and complete PhD dissertation. Develop two journal articles.

PROGRESS TO DATE: Biomass increment modeling complete. Development of dissertation and journal manuscripts underway. Expect completion by Dec 2011.

NEXT YEAR'S PROJECT BUDGET - NSF CAFS PORTION (2011 $10,000); OTHER SOURCES (UW TA & RA 2010 = $40,000; 2011= $20,000).

PRISM 2007. Climatological Normals, The PRISM Group, Oregon State University, Corvallis, OR.

Daly, C., M. Halbleth, J.I. Smith, W.P. Gibson, M.K. Doggett, W.P. Taylog, J. Curtis, , P.P Pasteris. 2008. Physiographically-sensitive mapping of climatilogical temperature and precipitaiton across the conterminous United Statees. Internaitonal Journal of Climatology, published online in Wiley InterScience (www.interscience.wiley.com) DOI:10.2002/joc.1688.

D. COMPLETED PROJECT: Remote Sensing for Measuring and Monitoring the Response of Plantations to Intensive Management

INVESTIGATOR(S): L. Monika Moskal (UW)

PROJECT DESCRIPTION: This project will contribute to CAFS' mission by introducing spatially explicit dynamic change monitoring techniques capable of assessing the effectiveness of intensive plantation silviculture and management techniques at scales from individual tree level to stand and ecosystem levels. Laser scanning methods such as aerial LiDAR have been effectively demonstrated by many, for example: in forest height inventory assessment (Andersen et al 2006), multiple resource inventory (Reutebuch et al 2005), precision forestry (Moskal et al. 2008) and ecosystem studies (Lefsky et al 2002). The improvements in density, quality and foremost availability of aerial and terrestrial LiDAR technology have supplemented the inventory research and facilitated research focusing on leaf area and productivity parameterization necessary for assessment of ecosystem services (Zheng and Moskal, 2008; Richardson et al 2008) . Previously, Vose and Allen (1988) have demonstrated the relationship between leaf area and nutrient through ground sampling, however, non-destructive testing methods facilitated by terrestrial laser scanning allow for re-visitation and multitemporal assessment of above ground biomass accumulation; a critical characteristics of productivity that can be related to carbon sequestration or water interception. The relationship between nutrient treatments and plantation response has not been explored through the laser scanner remote sensing perspective. Such approach, combined with three-dimensional crown reconstruction (Moskal and Kato, 2008; Kato et al 2008) and point cloud slicing (Zheng and Moskal 2008), will benefit from the systematic ability of aerial and satellite LiDAR to capture spatially explicit coverages and the fine structural and temporal resolutions provided by the terrestrial LiDAR instrument.

EXPERIMENTAL PLAN: We assessed multi-scale, from tree-level to stand and greater, forest inventory characteristics and leaf are index of plantation and intensive management experimental sites. The assessment will required multitemporal monitoring at the ground level, with a terrestrial laser scanner (Leica Scan Station 2), through the growing season, as well as fusion of the terrestrial scanning observation with available aerial and satellite based (IceSAT/GLAS) LiDAR data. The analysis will utilizde point cloud slicing approach (Zheng and Moskal 2008) and three dimensional crown reconstruction (Kato et al. 2008), to determine dynamic changes in the forest inventory parameters and crown formation, including leaf area index. The assessments were validated using field data; were available.

HOW THIS PROJECT IS UNIQUE: Our approach develops methods that synergize data from multiple scans and fuse that information with additional sensor observations. Our techniques are evolving to utilize the three dimensional structure inherent in the LiDAR data and promise to deliver finally resolved parameters of forest structure that can compliment field observations and other methods of sampling.

MEMBER COMPANY BENEFITS: Algorithms and protocols for collecting and analyzing terrestrial LiDAR data.

DELIVERABLES:

- Graduate Student Participants: Guang Zheng –PhD Dissertation entitled Terrestrial Laser Scanning of Leaf Area will be completed in early 2011.
- Undergraduate Student Participants: Chris Vondrasek, Megan Davis, Brendan Boyer

PEER-REVIEWED PUBLICATIONS (PUBLISHED):

- Zheng G., Moskal L.M, 2009. Retrieving Leaf Area Index (LAI) Using Remote Sensing: Theories, Methods and Sensors. Sensors, 9(4):2719-2745.

- Moskal, L. M., T. Erdody, A. Kato, J. Richardson, G. Zheng and D. Briggs, 2009. Aerial and Terrestrial LiDAR Applications in Precision Forestry, SilviLaser2009 Peer reviewed Conference Proceedings, College Station, TX.

PUBLICATIONS (IN REVIEW)

- Moskal, L.M., A. Kato, G. Zheng, N. Vaughn and D. Briggs, submitted 2011, LiDAR Applications in Precision Forestry, Forests.
- Zheng, G., and L.M. Moskal, submitted 2011, Spatial variability of terrestrial laser scanner (TLS) based.
- leaf area index (LAI). International Journal of Remote Sensing.
- Zheng, G., L.M. Moskal and S-H. Kim, submitted 2011, Retrieval of effective leaf area index in heterogeneous forests with a terrestrial laser scanner. Agricultural and Forest Meteorology.
- Moskal, L.M. and G. Zheng, submitted 2010, Retrieving Forest Inventory Variables with Terrestrial Laser Scanning (TLS) in Urban Heterogeneous Forest, ISPRS Journal of Photogrammetry and Remote Sensing.
- Zheng, G., and L.M. Moskal, submitted 2010, Toolkit for Terrestrial LiDAR: An object-oriented cross-platform program for retrieving leaf area index (LAI) and forest inventory parameters. Computers & Geosciences.
- Zheng, G., and L.M. Moskal, submitted 2010, Leaf Orientation Retrieval from Terrestrial Laser Scanner.
- (TLS) Data. IEEE Transactions on Geosciences and Remote Sensing.

OTHER PUBLICATIONS & REPORTS:

- Zheng G. and L. M. Moskal, 2008. Leaf Area Index (LAI) from Terrestrial LiDAR. Factsheet # 2. Remote Sensing and Geospatial Application Laboratory, University of Washington, Seattle, WA.
- Moskal., L. M. and G. Zheng, 2008. Forest inventory and stem characterization from terrestrial LiDAR. Factsheet # 1. Remote Sensing and Geospatial Application Laboratory, University of Washington, Seattle, WA.

PRESENTATIONS:

- Zheng, G. and L.M. Moskal, 2011. Combining Computational Geometry and Terrestrial Laser Scanner for Quantifying Leaf Area Index and Canopy Structure at Forest Plot Level. Accepted to the American Association of Geographers Annual Meeting, Seattle, WA, April 2011.
- Terrestrial LiDAR: The Application of Leaf Area Index (LAI), LiDAR10 – International LiDAR Forum, Denver, CO, February, 2010.
- Moskal, L. M., T. Erdody, A. Kato, J. Richardson, G. Zheng and D. Briggs, 2009. LiDAR Applications in Precision Forestry, Puget Sound and Columbia Regions Fall Info Exchange, Vancouver, WA .
- Zheng, G. and L. M. Moskal Determining LAI from terrestrial LiDAR. Puget Sound and Columbia Regions Fall Info Exchange, V ancouver, WA.

- Zheng, G. and L. M. Moskal Terrestrial LiDAR scanning for leaf area index. ASPRS Puget Sound Region Spring Info Exchange, Seattle, WA, February 2009.

NUTRITION PROJECT PROGRESS REPORT

Project Leader: Rob Harrison, University of Washington

Graduate Students: Paul Footen (M.S. completed Dec. 2010), Kim Littke (Ph.D.), Austin Himes (M.S.), University of Washington.

A copy of this report is available at:

http://soilslab.cfr.washington.edu/publications/SMC-Nutrition-2010.doc

PROGRESS TO DATE

The major SMC-related work on nutrition completed in 2010 includes 1) continued establishment (to 73 total current) of Type V Paired-Tree fertilization studies, and initiation of an NSF-funded study of the fate of N-15 fertilizer applications at the site, 2) additional work on the Fall River/ Matlock/ Molalla research studies including producing an assimilatory paper comparing 5 year biomass at each site, nitrogen leaching at Fall River and Matlock, and characterizing current biomass at Fall River, 3) Paul Footen finishing his M.S. with a thesis on the carryover study.

1. Type V Paired-Tree Fertilization Study Summary

OBJECTIVES: The primary objectives of this study are to evaluate the potential for response of 15-25 year-old stands to N fertilization within a given vegetation/geology type. Secondary objectives include being able to predict potential response from site and stand variables such that cooperators would be able to focus scarce fertilization resources into sites most likely to respond. A third objective would be to acquire outside funding to expand the scope and usefulness of the fertilization studies by providing a field laboratory for additional work. These studies have the potential to attract already-funded graduate students and visiting faculty (in fact, they previously have, and currently are) further amplifying the impact of the study.

METHODS: The design for installing fertilizer treatments are copied almost exactly from the design utilized by Weyerhaeuser Company in similar research studies, as well as the CIPS fertilizer studies of Doug Maguire and Doug Mainwaring. A copy of the establishment report for the CIPS study is available at:

http://soilslab.cfr.washington.edu/publications/MaguireFertilizationProject2007.pdf

Copying their installation design not only allows this study to utilized the combined earlier thought that went into designing these studies, but also to greatly increase the coverage and "n" available when results of several studies are combined.

STAND AND SITE SELECTION: SMC Type V installations are located across the major geologic parent materials/soils and climate zones in the western Douglas-fir region of Oregon and Washington (Figure 1). Climate zone and parent materials were used to stratify the land for sampling.

A copy of the candidate area selection form is available from:

http://soilslab.cfr.washington.edu/publications/TypeV_SingleTreeFert.doc

With SMC cooperator input, we selected the strata with the most land coverage selected by each cooperator ensuring that each cooperator is included, but are also including minor strata that could provide meaningful information about response diagnostics. A portion of the stands were selected with attempts to include stands near the endpoints of the range of elevation, precipitation, site index, slope, etc. to allow interpolation of statistical models rather than extrapolation. Position on slope (ridge, sideslope, toeslope) were also considered when selecting sites, but it was difficult to find toeslopes. Priority was given those stands that have not received fertilization or thinning in the past 10 years. To date, all stands in the study meet these criteria. Existing SMC and Swiss Needle Cast Co-op "Beyond Nitrogen" installations are also being considered as a secondary part of this study, and indeed, additional work in CIPS "Beyond Nitrogen" studies were funded as part of the Agenda 2020 study proposal along with the new SMC sites.

EXPERIMENTAL DESIGN: The experimental design (at an "installation") is a randomized complete block with two treatments and nominally 19-20 paired tree blocks at each location. The experimental unit consists of a 1/50th acre circular plot centered on a single subject tree. Each block consists of two experimental units selected to make the paired tree block as uniform as possible, primarily with respect to tree size, crown dimension, stocking in relation to surrounding trees, aspect, slope, soils, vegetation etc. Even though these "blocks" will not be physically contiguous, the matching of similar trees will reduce variation, thereby increasing the probability of detecting differences between treatments. The sampling unit is the single tree at the center of the plot. There are about 19-10 paired tree blocks per location with two treatments for a total of 38-40 single tree plots that are being established. One of the paired tree subplots is being randomly chosen to be fertilized.

Analysis is at the installation level and grouping by parent material types or other soil property choices for stratification as well as by position on slope within parent material types. A small difference in response should be detectable by this design.

A joint SMC/CIPS equipment proposal was selected for funding in the latest Agenda 2020 program, entitled "Agenda 2020 Management of PNW forest plantations: Additional site characterization and instrumentation for SMC/CIPS Paired-Tree Fertilization Projects". Support for new research for the fertilization project is at $100K/year for 3 years. A copy of the proposal is available at:

http://soilslab.cfr.washington.edu/publications/Agenda2020ProposalFinal.doc

Kim Littke, who is the full-time Ph.D. student working on the fertilization project, continues to secure all of her personal support (stipend and tuition) from CFR scholarships and assistantships, which is a contribution of approximately $36,000 per year in terms of member dues plus overhead for 2008. We also received funding from the NSF CAFS (Center for Advanced Forest Systems) of $20,000 for 2009 (and 2010) to install and instrument additional sites. Such funding will help us greatly to multiply the impact of SMC member contributions to the overall project.

A total of 71 Douglas-fir and 2 Ponderosa pine Paired Tree Installations have been installed through the end of 2010 (Figure 1). Details of sampling methods can be found in last year's SMC Nutrition report at:

http://soilslab.cfr.washington.edu/publications/SMC-Nutrition-2009.doc

Results so far indicate that there is an initial response to fertilization overall, though most of the responses are small. Full response data for two year's growth (except for the 11 sites installed in winter2010/spring2011) should be available at the end of the growing season (Fall, 2011) for most sites and three growing seasons for the six installed the first year of the study. Foliar response data indicates that the crown is responding with increased needle size vs. nitrogen concentration, which is a normal precursor to stem volume growth (Figure 2). Foliage will be sampled again at the end of this growing season.

2. Fall River/Matlock/Molalla LTSP:

We now work on the Fall River, Matlock and Molalla LTSP's as an integrated project, with decisions on what to do at each site aimed at maximizing the overall usefulness of the work. Work emphasis was actually shifted to Matlock and Molalla because of loss of funding and need for timely work there. NCASI has decided to renew the original $40K/year funding level (earlier cut to $24K) for 2011-2012 for the 15th continuous year of funding for this project. Accomplishments related to Fall River work include:

Work from 2010 has been completed. We have published a special issue (Issue 1 in 2011) of the Journal *Forest Science* entitled "Deep Soils". Rob Harrison, Tom Fox and Dan Richter were editors. The cover of this issue shows a profile of a Boistfort series soil from the Fall River LTSP with C and N distribution with depth (Figure 1). Two of the eight articles in the special issue include detailed information from the Fall River, Matlock and Molalla LTSPs, including "Initial Response of Soil Carbon and Nitrogen to Harvest Intensity and Competing Vegetation Control in Douglas-Fir (*Pseudotsuga menziesii*) Plantations of the Pacific Northwest" by Robert A. Slesak, Stephen H. Schoenholtz, Timothy B. Harrington, and Nathan A. Meehan (Slesak et al. 2011), and Deep Soil Horizons: Contribution and Importance to Soil Carbon Pools and in Assessing Whole-Ecosystem Response to Management and Global Change by Robert B. Harrison, Paul W. Footen, and Brian D. Strahm (Harrison et al. 2011).

Copies of the entire publication are available at:

http://soilslab.cfr.washington.edu/publications/DeepSoilsForestScience2011.pdf

Chapter 6 in "Maintaining Adequate Nutrient Supply — Principles, Decision-Support Tools, and Best Management Practices" by Robert B. Harrison, Douglas A. Maguire and Deborah Page-Dumroese, in Sam D. Angima and Thomas A. Terry (eds) Best Management Practices for Maintaining Soil Productivity in the Douglas-fir Region. Oregon State University extension manuscript EM9023, April 2011 was also completed

Copies of the entire manuscript are available at:

http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20678/em9023.pdf

A compilation comparison of the Fall River, Matlock and Molalla 5-year growth results was recently reviewed favorably by Forest Ecology and Management. Comments are being addressed and a rewrite will be returned to the journal soon. The title is: "Predicting 5-year vegetation control effects on aboveground biomass and nitrogen distribution of planted Douglas-fir on three sites" by W.D. Devine, T.B. Harrington, T.A. Terry, R.B. Harrison, R.A. Slesak, D.H. Peter, C.A. Harrington, C.J. Shilling, S.H. Schoenholtz". Figure 3 shows the most important graph from the journal article, showing the "low, medium and high" productivity of Matlock, Molalla and Fall River LTSPs, and the major impact of vegetation control on growth of the plantation trees.

Measurements of current tree diameters and heights at the Fall River LTSP are being completed, and 26 trees have been sampled, harvested and processed to provide estimates of biomass in the bole-only harvest with and without competing vegetation control. Nutrient and carbon pools will also be estimated after analyses of the samples are made. Field and lab work is currently being completed and we are preparing a journal article on methodology and results. We expect that it will be several months before this manuscript is ready. Figure 4 shows the basic results of the dry total biomass vs. stem D^2H. There was essentially no difference between year 5 and year 11 biomass vs. D^2H, so the data was combined.

3. Carryover Effects of N-fertilization.

Paul Footen continued to make progress on work on the carryover study. Paul should finish his M.S. degree in 2010, and plans to continue on for a Ph.D. in forest soils at UW. He is publishing a journal article based on the growth of seedlings and young trees from the carryover study as follows: "Long-term Effects of Nitrogen Fertilization on the Productivity of Subsequent Stands of Douglas-fir in the Pacific Northwest" in Forest Ecology and Management". An abstract of the paper shows the significant long-term impact of N fertilization on the growth of the subsequent plantation:

"The carryover effects of N fertilization on five coastal Pacific Northwest Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) plantations were studied. "Carryover" is defined as the long-term impact of N fertilizer added to a previous stand on the growth of a subsequent stand. Average height and diameter at 1.3 m above-ground (DBH) of 7-9-year-old Douglas-fir trees and biomass and N-content of understory vegetation were assessed on paired control (untreated) and urea-N-fertilized plots that had received cumulative additions of 810-1120 kg N/ha to a previous stand. Overall productivity was significantly greater in the fertilized stands compared to the controls. In 2006, the last growth measurement year, mean seedling height was 15% greater ($p = 0.06$) and mean DBH was 29% greater ($p = 0.04$) on previously fertilized plots compared to control plots. Understory vegetation biomass of fertilized plots was 73% greater ($p = 0.005$), and N-content was 97% greater ($p = 0.004$) compared to control plots. These results show that past N fertilization markedly increased seedling growth in these plantations as well as biomass and N-content of understory vegetation in a subsequent rotation. These findings suggest that N fertilization could potentially increase site productivity of young Douglas-fir stands found on low quality sites in the Pacific Northwest 15–22 years after application by a carryover effect. These plantations have not yet reached the age where marketable materials can be harvested from them, and the growth of trees should be monitored over a longer time period before potential impacts on older stands, if any, can be determined."

The "bottom line" results from the study showed significant increases in total height and DBH of young trees planted after the previous fertilization was done, up to 20 years afterward.

Conclusions from the study include the following:

1) Repeated N fertilization of previous stands coupled with postharvest organic matter retention increased DBH by 29% and total height by 15% for a new Douglas-fir plantation in the Pacific Northwest compared to an unfertilized control.

2) Biomass and N-content of understory vegetation increased by 73% and 93%, respectively in N-fertilized compared to unfertilized stands.

3) The effects of repeated N fertilization may last much longer than previously understood when considering impacts of that fertilization on young, replanted second growth stands instead of first rotation stands.

4) Increases in tree growth witnessed on carryover plots should continue to increase with time; meaning earlier first commercial entry and harvest than on the paired controls.

The text of the entire article is available at:

http://soilslab.cfr.washington.edu/publications/Footen-etal-2009.pdf

A copy of Paul's M.S. thesis, completed in 2011, is available at:

http://soilslab.cfr.washington.edu/publications/FootenPaul-thesis-2011.pdf

PUBLICATIONS

Journal articles published in 2010 or early 2011

Lippke, B., E. Oneil, R. Harrison, K. Skog, L. Gustavsson, and R. Sathre. 2011. Life cycle impacts of forest management and wood utilization on carbon mitigation: knowns and unknowns. Future Science: Carbon Management 2:303-333.

Harrison, R.B., D.A. Maguire, and D. Page-Dumroese. 2011. Maintaining Adequate Nutrient Supply — Principles, Decision Support Tools, and Best Management Practices. Page 33-42 *in* S.D. Angima and T.A. Terry Best Management Practices for Maintaining Soil productivity in the Douglas-fir Region. Oregon State University EM 9023.

Available at: http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20678/em9023.pdf

Harrison, R.B., P.W. Footen and B.D. Strahm. 2011. Deep soil horizons: Contribution and importance to soil C pools and in assessing whole-ecosystem response to management and global change. Forest Science 57:67-76.

Available at: http://soilslab.cfr.washington.edu/publications/Harrison-etal-2011.pdf

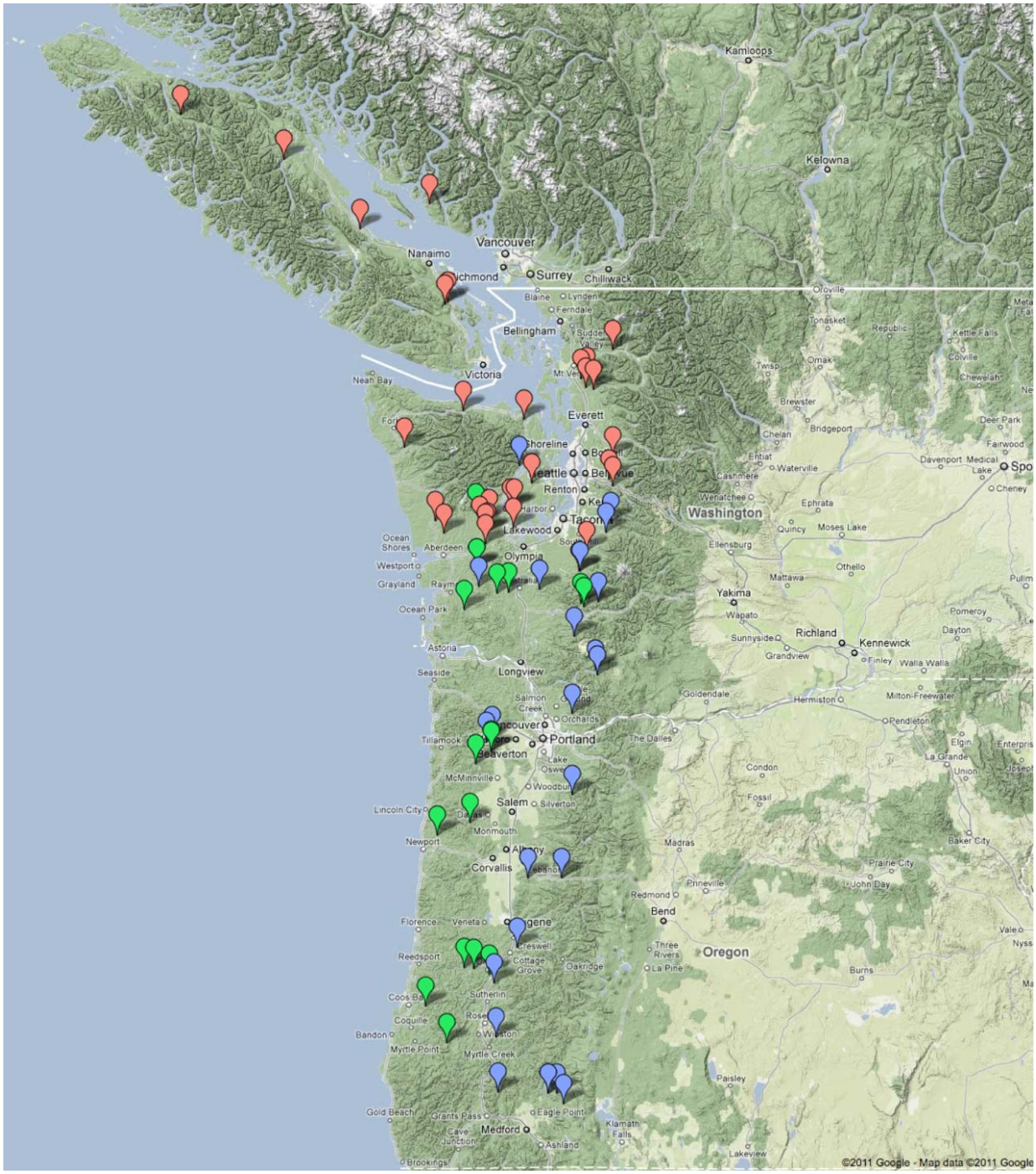


Figure 1. Distribution of current and pending installations in the SMC Type V Paired-tree fertilization study. Red indicators are for glacial origin sites, green for sedimentary, and blue for volcanic origin sites.

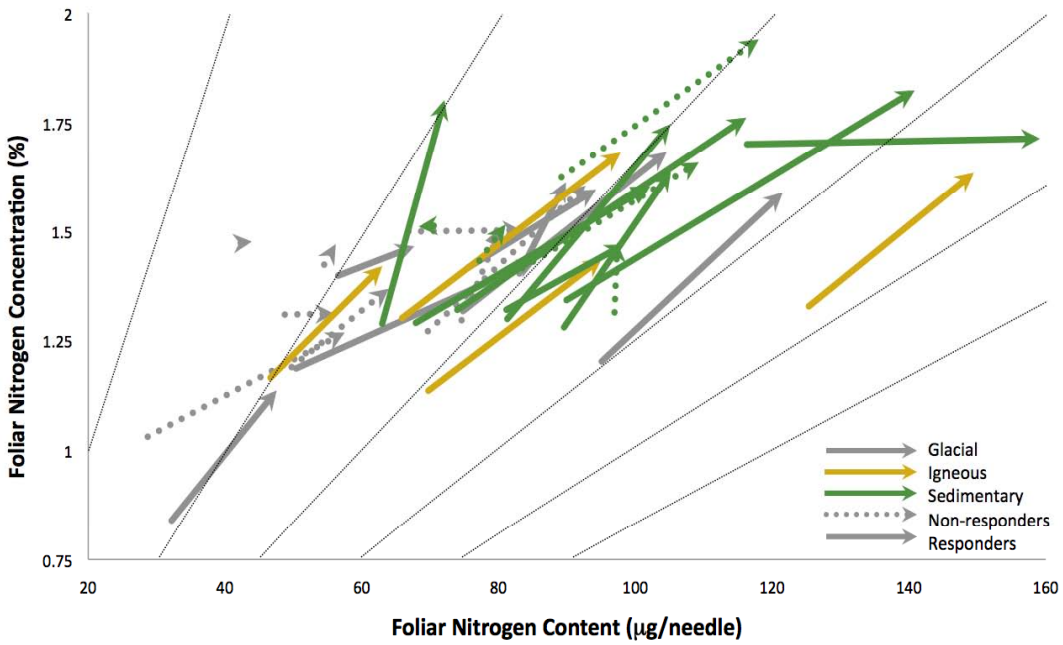


Figure 2. Graphical analysis of response of foliage to N fertilization.

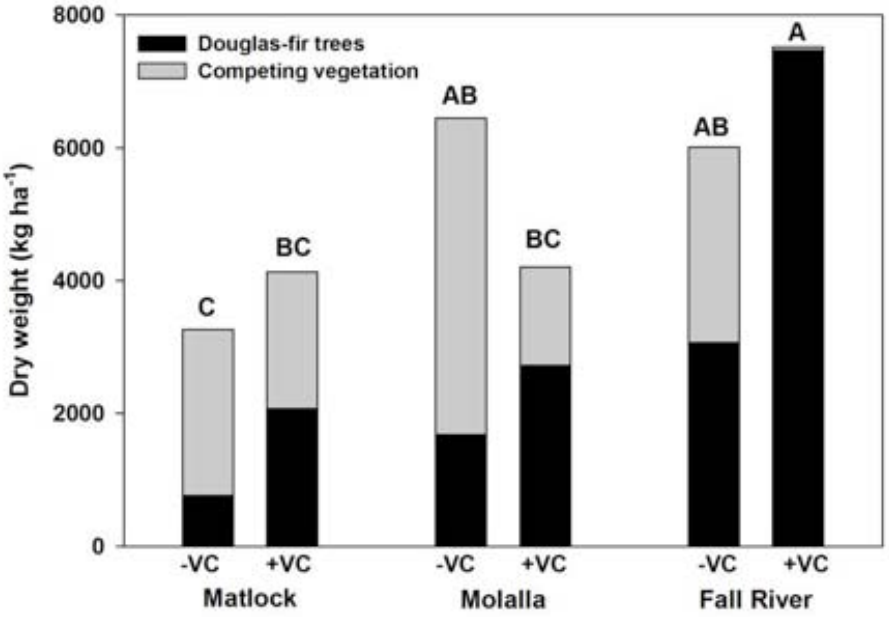


Figure 3. Aboveground biomass at age 5 after planting at the three PNW LTSP studies.

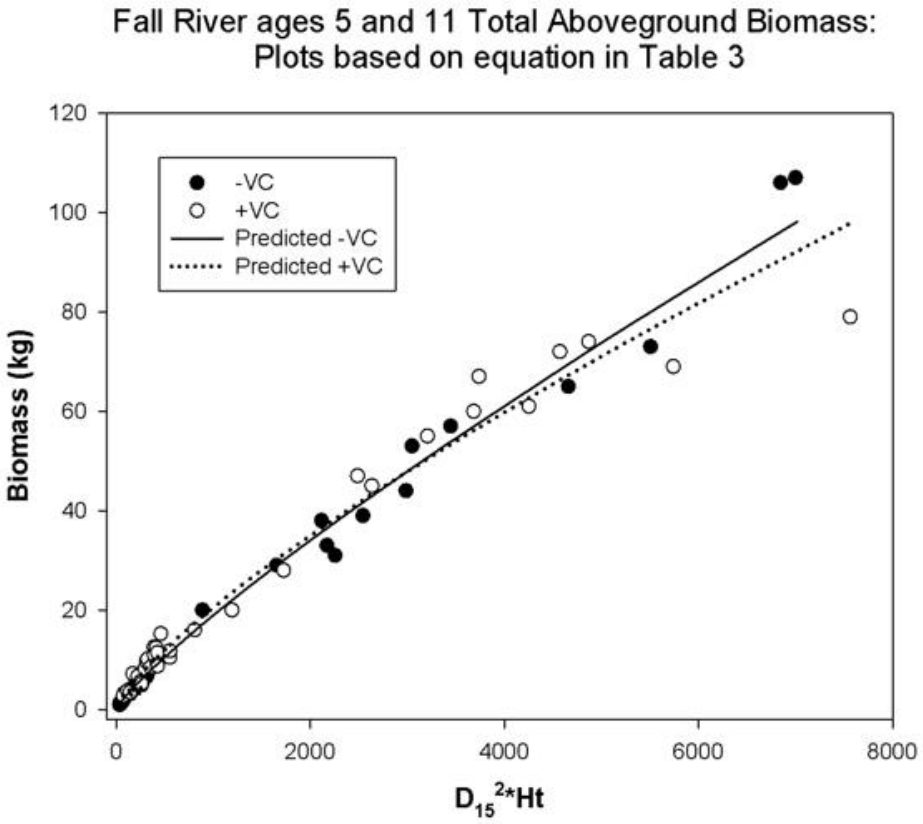


Figure 4. Biomass vs. D^2H relationships for Fall River trees.

SILVICULTURE PROJECT PROGRESS REPORT

Project Leader: Eric Turnblom, University of Washington

Graduate Students: Kevin Ceder (Ph.D.), Jeff Comnick (Ph.D.), Nai Saetern (M.S.), Nick Vaughn (Ph.D.), University of Washington

The Silviculture Project Leader oversaw the SMC mission-driven data gathering and information syntheses in 2010. Data collection was completed for the research sites scheduled for measurement as given in the Field Work summary earlier in this report. In particular, the measurements made at the Type IV installations gave us 7-yr from seed information on the first three plantations in that trial. The complete 7-yr set will be available after the 2011 growing season.

Overstory / understory vegetation relationship modeling funded by NCASI was completed in 2010. Static and dynamics models were derived for total cover and major life forms (fern, forb, grass, shrub), species guilds (tolerant, intolerant, annual, perennial, etc.), and some individual species for which adequate data existed. A final presentation was made at the Technical Committee meeting of the Western Wildlife Program in Spring this year. Two peer-reviewed manuscripts are in preparation to report these results to the research community at large. Silviculture Project Leader Turnblom also worked with graduate student R. Kantavichai and David Briggs, SMC Director to co-author a paper on butt-log quality as judged from breast-height region assessments using data collected in the Type I installations. New MS student Jed Bryce joined the pool of SMC graduate student analysts and will be working with breast-height region assessments of butt-log quality in Type III research sites.

Work also advanced on the "Sun Tree Identification" project sponsored by the Olympic Natural Resources Center (ONRC) and USFS. Graduate student Nick Vaughn assists on this project and has developed some very promising techniques for identifying / separating the sun tree layer as well as other distinct canopy layers in multi-layered canopy forests growing on the Olympic Peninsula. A manuscript is now in preparation that reports the findings, likely to be submitted in 2011.

Work on a project in collaboration with ONRC / USFS this is examining the quantity of available and recoverable biomass in the form of logging slash. The area of focus is the North Olympic Peninsula, which includes Clallum, Kitsap, Jefferson, and northern Grays Harbor and Mason counties. The goal is to establish an "investment grade" ratio of recoverable tons of biomass per acre logged for the region.

Work continued on the "Silviculture Manipulations Consequences on Stand Management Cooperative Sites," or, the "SMC2 Report," which will feature summaries of research plot behavior to date on Type I, II, and III installations, one Strategic Plan goal for the Silviculture Project. We are focusing on the Type III sites (the youngest) first (Ph.D. candidate Kevin Ceder is assisting in this effort), followed by the Type I sites (next older cohort, analysis assisted by graduate student Nai Saetern), and finally the Type II sites (analysis assistance provided by Ph.D. student Jeff Comnick). Work also continued on a second Silviculture Project Strategic Plan goal, a model validation study covering some of the most recently developed models, such as TreeLab and SMC-CONIFERS, as well as some extant models, such as SMC-ORGANON and FVS. Phase one of three will identify criteria and indicators for identifying high-quality data sets for inclusion in the validation, phase 2 will be to obtain agreements with "owners" of the highest quality data for use in the study and identify a standard set of model "runs," and 3) run the models and analyze and report the results.

Silviculture Project Leader Turnblom participated in the SMC strategic planning meeting in January 2010 and engaged with the Wood Quality TAC meeting in February to collaborate with efforts on each of these

fronts. Work planning for the Silviculture Project also included continuing the collection of planned harvest dates for all SMC research sites so that the final measurement workload can be planned for and balanced.

In summer of 2010, Silviculture Project Leader Turnblom, Database Manager / Research Forester Collier, visiting scientist Eric Zenner, and grad student Jeff Comnick stem-mapped the four narrowest spacings at six Type III installations: Brittain Creek #1, #2, #3 (Installations 919, 920, 921) and Forks #1, #2, #3 (Installations 930, 931, 932). Dr. Zenner and Project Leader Turnblom are collaborating in a study examining the performance of several old and several new structural diversity indexes. Grad student Comnick will likely use these data as part of his Ph.D. work on developing fast field protocols for gathering crown information and their utility for adding spatial information to growth models.

Immediately following the 2010 SMC Fall Policy Committee Meeting, Project Leader Turnblom led SMC members and interested parties through the Roaring River SMC site (Installation 718) to assess status, evaluate treatment regime outcomes, and discuss study duration or longevity. Much beneficial discussion ensued.

Genetic Gain/Type IV Joint Trial (GGTIV) Results at Age Five: All Sites

The many advances made improving Douglas-fir in the region are based on results derived principally from experiments using a design in which many families were grown intermixed with each other, so estimates of per acre yield for a single family are extrapolations at best, or at worst, impossible. Through diligent work within the Northwest Tree Improvement Co-op (NTIC) and the Stand Management Co-op (SMC), these sites were established to address this question of per acre yield among others through "block plot" trials.

A multitude of objectives exist for this study: (1) To understand the long-term effects on productivity, quality, and diversity of Douglas-fir trees and stands when the latest advances in genetics, seedling culture, and early vegetation management are deployed in combination; (2) To demonstrate volume gains on an area basis; (3) To provide data to modify / update growth models for effects caused by genetic selection, intensive weed control and different spacing; (4) To compare the growth of genetically selected trees to unselected woods-run trees; and (5) To compare the predicted genetic gains derived from progeny tests with realized gains in independent block plot trials.

The experimental design for this study is known as a Randomized Block Design, where sites are statistical blocks, six in total spread over Grays Harbor Breeding Zone. Three factors are being examined: Genetic levels of seedlots, Density of planting, and Vegetation control type. There are three levels of genetic gain being tested: (1) Base population, i.e., a random sample of 50 wild trees distributed throughout the Grays Harbor breeding zone), (2) Intermediate population, which is a mix of pair crosses among 20 parent trees chosen to represent an intermediate level of genetic gain, and (3) Elite population, a mix of crosses among clones of the 20 best parent trees in each breeding unit designed to represent a high level of genetic gain. Planting density has three levels: (1) Low density – 15 × 15', or 200 Stems Per Acre (SPA), (2) Intermediate density – 10 x 10', or 440 SPA, and (3) High density – 7 × 7', or 889 SPA. Vegetation control has two types: (1) Standard or operational – single application as site prep, and (2) Complete, or 80% or better bare ground for five years. There are 22 plots at each of the six sites (0.23 to 0.33 ac in size) and there are 64, 100, and 250 trees per plot for density levels 1, 2, and 3, respectively.

DBH Response

Figure 1 shows how DBH responded to genetic gain level ($p = 0.001$) and the spacing factor ($p = 0.052$). While there was no significant difference between intermediate (mid-) and elite gain levels, they outperformed woods-run by 13% and almost 16%, respectively. Note that the pattern in DBH with respect to spacing is consistent overall with the so-called "crossover" effect, observed in other density trials with Douglas-fir. Across all sites, DBH in complete weed control stands edged past the stands receiving a single application of herbicides, but not significantly so. There were, however, significant differences observed between the two weed control levels on some individual sites.

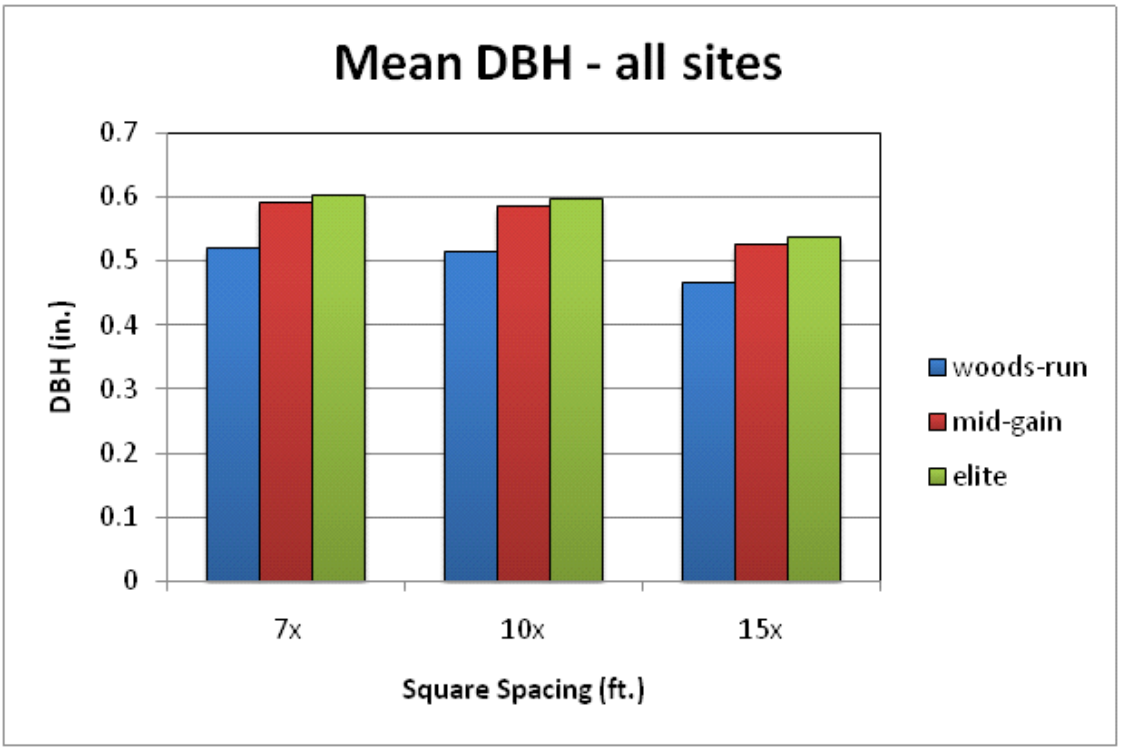


Figure 1. Attained DBH after four growing seasons (total age 5 years from seed) over all six sites.

Height Response

Figure 2 exhibits how height responded to genetic gain level ($p = 0.001$) and planting spacing ($p = 0.052$). As with DBH, the intermediate gain could not be statistically distinguished from the elite gain level, but each outperformed the woods-run (unimproved) level by about 8% and 10%, respectively, slightly smaller responses than for DBH on a relative basis. Note again that as with DBH, the pattern in height with respect to spacing is consistent overall with the so-called "crossover" effect. As with DBH, the overall response in height to weed control was not significant, except at two sites; trees growing in the weed-free sites were taller at these two sites ($p = 0.036$).

A correlation of 0.73 between age 3 and 5 estimated gains in height was observed.

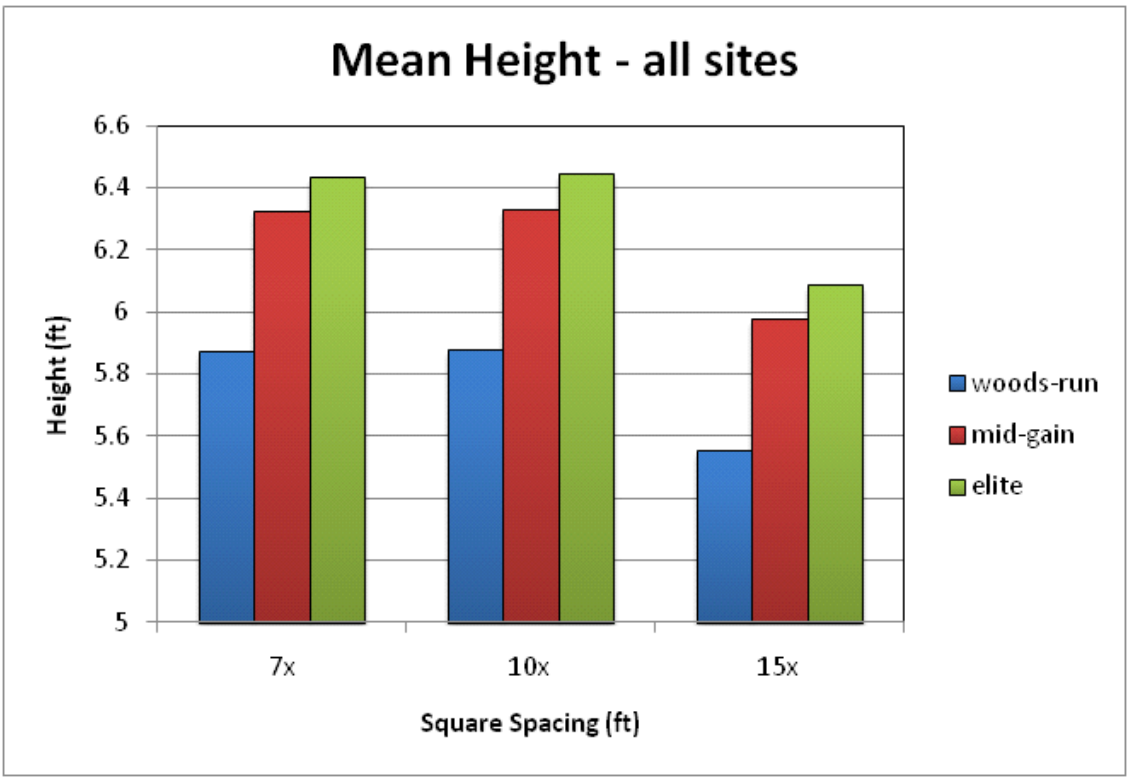


Figure 2. Attained Height after four growing seasons (total age 5 years from seed) over all six sites.

Survival Response

Over all sites, stands receiving complete weed control for five years exhibited an average survival rate that is 3% higher than the stands that received a single herbicide application at the time of site prep ($p = 0.034$). There were no statistically significant responses beyond that, i.e., there are no observable differences in survival due to either planting density or genetic gain level to date.

In general, we expect the differences observed to date to become greater as trees grow older and larger. The current plan includes monitoring these sites through measurement every two years until average heights approach 30 ft., then every four years thereafter.

Understory Vegetation Cover Prediction in Young, Managed Stands of Western Washington and Oregon

Understory vegetation in young stands is often regarded as a problem, because it competes with trees and may reduce tree growth, commonly being remedied by application of herbicides to maximize growing space for trees. This vegetation provides the bulk of the biodiversity and habitat in young stands. As public interest increases in sustainable forest management, managers may be asked to explain the biodiversity and/or habitat provided by these young forests. Since models of understory vegetation cover and composition in young stands are lacking, one solution would be to collect more data to get this information, adding probably significant cost to forest management. An alternate, efficient solution is to develop models that use readily available operational forest inventory data to predict vegetation cover and composition.

This project developed overstory/understory relationships using data mostly from SMC Silviculture Project Type III installations, with some data from older stands coming from Type I and II installations (Figure 3) displays the locations of study sites used for the analysis). Models for total cover and major life forms (fern, forb, grass, shrub), species guilds (tolerant, intolerant, annual, perennial, etc.), and some individual species for which adequate data existed at the species level in young managed Dou-glas-fir stands over time were developed. Both predictive, or static, models and dynamic models were developed. The static models predict expected cover, given some combination of basal area, trees per acre, top height, slope, aspect, elevation, latitude, and longitude. The dynamic models predict expected change in cover, given initial amount of cover and some mix of the stand and site variables already mentioned. Graduate student Kevin Ceder continued work on this project with Silviculture Project Leader Turnblom. Funding for this project was largely provided by the Western Wildlife Program of the National Council for Air and Stream Improvement (NCASI). (See "SMC Vegetation Data Collection Results in Understory Vegetation Models," by Ceder, K.R. and E.C. Turnblom, SMC Quarterly Newsletter 3rd Quarter 2010, for an early report on results.)

Figure 3. Locations of SMC Installations used in the vegetation dynamics study.

While early data exploration suggested the use of nonlinear models, it was unknown how the interaction should play out in the models. These explorations also suggested that the proportion of total cover represented by constituent vegetation groups and species may be more consistent and easy to predict than absolute cover.

The final set of models highlight several points. The superior performance of nonlinear models furthers the idea that dynamics in these communities are nonlinear in nature. While it was assumed that overstory structure is the dominant factor driving understory vegetation cover, location and site productivity variables were significant as well, pointing to climatic and productivity gradients being important factors in addition to light interception by the overstory. For any given stand structure and location, the composition of the understory vegetation is more consistent than the absolute cover of each constituent group or species. Total cover along with life form, ecological group and species proportion models leave a substantial amount not yet explained due to variables that either were not included, such as modeled climate variables

used in other studies, or not available, such as herbivory effects by animal populations in the area. Including these variables, if they are available or measurable, may help in predictions and understanding of the community dynamics in more detail.

Sun Trees Detection From Ordinary (Tree List) Inventory Data

Stand Density Management Diagrams (SDMDs) themselves were developed largely for use in quantifying and encapsulating stand dynamics into a few variables for single canopy (single stratum, and by implication single cohort) stands. However, the limiting size-density relationships upon which SDMDs are based apply equally well to mixed species stands possessing multiple strata, perhaps even multiple cohorts. In a light-limited environment such as is found on the Olympic Peninsula of Washington there is reason to believe that the top (or uppermost) level stratum (or cohort) still drives size/density dynamics. The objective of this study is to test existing stratum-identification algorithms and either modify them or develop a new one as necessary for use in this environment to identify objectively the individual strata in multi-strata (or multi-cohort) stands. By direct imputation, the tallest or top level stratum should be composed of so-called sun-trees, identifiable by their shade intolerance, rapid growth rates, high light compensation points, etc. Graduate Student Assistant Nick Vaughn continued to work on this project in 2010. This project was funded mainly by a collaborative agreement between the Olympic Experimental State Forest, the US Forest Service, and the Olympic Natural Resources Center, University of Washington.

In order to compare the performance of different algorithms, some idea of the correct number of layers was required. We desired a majority opinion that would serve as a benchmark number of strata for each stand. In order to obtain such a majority opinion, we derived a survey that could be answered by a human respondent in a reasonable amount of time. Requests to participate in the study were made to 32 individuals randomly selected from a compiled list of silviculture instructors in the U.S. and Canada. Survey response rate was moderate (34%). Mean numbers of strata for the 44 stands in the survey, covering the entire range of conditions represented by the 3495 stand inventory at our disposal, were estimated with a standard deviation of 0.19 layers.

Results from comparing the number of strata (layers) predicted by each existing algorithm (Latham and Baker-Wilson) and the new, clustering algorithm we developed indicate several points. The Latham algorithm performed most poorly, over-predicting the number of actual strata on average, and by as much as a factor of 3 in some cases. The Baker-Wilson algorithm performed better, with only slight over-prediction and the least amount of variance. The new algorithm was completely unbiased in its prediction of number of strata, though it did so with more residual variance than the Baker-Wilson algorithm (Figure 4).

Of more interest to us perhaps, is how the various algorithms perform on SDMDs. Figure 5. shows the density management diagrams resulting from the plotting of average upper stratum data produced by each of the three algorithms. On each of these figures, we plotted the information from only the top layer produced by the given algorithm, for each of the 3495 stands in the OESF data. In order for the SDMD technique to be useful for managing multi-strata (or multi-cohort) stands to some condition, such as functional old-growth, stands with the greatest resemblance to old-growth should appear clustered in these plots. The best grouping of the stands with high Weighted Old Growth Habitat Index (WOGHI) scores, shown as enlarged red dots, appears in the plot for the new, clustering algorithm (c). The worst grouping of the three is from the Baker-Wilson algorithm (a). The dynamic threshold height of the Baker-Wilson algorithm may lead to larger dominant layers, in turn leading to more scatter of the high-WOGHI stands. The Latham algorithm (b), with the exception of two cases, clumps the stands with high WOGHI score moderately well.

While some degree of variance exists between the opinions of experts in the field of silviculture, the Baker-Wilson algorithm, as well as the new clustering algorithm both performed very well in matching such expert opinion. The Latham algorithm seems to provide a poor match. However, matching expert opinion on the number of strata in a stand is not the same as correctly grouping the dominant trees that might place the stand in a consistent manner on a SDMD. For this, the new clustering algorithm performed very well, followed closely by the Latham algorithm. More work needs to be performed in order to determine if stands move in a predictable way on the SDMD as they develop. If this is turns out to be the case, then the SDMD might be a useful tool for tracking stand progress when managing more complex stands. An understanding of how management activity might affect the position of a stand on such a diagram would also be needed in order for SDMDs to be useful in this application.

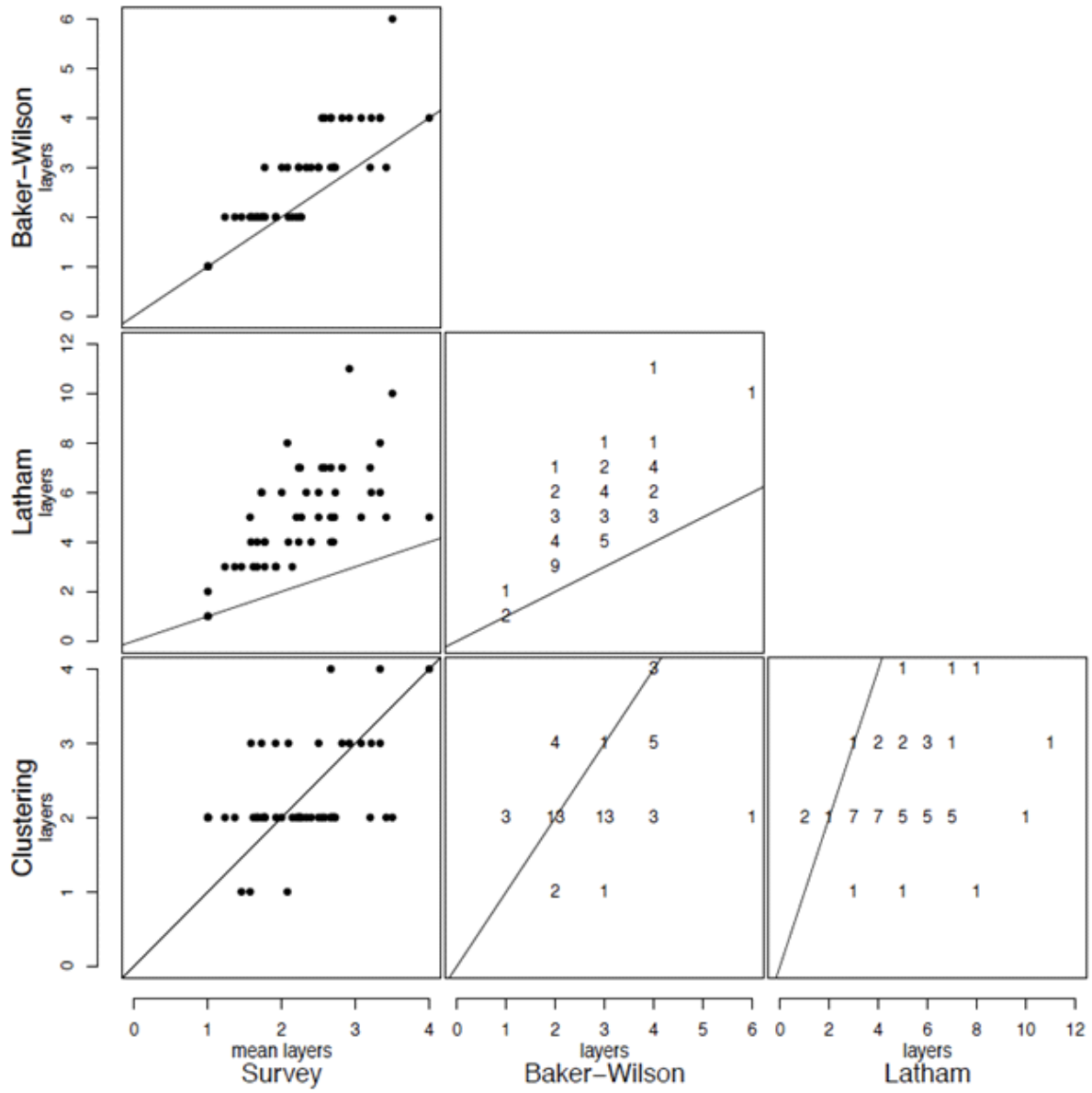


Figure 4. Scatter plot matrix of the number of layers selected by each algorithm and the mean survey response. Numbers indicate the number of points at current location. A line with a slope of 1 and intercept of 0 is plotted for reference.

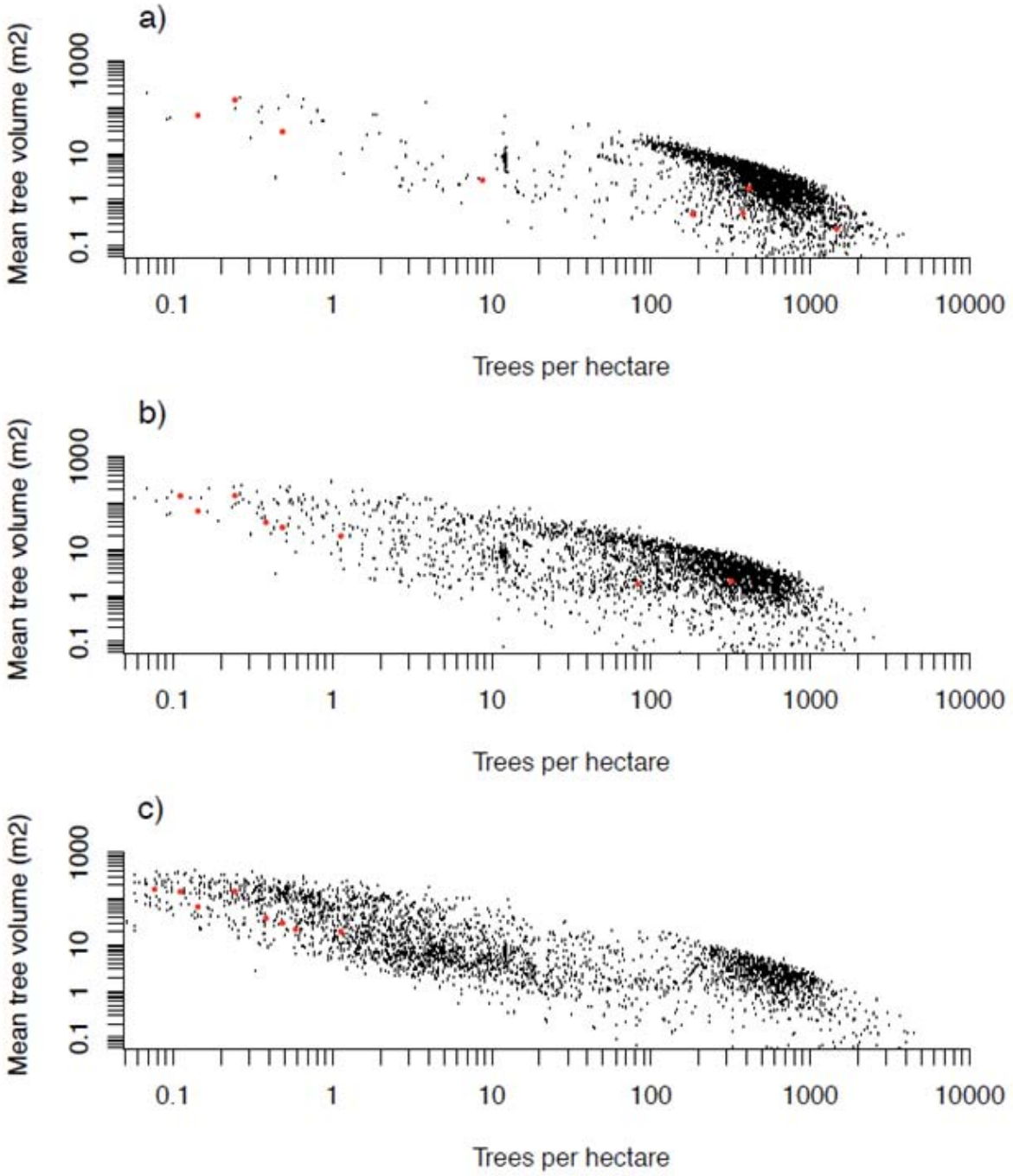


Figure 5. Density management diagrams using the summary information from the dominant stratum only, as determined by the three algorithms: Baker-Wilson (a), Latham (b), and clustering (c). Stands with greater old-growth characteristics (WOGHI score > 75) are shown with enlarged, red dots in each plot.

NEW or initiated Publications / Theses / Reports in 2010

Briggs, D.G., R. Kantavichai, E.C. Turnblom. 2010. **Predicting the Diameter of the Largest Breast-height Region Branch of Douglas-fir Trees in Thinned and Fertilized Plantations**. *For. Prod. J.* 60(4): 322 –330.

Ceder, K.R. and E.C. Turnblom, 2010. **SMC Vegetation Data Collection Results in Understory Vegetation Models**, SMC Quarterly Newsletter 3rd Quarter 2010.

Kantavichai, R., D. Briggs, and E. Turnblom. 2010. **Modeling effects of soil, climate, and silviculture on growth ring specific gravity of Douglas-fir on a drought-prone site in western Washington**. *For. Ecol. & Mgt.* 259(6): 1085 – 1092.

Kantavichai, R. D. G. Briggs, E. C. Turnblom 2010. **Effect of Thinning, Biosolids, and Weather on Annual Ring Specific Gravity and Carbon Accumulation of a 55 Year-old Douglas-fir Stand in Western Washington**. Can. J. For. Res. 40(1):72-85.

Vaughn, N.R., E.C. Turnblom and M.W. Ritchie. 2010. **Bootstrap evaluation of a young Douglas-fir height growth model for the Pacific Northwest.** *For. Sci.* 56(6): 592 –602.

Vaughn, N.R., L.M. Moskal, and E.C. Turnblom. 2010. **Fourier transformation of waveform Lidar for species recognition**. Remote Sensing Letters 2(4): 347 –356.

WOOD QUALITY PROJECT PROGRESS REPORT

Project Leader: Eini Lowell, USFS PNW Research Station

TAC REPORT

The Wood Quality TAC held an official meeting in February 2010 in Olympia, WA. At this meeting, the following items were discussed:

- Agenda 2020 (2004): status of data was reviewed and plans made for analysis
- An update on the LOGS project was given by Al Mitchell, Canadian Wood Fibre Centre and plans made to complete data collection
- Type II installations: not much interest in doing any more destructive sampling at the moment
- Type III installations: low priority for looking at pruned trees. There is no intent to remove those trees so they will be available in the future if renewed interest in pruning.
- Rob Harrison provided a handout and update for the Agenda 2020 project on paired tree project. Terrestrial LIDAR is not being collected as the stands are too dense.
- Dave Briggs presented ideas for new proposals including
- Wood Quality TAC input to the SMC Strategic Plan was reviewed and updated and submitted.

TAC members also attended the SMC Strategic Plan Meeting in January 2010 in Seattle.

In response to a request for proposals, four proposals were developed by the WQ TAC members and submitted to the SMC Policy Committee. These were presented at the Fall 2010 meeting. The titles of these proposals are:

1) Response of Wood Quality Parameters to Stand Density Regime and Nitrogen Fertilization
2) Update Wood Quality Models for Inclusion in Individual Tree Models
3) All things Douglas-fir Wood Quality Web Site
4) Animal Damage on SMC Installations

CONTINUING PROJECTS

A. PROJECT TITLE: Determining the effect of thinning, site quality and stand density on wood quality using non-destructive testing to develop predictive models

PRINCIPAL INVESTIGATORS: _Lowell (USFS PNWRS), Cosmin Filipesu, Ross Koppennaal, Al Mitchell (retired), (Canadian Forest Service Wood Fibre Centre), David Briggs (UW)

COLLABORATORS: Southern Research Station, Stand Management Cooperative

FUNDING: USFS PNW Research Station, $35,000 (field work, x-ray densitometry, NIR, salary); Canadian Forest Service Wood Fibre Centre (field work, analysis), UW NSF Center for Advanced Forest Sys-tems, $20,000 (field work); UW Precision Forestry Cooperative $7,500 (Resistograph)

PROJECT DESCRIPTION: Information concerning the effect of intensive plantation silviculture and genetics on wood properties of PNW conifers is sparse and piecemeal precluding integration of wood quality with growth and yield models to improve understanding and predictions. Furthermore, traditional techniques to acquire data on wood properties are time consuming and expensive which has limited data collection for research purposes and essentially precluded routine collection of wood property data as part of forest inventory procedures. However, recent development of nondestructive testing (NDT) test-ing technology using acoustic, resistance, and NIR methods presents the opportunity to obtain indirect measures of stiffness (MOE), specific gravity (SG) and other properties from standing trees which would permit pre-harvest assessments of these quality parameters.

Five Levels of Growing Stock (LOGS) thinning trial sites were selected for the study. Each site has 3 replications of 8 thinning treatments plus an unthinned control. At each site, 15 tees were sampled from each of the control, 70% basal area retention and 30% basal area retention thinning plots for a total of 135 trees per site and 540 total trees for the study. Acoustic velocity over a 1m distance at breast height was taken at three locations around the circumference of each sample tree. A 20% (3-tree) subsample of trees on each plot was drilled with a Resistograph and an inclement core taken as close as possible to the resistance bore. X-ray densitometry has been performed by the USDA Forest Service Southern Research Station (SRS) and NIR analysis will be performed on cores by SRS personnel. The LOGS study was chosen in part because of its long time frame spans and the fact that it exceeds rotation lengths used by many landowners and can provide a baseline for comparisons with younger plantations being grown today. It also represents a significant longitudinal gradi-ent with accompanying differences in climate. We expect to expand this study to younger intensively man-aged research sites of the Stand Management Cooperative (SMC) in the future.

OBJECTIVES: This project focuses on (1) determination of how acoustic velocity, a predictor of wood stiff-ness, is affected by tree, stand and site variables, (2) development of a model to predict wood density, which is strongly linked to quality of traditional wood products and the carbon and energy content of wood, to resistance and assess effects of tree, stand and site variables, and (3) building of models using NIR to predict wood physical (density), mechanical (modulus of elasticity, modulus of rupture), and chemical content (e.g. cellulose and lignin).

PROGRESS: In 2010, a fifth, southernmost site was added, Stampede Creek, OR. All data from this site was collected in September 2010. Resistograph measure-ments were taken on the other four sites in July (U.S.) and August (Canada). Increment cores from the U.S. sites (Iron Creek and Hoskins) were collected in July 2010 and sent to the Southern Research Station for x-ray densitometry.

POSTER PRESENTATIONS:

Ross Koppenaal, Al Mitchell, Graeme Goodmanson, Tom Bown, Tristan Carl. 2009. Acoustic assessment of fibre quality on four coastal Douglas-fir sites. Canadian Wood Fibre Centre, Pacific Forestry Centre, Victoria, B.C. An update on the project presented at a Canadian Wood Fibre Centre (CWFC) forum.

B. PROJECT TITLE: Non-destructive evaluation of wood quality in standing Douglas-fir trees and logs

PRINCIPAL INVESTIGATORS: David Briggs (UW), Eini Lowell (USFS PNWRS), Eric Turnblom (UW), Bruce Lippke (UW RTI), Peter Carter (CHH Fibre-Gen, New Zealand)

COLLABORATORS: Robert J. Ross, Xiping Wang, USDA Forest Service Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI. Dennis Dykstra, USDA Forest Service Pacific Northwest Research Station, Portland, OR. Glenn Howe, Marilyn Cherry, Vikas Vikram; Pacific Northwest Tree Improvement Research Cooperative, Oregon State University, Department of Forest Science, 321 Richardson Hall, Corvallis, OR, 97330-5752. The following members of the SMC provided support for the Objective 1 portion of the study; Green Diamond Resource Company (timber, harvesting, transportation), Port Blakely Tree Farms (timber, harvesting, transportation), Washington Department of Natural Resources (timber, harvesting, trans-portation), Weyerhaeuser Company (timber, harvesting, transportation, milling, x-ray densitometry). Olym-pic Resource Management, a member of both PNWTIRC and SMC provided support (seed orchard, prog-eny trials, harvesting) for the Objective 2 portion of the study.

FUNDING: This project combined an $87,500 grant from the USFS AGENDA 2020 FY 05/07, $80,000 industry funds, and $95,000 UW (Stand Management & Precision Forestry Cooperative) with $139,150 USFS PNWRS and, $74,941 industry in-kind support into a total effort of $476,591.

PROJECT DESCRIPTION: Douglas-fir (*Pseudotsuga menziesii* var. *menziesii* [Mirb.] Franco) is renowned as a building construction material due to its abundance and high strength and stiffness. Non-destructive testing technology, based on the velocity of acoustic waves propagated through wood, provides a method for indirectly measuring wood stiffness, an important property in structural and other applications. Within the past decade, technology has been developed that permits rapid, convenient measurement of acoustic velocity of wood in logs, and studies have found excellent relationships between the acoustic velocity of a log and the resultant stiffness of lumber or veneer recovered from the log. More recently, technology has been developed for measuring acoustic velocity of wood in the lower bole of standing trees, enabling the use of acoustic methods for assessing wood quality and sorting raw material along the chain of custody. The overall purpose of this study was to determine these relationships for Douglas-fir and to understand how genetics and silvicultural treatments may be used to influence the stiffness; hence quality, of Douglas-fir.

OBJECTIVES: (1) *What are the relationships between the average stiffness of lumber or veneer in a log, stiffness of the log, and stiffness of the parent tree and to what extent are these relationships influenced by stand, tree, or log variables?* Hypothesis: We hypothesize that relationships between average stiffness of product in a log, the HM 200 log stiffness measure, and the ST 300 stiffness measure of the parent tree are all linear and that these relationships are unaffected by tree and stand variables. (2) *What are the effects of cultural treatments and genetics on these stiffness relationships?* Hypothesis: Silvicultural treatments (planting spacing, thinning, fertilization, pruning) and genetics do not alter the basic relationships found by Objective # 1. That is, treatment or genetic effects would simply have the same slope and intercept as the baseline relationship between tree and log stiffness values. (3) *How can the natural variability of stiffness among trees within a stand be monitored and incorporated into decision support tools that assist managers in assessing if stands and stand treatments are within desired specifications and in making improved marketing decisions?*

PROGRESS: The data set has been finalized. For the veneer data, a second manuscript has been submitted by Christine Todoroki (Eini Lowell and Dennis Dykstra, co-authors) to New Zealand Journal of Forestry and a third manuscript looking at effects of treatment from a single installation is in progress.

PUBLICATIONS

Briggs, D.G., E.C. Turnblom, B.B. Bare. 2005. **Non-destructive Methods and Process Capability Analysis to Assess Conformance of Douglas-fir Stands to Customer Quality Specifications.** New Zealand Journal of Forestry Science 35(2/3):170-188 pp.

Cherry, M.L., Howe, G.T., Briggs, D., Cress, D., Vikram, V. 2007. **Genetic Variation in Wood Quality in a Clonal Douglas-fir Seed Orchard.** PNWETIRC Report 26. Pacific Northwest Tree Im-provement Research Cooperative, Oregon State University, Corvallis, OR. 11pp.

Cherry, M.L., Vikram, V., Briggs, D., Cress, D., Howe, G.T. 2007. **Genetic Variation in Direct and Indirect Measures of Wood Stiffness in Coastal Douglas-fir.** PNWTIRC Report 27. Pacific Northwest Tree Improvement Research Cooperative, Oregon State University, Corvallis, OR. 30 pp.

Briggs, D.G., G. Thienel, E.C. Turnblom, E. Lowell, D. Dykstra, R.J. Ross, X. Wang, and P. Carter. 2008. **Influ-ence of Thinning on Acoustic Velocity of Douglas-fir Trees in Western Washington and West-ern Oregon.** *In*: Proc. of the 15th International Symposium on Nondestructive Testing of Wood, Sept. 10-12, Duluth, MN. Forest Products Society, Madison, WI. 113-123 pp.

Cherry, M.L., Vikram, V., Briggs, D., Cress, D., and Howe, G.T. 2008. **Genetic Variation in Direct and Indirect Measures of Wood Stiffness in Coastal Douglas-fir.** Can. J. For. Res. 38: 2476-2486.

Thienel, Gonzalo 2008." **Nondestructive evaluation of wood stiffness in standing Douglas-fir trees in Western Washington and Western Oregon**" Masters Thesis, College of Forest Resources, University of Washington, Seattle, WA. 125 pp.

Todoroki, C.L., E.C. Lowell, D.P. Dykstra. 2010. **Automated Knot Detection on Douglas-fir Veneer Images Computers** in Engineering and Agriculture. 70(1): 163-171pp.

Accepted with revision and resubmitted:

Todoroki, C.L., Lowell, E.C., Dykstra, D.P. and Briggs, D.G. 201x. **Colour Maps and Models of Wood Property Distributions within Douglas-fir Trees.** New Zealand Journal of Forestry Sciences.

C. PROJECT TITLE: Modeling Biomass Growth Patterns in Four SMC Type II Douglas-fir Installations as Affected by Treatment, Soil and Local Climate

PRINCIPAL INVESTIGATORS: David Briggs, (UW), Student Rapeepan Kantavichai, (UW PhD), Eric Turnblom (UW)

See CAFS Continuing Project C on page 21.

D. PROJECT TITLE: Agenda 2020 Management of PNW forest plantations: Additional site characterization and instrumentation for SMC/CIPS Paired-Tree Fertilization Projects

PRINCIPAL INVESTIGATORS: Rob Harrison (UW), Doug Maguire (OSU), Eini Lowell (USFS PNWRS), Dave Briggs (UW), Doug Mainwaring (OSU), Eric Turnblom (UW), and Student Kim Littke (UW PhD).

See CAFS Continuing Project A on page 19

OBJECTIVES: Wood Quality TAC has plans to do NDT and other tests following year 6 of growth, the current longevity plan for the study.

COMPLETED PROJECTS

PROJECT TITLE: Material Property Evaluation of Juvenile Wood Strands from Pacific Northwest Softwoods

PRINCIPAL INVESTIGATORS: Vik Yadama (WSU), Eini Lowell (USFS-PNWST)

FUNDING: PNW Research Station

COLLABORATORS: Stand Management Cooperative

PROJECT DESCRIPTION:Wood from faster growing and small diameter trees could be more effi-ciently utilized for manufacturing wood composites or engineered wood composites (EWC). This project investigates the physical and mechanical properties of the strands produced from juvenile wood from young-growth Douglas-fir and hemlock trees that were harvested from the buffer area of two SMC Instal-lations in western Washington. The study would provide basic engineering data needed for understanding the mechanical behavior of wood-strand composites and for designing EWC.

OBJECTIVES:

1. Characterize juvenile and mature woods in sample trees of economically important soft wood specie from the Western U.S. and investigate the variation in juvenile wood within the sample trees.

2. Examine the physical and mechanical properties of small clear specimens and wood strands from juvenile and mature woods for each of these species.

PROGRESS: Project completed.

PUBLICATION:

Langum, C.E., V. Yadama, and E.C. Lowell. 2009. **Physical and Mechanical Properties of Young-growth Douglas-fir and Western Hemlock from Western Washington**. For. Prod. J. 59(11/ 12):37-47.

Submitted:

Yadama, V.; Lowell, E.C.; and Langum, C. 201x. **Characterization of Wood Strands From Young, Small-Diameter Trees**. Wood and Fiber Science

MODELING PROJECT PROGRESS REPORT

Project Leader: Dave Marshall, Weyerhaeuser Company

SMC Modeling TAC Activates

- Updated Strategic Plan
- Participated in Modeling Collaborations
  - FVS-ORGANON collaboration
  - Participated in discussions on Hann's retirement and ORGANON plans
  - Release of ORGANON 9.0 and the Red Alder plantation model
  - Attended review of CIPS/VMRC young stand modeling work
- Publications:

Gould, P.J.; Marshall, D.D. 2010. Incorporation of genetic gain into growth projections of Douglas-fir using ORGANON and the Forest Vegetation Simulator. Western J. of Applied Forestry 25(2):55-61.

TECHNOLOGY TRANSFER

A. MEETINGS, WORKSHOPS & FIELD TOURS, AND CONFERENCES

1. Strategic Planning Committee Meeting, Jan. 27, Seattle, WA
2. Wood Quality Project TAC Meeting, Feb. 23, Olympia, WA
3. Spring Policy Committee Meeting, April 13, Olympia, WA
4. SMC Forest Carbon Workshop, April 14, Olympia, WA
5. NSF CAFS Annual Meeting, April 27-29, Indianapolis, Indiana
6. Fall Policy Committee Meeting, Sept. 21-22, Corvallis, OR

B. PUBLICATIONS and REPORTS 2007-2010

SMC fact sheets, reports, proceedings, and journal articles produced over the last 4-years are listed in this section. A * preceding the first author indicates a peer-reviewed publication. Many can be obtained from the SMC website; for others contact the authors.

2007

Theses

1. Flint, Cindy 2007. **"Leaching of nitrogen from the rooting zone of Douglas-fir forests following urea fertilization and potential impacts on water quality of the Hood Canal.**" MS Thesis. College of Forest Resources, University of Washington, Seattle, WA. 68 pp. http://soilslab.cfr.washington.edu/publications/

2. Vaughn, Nick. 2007. "**An individual-tree model to predict the annual growth of young stands of Douglas-fir in the Pacific Northwest**" MS Thesis. College of Forest Resources, University of Washington, Seattle, WA. 106 pp.

Publications (15 total, 5 peer-reviewed=*)

1. Ares, A., T.A. Terry, K.B., Piatek, R.B., Harrison, C.A., Harrington, R. Meade, R. Leon, R.E. Miller, B.L., Flaming, C.W. Licata, K. Petersen, B.D. Strahm, H.W., Anderson, L.C. Brodie, and J.M. Kraft. 2007. **Pre- and post-harvest stores of carbon and nitrogen in a highly-productive forest site subjected to increasing biomass removals in coastal Washington**. Weyerhaeuser Company Technical Note. 15 pp.

2. Ares, A., T.A. Terry, K.B Piatek, R.B. Harrison, R.E. Miller, B.L. Flaming, C.W. Licata, B.D. Strahm, C.A. Harrington, R. Meade, H.W. Anderson, L.C. Brodie, J.M. Kraft. 2007. **The Fall River long-term site productivity study in coastal Washington: site characteristics, methods, and biomass and carbon and nitrogen stores before and after harvest.** General Technical Report PNW-GTR-691. USDA Forest Service Pacific Northwest Research Station, Portland, OR. 85 pp.

3. Briggs, D.G. 2007. **Management Practices on Pacific Northwest West-side Industrial Forest Lands: 1991-2005 with Projections to 2010.** Working Paper # 6, Stand Management Cooperative, College of Forest Resources, University of Washington, Seattle, WA. 72 pp.

4. *Briggs, D.G., L. Ingaramo, E.C. Turnblom. **Number and Diameter of Breast-height Region Branches in a Douglas-fir Spacing Trial and Linkage to Log Quality.** Forest Products Journal. 57(9):28-34 pp.

5. Cherry, M.L., Howe, G.T., Briggs, D. G., Cress, D., Vikram, V. 2007. **Genetic Variation in Wood Quality in a Clonal Douglas-fir Seed Orchard.** PNWTIRC Report 26. Pacific Northwest Tree Improvement Research Cooperative, Oregon State University, Corvallis, OR. 11 pp.

6. Cherry, M.L., Vikram, V., Briggs, D., G. Cress, D., Howe, G.T. 2007. **Genetic Variation in Direct and Indirect Measures of Wood Stiffness in Coastal Douglas-fir.** PNWTIRC Report 27. Pacific Northwest Tree Improvement Research Cooperative, Oregon State University, Corvallis, OR. 30 pp.

7. Footen, P.W. and R.B. Harrison. **King County METRO Biosolids 5 year Report for 2007.**

8. Footen, P.W., R. Harrison, B. Strahm. 2007. **Stand growth response of Douglas-fir to biosolids applications. Report to King County DNR.** College of Forest Resources, University of Washington, Seattle, WA. 61 pp.

9. Hann, D.W, D.D. Marshall, M.L. Hanus 2006. **Reanalysis of the SMC-ORGANON equations for diameter growth rate, height growth rate, and mortality rate of Douglas-fir. Research.** Contribution 49. Forest Research Laboratory. Oregon State University, Corvallis, OR. 24 pp.

10. Hann, D.W, D.D. Marshall, M.L. Hanus 2007. **Reanalysis of the Western hemlock diameter-growth-rate equation in SMC-ORGANON.** SMC Working Paper 5. Stand Management Cooperative, College of Forest Resources, University of Washington, Seattle, WA 23 pp.

11. *Li, Y., E.C. Turnblom, D.G. Briggs. 2007. **Effects of Density Control and Fertilization on Growth and Yield of Young Douglas-fir Plantations in the Pacific Northwest.** Can. J. For. Res. 37:449-461 pp.

12. *Pittman, S. D., B. B. Bare, D. G. Briggs. 2007. **Hierarchical Production Planning in Forestry Using Price-Directed Decomposition.** Can. J. For. Res. 37:2010-2021 pp.

13. *Remington, S.M., B.D. Strahm, V. Neu, J.E. Richey, and H. Brandão da Cunha. 2007. **The Role of Sorption in Control of Riverine Dissolved Organic Carbon Concentrations by Riparian Zone Soils in the Amazon Basin**. Soil Sci. 172:279-291 pp.

14. *Strahm, B.D., and R.B. Harrison. 2007. **Mineral and organic matter controls on the sorption of macronutrient anions in variable-charge soils.** Soil Science Society of America Journal. 71(6): 1926-1933 pp.

15. Turnblom, E.C., Andrew Hill, 2007. **Using climate related information to improve short term growth projections**. Final report to USDA Forest Service PNW Research Station JV agreement PNW-02-JV-11261979-145. College of Forest Resources, University of Washington, Seattle, WA. 64 pp.

2008

Theses

1. Hill, Andrew D. 2008 "**Improving diameter growth prediction of Douglas-fir in Eastern Washington state, USA, by incorporating temperature and precipitation"**, PhD Dissertation, College of Forest Resources, University of Washington, Seattle, WA. 213 pp.

Publications: (6 total, 4 peer-reviewed=*)

1. Briggs, D. 2009. **Research Cooperatives Serve the Forestry Community**. Western Forester. 54(4):1-4.

2. Briggs, D. 2009. PFC **Brings High Tech Tools to Forestry Sector**. Western Forester. 54(4):10.

3. Footen, P.W., Harrison, R. B., and B.D. Strahm., 2009. **The long-term effects of nitrogen fertilization on understory vegetation in Douglas-fir plantations in the Pacific Northwest.** For. Ecol. & Mgt. 258(10):2194-2198. Available at: http://soilslab.cfr.washington.edu/publications/Footen-etal-2009.pdf

4. Strahm B. D., Harrison, R. B., Terry, T. A., Harrington, T. B., Adams, A. B., Footen, P.W., 2009. **Changes in dissolved organic matter with depth suggest the potential for postharvest organic matter retention to increase subsurface soil carbon pools.** For. Ecol. & Mgt., 258(10):2347-2352. Available at: http://soilslab.cfr.washington.edu/publications/Strahm-etal-2009.pdf

5. Harrison, R.B., T.A. Terry, C.W. Licata, B.L. Flaming, R. Meade, I.A. Guerrini, B.D. Strahm, D. Xue, A.B. Adams, M.R. Lolley, A. Sidell, G.L. Waggoner, D. Briggs, E.C. Turnblom. 2009. **Biomass and stand characteristics of a highly-productive mixed Douglas-fir and western hemlock plantation in coastal Washington**. Western Journal of Applied Forestry 24(4):180-186. Available at: http://soilslab.cfr.washington.edu/publications/Harrison-etal-2009.pdf

6. Slesak, R.A., S.H. Schoenholtz, T.B. Harrington, and B.D. Strahm. 2009. Dissolved carbon and nitrogen leaching following logging-debris retention and competing-vegetation control in Douglas-fir plantations of western Oregon and Washington. Can. J. For. Res. 39:1484-1497.

2010

Theses: none

Publications: (10 total, 10 peer-reviewed = *)

1. *Briggs, D.G. 2010. **Enhancing forest value productivity through fiber quality**, J. of Forestry, 108(4):174-182.

2. *Kantavichai, R. D. G. Briggs, E. C. Turnblom 2010. **Modeling effects of soil, climate, and silviculture on growth ring specific gravity of Douglas-fir on a drought-prone site in Western Washington**. Forest Ecology & Management. 259:1085-1092.. doi: 10.1016/j.foreco.2009.12.017.

3. *Kantavichai, R. D. G. Briggs, E. C. Turnblom 2010**. Effect of Thinning, Biosolids, and Weather on Annual Ring Specific Gravity and Carbon Accumulation of a 55 Year-old Douglas-fir Stand in Western Washington.** Can. J. For. Res. 40(1):72-85.

4. *Todoroki, C.L., E.C. Lowell, D.P. Dykstra. 2010. **Automated knot detection on Douglas-fir veneer images.** Computers in Engineering and Agriculture. 70(1): 163-171.

5. *Langum, C.E., V. Yadama, and E.C. Lowell. 2010. **Physical and Mechanical properties of young-growth Douglas-fir and western hemlock from western Washington**. For. Prod. J. 59(11/112):37-47.

6. *Gould, P.J.; Marshall, D.D. 2010. **Incorporation of genetic gain into growth projections of**

Douglas-fir using ORGANON and the Forest Vegetation Simulator. Western J. of Applied Forestry 25(2):55-61.

7. *Weiskittel, A.R., D.A. Maguire, R. Monserud, G.P. Johnson. 2010. **A hybrid model for intensively managed Douglas-fir plantations in the Pacific Northwest, USA**. Eur. J. For. Res. 129:325-338.

8. *Briggs, D.G., R. Kantavichai, E. C. Turnblom. 2010. **Predicting the Diameter of the Largest Breast-height Region Branch of Douglas-fir Trees in Thinned and Fertilized Plantations**. For. Prod. J. 60(4):322-330.

9. *Vaughn, N.R., E.C. Turnblom, M.W. Ritchie. 2010. **Bootstrap evaluation of a young Douglas-fir height growth model for the Pacific Northwest**. For. Sci. 56(6): 592-602.

10. *Vaughn, N.R., L.M. Moskal, and E.C. Turnblom. 2010. **Fourier transformation of waveform Lidar for species recognition**. Remote Sensing Letters 2(4): 347 –356.

Accepted

1. *Vikram, Vikas, Marilyn L. Cherry, David Briggs, Daniel W. Cress, Robert Evans, and Glenn T. Howe (accepted 2010). **Stiffness of Douglas-fir Lumber: Effects of Wood Properties and Genetics**. Canadian Journal of Forest Research.

2. *Harrison, R.B., P.W. Footen and B.D. Strahm. (accepted). **Deep soil horizons: Contribution and importance to soil C pools and in assessing whole-ecosystem response to management and global change.** Forest Science.

3. Todoroki, C.L., Lowell, E.C., Dykstra, D.P. and Briggs, D.G.. **Colour maps and models of wood property distributions within Douglas-fir trees.** New Zealand Journal of Forestry Sciences.

SOFTWARE

1. Sidell, A., R.B. Harrison. 2000. **Productivity Management "Toolbox"** http://depts.washington.edu/nitrogen/http://www.cfr.washington.edu/research.smc/treelab/Website/TreeLab_home.htm.

2. Gehringer, K., E.C. Turnblom. 2001. **Tree List Generator Software & Manual:**

   http://depts.washington.edu/silvproj/tlghome [download requires password available from Silviculture Project Leader Eric C.Turnblom]. 2006. **Young Tree List Generation Database System,** available in CD, beta test version, contact Randy Collier for a copy at 206-543-5355.

3. Pittman, S., E.C. Turnblom. 2001. **Treelab Software & Manual** http://www.cfr.washington.edu/research.smc/treelab/Website/TreeLab_home.htm.

4. Haukaas, J. 2008. **Tree List Generator: Graphical User Interface.** http://depts.washington.edu/silvproj/tlghome/

5. **SMC ORGANON and associated DLL's** are available on the ORGANON web site: http://www.cof.orst.edu/cof/fr/research/organon/

6. **Conifers Version 4.01** is available from the USFS web site
http://www.fs.fed.us/psw/programs/ecology_of_western_forests/projects/conifers/

CD's
(Contact the SMC for copies 206-543-5355)

1. 2004 RFNRP Publications
2. Alder Symposium "Red Alder: A State of Knowledge" streaming video
3. SMC 20th Anniversary streaming video

BY-LAWS OF THE STAND MANAGEMENT COOPERATIVE

First Adopted: April 22, 2003

Most recent amendment: Sept. 18, 2007

ARTICLE I: Name

The name of this organization shall be the Stand Management Cooperative (SMC).

ARTICLE II: Mission

The Mission of the SMC is "To provide a continuing source of high-quality data and information on the long-term effects of silvicultural treatments and treatment regimes on stand and tree growth and development and on wood and product quality."

ARTICLE III: Scope and Limitations

The territorial coverage of the programs and activities of the SMC consists of forested lands west of the Cascades in Oregon and Washington, northern California, and coastal British Columbia.

ARTICLE IV: Location and Contact

1. The SMC headquarters are located in the College of Forest Resources, University of Washington, Seattle, WA.
2. Contact with the SMC headquarters can be made via
   - a. Web site http://www.standmgt.org
   - b. Telephone 206-543-9744 or 206-543-1581
   - c. FAX 206-685-3091
   - d. Email Director: David Briggs dbriggs@u.washington.edu
   - e. Staff: Megan O'Shea moshea@u.washington.edu

ARTICLE V: Membership Categories

1. Land Managing Organizations

a. Public agencies and private companies that manage forest land provide funds to support the mission and provide land and operational support for field research sites.

b. A Memorandum of Agreement governs the relationship between the Land Managing Organization members and the SMC. Each member agrees to terms presented in the renewable annual Memorandum of Agreement. An example is presented in ANNEX A.

c. Organizations wishing to join the SMC as a Land Managing Organization member do so through a written request to the Director. The application is presented to the Policy Committee at its next meeting for approval.

2. Analytic Organizations

a. Organizations that utilize information gathered through SMC research and stored in its database for the purpose of producing and marketing information, products and service.

b. A Memorandum of Agreement governs the relationship between the Analytic Organization members and the SMC. Each member agrees to terms presented in the renewable annual Memorandum of Agreement. An example is presented in ANNEX B.

c. Organizations wishing to join the SMC as an Analytic Organization member do so through a written request to the Director. The application is presented to the Policy Committee at its next meeting for approval.

3. Institutional Organizations

a. Universities, research laboratories, and trade associations are Institutional members that provide scientist time, laboratory and office space and other services to the SMC. Also research grants from external sources leveraging SMC investments in field sites may be received by these institutions or provided by them.

b. Organizations wishing to join the SMC as an Institutional member do so through a written request to the Director. The application is presented to the Policy Committee at its next meeting for approval.

4. Supplier Organizations

a. Organizations that provide materials and supplies to the SMC or its members may become a Supplier member.

b. Organizations wishing to join the SMC as a Supplier member do so through a written request to the Director. The application is presented to the Policy Committee at its next meeting for approval.

ARTICLE VI: Fees & Continuing Membership

Dues and fees are established by the Policy Committee.

1. Land Managing Organizations
Annual dues are calculated by a funding formula established by the Policy Committee. Membership is retained through payment of assessed dues.

2. Analytic, Institutional, and Supplier Organizations

Annual dues are not assessed. Continuing membership is maintained through an annual vote by the Policy Committee based on active participation and contribution to the SMC mission.

ARTICLE VII: Voting and Representation

1. Organizations under ARTICLE V, paragraphs 1, 2 and 3, are voting members of the SMC Policy Committee.

2. Each such voting organization designates one individual as its representative on the Policy Committee and has a single vote.

ARTICLE VIII: Receipt of SMC Database, Research Tools and Services

1. Each Land Managing Organization member receives

a. An annual updated version of the complete SMC database.

b. Copies of the SMC Annual Report and Quarterly Newsletter.

c. One free printed copy of research papers and technical reports with a discount for additional printed copies (electronic copies are free from the SMC website).

d. Unlimited access to SMC staff for questions and technical support "as available" in consideration of their institutional obligations.

2. Each Analytical Organization member receives

a. An annual updated version of the complete SMC database.

b. Copies of the SMC Annual Report and Quarterly Newsletter.

c. One free printed copy of research papers and technical reports with a discount for additional printed copies (electronic copies are free from the SMC website).

d. Unlimited access to SMC staff for questions and technical support "as available" in consideration of their institutional obligations.

3. Each Institutional and Supplier Organization member receives

a. Copies of the SMC Annual Report and Quarterly Newsletter.

b. One free printed copy of research papers and technical reports with a discount for additional printed copies (electronic copies are free from the SMC website).

4. All recipients of any portion of the SMC database must comply with the SMC Database Policy (ANNEX C).

ARTICLE IX: Management

1. The management policies and operations of the SMC shall be vested in a Policy Committee as defined in Article VII.

2. A Director, appointed by the Dean of the College of Forest Resources, University of Washington, and approved by the Policy Committee, will be responsible for operational management of the SMC. A review of the Director's performance may be initiated by the Dean every 5 years per University of Washington policy or at any time per request from the Chair of the Policy Committee. Enaction of a review and appointment of the review committee membership are at the discretion of the Dean.

ARTICLE X: Election

1. The term of the Chair of the Policy Committee is 2 years. At the end of the term, which is a Fall Meeting, the current Vice-Chair will become Chair effective 30 days after the date of that meeting.

2. At this same Fall Policy Committee meeting, a new Vice-Chair is elected and will serve 2 years as Vice-Chair followed by 2 years as Chair.

3. All elections and resolutions, unless specifically provided for, shall require a majority vote of the members in attendance.

4. Fifty percent of the members shall constitute a quorum at any annual or special meeting of the SMC for the transaction of business. Proxy votes submitted to the Director or Chair of the Policy Committee shall be included in achieving a quorum.

ARTICLE XI: Powers and Duties of the Policy Committee

1. The Policy Committee defines the dues structure of the SMC and approves annual budgets prepared by the Director.
2. The Policy Committee approves all research activities utilizing funds obtained through the dues assessments.
3. The Policy Committee elects a Chair and Vice-Chair.
4. The Policy Committee consults with the Dean of the College of Forest Resources in appointing the Director and any subsequent reviews and consults with the Dean and Director in appointing Technical Advisory Committee leaders and hiring staff.

ARTICLE XII: Meetings

1. Policy Committee. The SMC shall have two meetings of the Policy Committee each year; one in April (Spring Meeting) and one in September (Fall Meeting) at a specific date and location determined by the Policy Committee. Special meetings may be called at the discretion of the Policy Committee. Notices of meetings shall be sent to all members at least 2 weeks prior to the meeting. Such notice will be sent to the last known address of the member as it appears in the membership database.
2. Technical Advisory Committees. TAC's shall meet on dates and places as determined by the appropriate TAC Project Leader. Notices of meetings shall be sent to all members at least 2 weeks prior to the meeting. Such notice will be sent to the last known address of the member as it appears in the membership database.

ARTICLE XIII: Technical Advisory Committees

Each Technical Advisory Committee (TAC) is headed by a Project Leader approved by the Policy Committee. TAC's provide technical review and advice to the Policy Committee on field activities and research projects being conducted by SMC staff or affiliated scientists. The need for, definition of, and effectiveness of TAC's will be reviewed by the Policy Committee every 2 years.

ARTICLE XIV: Duties of Officers

1. The duties of the Chair of the Policy Committee shall be to preside at the regular and special meetings of the SMC.
2. The Vice-Chair shall perform the duties of the Chair in the absence of the Chair and such other duties as may be delegated by the Policy Committee.
3. The Director shall be responsible for all operations of the SMC, supervision of employees and students. He/she reports to both the Chair of the Policy Committee and to the Dean, College of Forest Resources, University of Washington.

ARTICLE XV: Property

The real property of the SMC shall be in the custody and at the disposal of the Dean of the College of Forest Resources, University of Washington for reallocation to other uses at the College. Each member of the SMC own the data collected from its land holdings. The University of Washington acts as an agent for SMC member data for the purposes of collecting and storing said data. The University of Washington shall be the sole licensor for SMC databases, research tools and other SMC services.

ARTICLE XVI: Conduct of Meetings

The meetings shall be conducted under the rules of procedure contained in M.A. DeVries (1998) *The New Robert's Rules of Order, 2nd Ed.* Signet, NY. When a conflict of interest arises, the member will be recused from voting.

ARTICLE XVII: Vacancies

1. Any vacancy in the Office of Chair of the Policy Committee shall be filled immediately by the Vice-Chair.
2. Any vacancy in the Office of Vice-Chair shall be filled by nominations and vote at the next regular Policy Committee meeting.

ARTICLE XVIII: Amendments

The By-laws of the SMC may be amended by a two-thirds vote of the full membership at any regular or special meeting provided notice of such amendment shall have been sent to all members by the Director at least two weeks prior to such meeting.

ANNEX A

MEMORANDUM OF AGREEMENT BETWEEN LAND MANAGING ORGANIZATION COOPERATORS AND THE UNIVERSITY OF WASHINGTON IN THE STAND MANAGEMENT COOPERATIVE (copy available upon request)

ANNEX B

MEMORANDUM OF AGREEMENT BETWEEN ANALYTIC ORGANIZATION COOPERATORS AND THE UNIVERSITY OF WASHINGTON IN THE STAND MANAGEMENT COOPERATIVE (copy available upon request)

ANNEX C

STAND MANAGEMENT COOPERATIVE DATA & PUBLICATION POLICY

I. Data & Database

A. Definition

Data are defined as any measurements of stands, trees, or products (a) developed by the SMC research program or (b) shared with the SMC and another organization and for which the SMC has direct responsibility. The Database is defined as all data resulting from efforts of the integrated program, the Regional Forest Nutrition Research Project (RFNRP), and the Stand Management Cooperative; for policy matters no distinction will be made among these three sources of data.

Kantavichai, R., D. Briggs, and E. Turnblom. 2010. **Modeling effects of soil, climate, and silviculture on growth ring specific gravity of Douglas-fir on a drought-prone site in western Washington**. *For. Ecol. & Mgt.* 259(6): 1085 – 1092.

Kantavichai, R. D. G. Briggs, E. C. Turnblom 2010. **Effect of Thinning, Biosolids, and Weather on Annual Ring Specific Gravity and Carbon Accumulation of a 55 Year-old Douglas-fir**

B. Data & Database Rules

1. All organizations, member or non-member, have access to data from installations on their own land at any time.
2. Upon request, each SMC member receives a CD copy of the annually updated database. Updates are generally available at mid-year. Costs of special requests to SMC staff for retrieving, analyzing, reporting, and/or transmitting data will be borne by the Cooperator requesting the data.
3. SMC members have access to all data collected from SMC-supported studies under the condition that the data will not be released to non-member organizations with the exception that a member may temporarily share data with confidentially bound assigns for the sole purpose of having analyses performed for the benefit of the SMC member with the assign allowed to make no further use of the data or analyses.
4. It is recognized that certain individuals and organizations who are not SMC members may desire access to the SMC database for research or other purposes without joining. Requests for data in these situations will be treated on a case-by-case basis. The individual or organization will submit to the SMC Director a written proposal request outlining the analysis planned, plans for use and/or publication of results, and the specific data requested. The proposer must agree to (a) share results of their analyses with the SMC and (b) to provide a review draft of any related publication. The Director will present the request to the Policy Committee for approval. Upon approval, a formal agreement, including a Licensing Agreement and appropriate fees, will be negotiated by the SMC and the proposing entity through the University of Washington Office of Software and Copyright Ventures.
5. Data shared with the SMC by other organizations will not be available to any other member or non-member organization without the express permission of the sharing organization. Data shared with the SMC are to be used for accomplishment of SMC goals, and only results and summaries from analyses are to be published. Shared data will be considered as proprietary information and the designated analyst(s) will take every precaution to ensure confidentiality.
6. Requests for data by Institutional Members are made only through the Institution's representative on the Policy Committee. This same representative is responsible for making sure that all users within the Institution: (1) are aware of the proprietary nature of the SMC Database; (2) obtain the data directly from the Institutional representative; (3) do not pass any part of the database to any other party within or outside of the Institution; and (4) secure written permission from the SMC Director to proceed with any analyses. Requests for permission include specific objectives, data required, analysis approach, and intended authors of all planned reports and manuscripts.

II. Publications, Software, Models and Other Works

7. SMC members are encouraged to share results from their analyses involving use of SMC data. Any publications or products resulting from the use of SMC data must credit that fact.
8. Analyses and software derived in whole or in part on SMC data may not be shared with non-SMC members except when placed in the public domain.
9. Results of analyses, software, or models based on the SMC database produced by UW faculty, staff, students, and designated analysts appearing in peer-reviewed journals, theses, symposium proceedings, and other media are owned by the University of Washington and administered by the Cooperative Director. SMC members will receive copies of these works. These works may be copyrighted by the UW, the authors, or the publishing entity.
10. Non-UW members may also develop and publish analyses, software, or models based on the SMC database. Copyright, if any, established on any such works remains under the ownership and control of their respective authors (or assignees).
11. SMC members and non-members wishing to use or distribute copyrighted materials must obtain appropriate permissions from the copyright owner(s).

12. The SMC data used in the development of any copyrighted or un-copyrighted works remains the property of the University of Washington and subject to the distribution rules in Section I.

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Changes and exceptions to this Policy must be approved by the Policy Committee.

MINUTES OF MEETINGS
Stand Management Cooperative

SMC Strategic Planning Committee Meeting, January 27, 2010
School of Forest Resources, University of Washington, Seattle, WA.

Attendees: David Briggs. Rob Harrison, Eini Lowell, Doug Maguire, David Marshall, Gene McCaul. George McFadden, Megan O'Shea, Eric Turnblom. By Telephone: Louise de Montigny, Jake Gibbs, Scott McLeod

The meeting began at 9:30 with the following agenda topics

Agenda

1. Status of the Budget

D. Briggs provided a brief update. It appears that the goal of ending 2009 with a budget balance of $80,000 to help buffer 20% reduced 2010 budget will be met. Examination of the 2010 budget involves carrying the 2009 budget forward plus three significant changes in income, (1) the Weyerhaeuser NR Co. reduction of 50% changed to 20%, (2) special contract income that we had assumed would be zero now totals $7500, and (3) International Forestry Consultants has joined with dues (after the 20% reduction af about $6,000. With these changes the goal of finishing 2010 with a $20,000 ending balance can be achieved even after restoring regular salary levels of SMC staff and faculty. D. Briggs will start preliminary scenarios for 2011 assuming the 20% dues reduction continues and prepare15%, 10% and 0% reduction scenarios for discussion with the Finance Committee.

2. Evaluate and recommend on suggestions concerning restitution for unpaid dues.

The committee noted that the SMC has discussed (a) restitution fees for members that either dropped out or temporarily lowered their dues and (b) "initiation" fees that organizations wishing to join the SMC would pay in addition to the normal dues. The conclusions reached in the past were that imposing restitution fees were more likely to act as a further incentive to lower commitment further or drop out and a disincentive to return. We have had a number of cases (Boise Cascade, Trillium) in the past that dropped out and rejoined with no penalty. If we were to institute restitution fees then it would be unfair to those organizations to allow one who had never been a member to join without paying a similar lump sum initiation fee". It was felt that making it more expensive to join would likely be a disincentive.

The possibility of some form of "voluntary contribution" was also mentioned. This could be an analysis needed by the SMC or other service. It was noted that this may be easy for some to do but virtually impossible for others. With the exception of the GGTIV installations where we have tracked maintenance costs and credited the owners of those sites for contracting this work, we do not have a system in place for documenting services or analyses that members perform.

The Strategic Planning Committee was unanimous that we should recommend no change in past policies.

3. TAC reports on strategic plan activities

Modeling

- Current or Competed Strategic Plan Activities
  - ✓ Updated ORGANON

- ✓ Completed the PNW variant of Conifers
- ✓ Genetics growth multiplier completed and implemented
- ✓ Red alder modeling database completed and provided to modeling groups
  - ♦ FVS version is complete
  - ♦ ORGANON version is nearly finished

- Proposed Strategic Plan Activities
  - ✓ Reanalysis of fertilization response
  - ✓ Use of paired tree study in modeling
  - ✓ Improve ability to model biomass, productivity, and carbon balance
  - ✓ Incorporation of climate-soil-water balance effects. Would improve predictions and pave the way for seeking external grants

Nutrition

- Current or Competed Strategic Plan Activities
  - ✓ Paired-tree fertilization (Type V); good coverage of installations on medium to high sites. Could try to expand to get low sites. Comment was made that it may be more important to focus on developing an understanding of which medium-high sites respond and why.
  - ✓ Fall River/Matlock/Mollalla LTSP sites; biomass work is underway. Will soon know if NCASI will provide another $30-40k for 2010.
  - ✓ Carryover
  - ✓ The RFNRP sites we are monitoring are continuing to diverge and will continue to assess them
- Proposed Strategic Plan Activities
  - ✓ The opportunity to convert the 9 Type I installations with fertilizer (see attached proposal) into a new more robust carryover study received support by the Nutrition TAC. It was also supported by the Silviculture TAC. Next steps would be to asses a scheduling process for conversion and assess how this could link to the biomass proposal (attached).
  - ✓ UW, VT, and NCSU are working on a joint proposal to be submitted to NSF via CAFS.

Silviculture

- Current or Competed Strategic Plan Activities
  - ✓ Installation Retirement; Options were discussed at the TAC meeting and will be presented at the Spring Policy Committee meeting.
  - ✓ Model Validation; this project has been discussed with the Modeling TAC, a plan and budget have been developed. Finding funding is the next step.
  - ✓ "LOGS style" installation performance reports
  - ✓ New Masters student Nai Saetern will do the basic 7 of the Type I's
  - ✓ Jeff Comnick, PhD student and part time ONRC staff is working on Type II, and III
- Proposed Strategic Plan Activities
  - ✓ Proposals to use the 9 fertilized Type I's for biomass (see attached proposal) and as the basis for a carryover effect study were supported by the TAC. Next step is to begin detailed planning, sources of external funding, etc.
  - ✓ GGTIV

- ♦ Existing Grays Harbor sites are coming along; are there ancillary studies that could overlay on them?
- ♦ Originally we had a plan for six GGTIV's three along the OR/WA coast and three along the Cascade foothills. Ideas for another, most likely Oregon coast were discussed. Need to find a partner breeding zone and start planning.

Wood Quality (TAC meeting is being scheduled, likely in February)

- Current or Completed Strategic Plan Activities
  - ✓ NDT study from Type II installations
  - ✓ Still working on analyses. Need some prioritization.
  - ✓ Analysis of wood density and biomass profiles from x-ray densitometer data from the cookies from the sample trees is UW PhD topic of Rapeepan Kantavichai.
  - ✓ LOGS sites (4, possibly 5 installations). FP Innovations (Canadian Wood Fibre Centre) has been testing as subset with the ST-300 standing tree tool. We plan to obtain increment cores (x-ray densitometry at the Southern Research Station) and then use core material for near-infrared spectroscopy (Southern Research Station) and take resistograph readings (UW has a unit). We hope to develop relationships (calibrations) between the actual density (core) profile, near IR spectra, resistograph, and NDT readings. If successful it could pave the way for a fast reliable field approach to estimate wood density and stiffness.
  - ✓ Paired-tree (Type V) Installations. Wood Quality has plans to do NDT and other tests following year 6 of growth, the current longevity plan for the study.
- Proposed Strategic Plan Activities
  - ✓ Type I's: many aspects of the attached biomass proposal involve wood properties. We want to try NDT methods to develop reliable fast methods to get wood density estimates in the field. FP Innovations (Canadia Wood Fibre Centre) could be involved with this as well as NDT tests of Type II's and III's.
  - ✓ Type III's present assessing pruning effects (14 plots) and have a good series of knot measurement protocol data that follow bh branches while alive until after death.

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4. Discuss other potential strategic planning priorities.

D. Briggs briefly reviewed a "pre-proposal" document. It proposes to use the nine Type I Installations that contain fertilized plots as the initial basis of a transect to gather biomass data to better understand the interrelationships between silvicultural treatments, productivity, carbon storage and energy potential (via life-cycle analysis), and soil-climate-water balance. Some points

- As we did this we could and will need to gather a lot of useful stem analysis and wood property data.
- There is strong interest to obtain lidar coverage over on these sites to assess how well lidar can be used to asses biomass of intensively managed plantations. This led to a discussion about the potential of amending the SMC database with "clips" of lidar data from flights flown over them. We have already geo-referenced many installations and could provide landowners with information so they could provide the clips.
- This could also be accomplished in concert with the proposed Nutrition project to convert these Type I's into a new, more robust carryover effects study.

- There is strong interest from NSF's I/UCRC CAFS group to expand this idea to loblolly pine and perhaps other species.
- This is a long-term expensive project but potential sources of large funds exist in NSF, DOE, various climate change initiatives, etc.
- D. Briggs will start developing a draft for circulation.

D. Briggs also mentioned that once 2010 ends it will be time to do the 5-year owner survey update. It was suggested that we also look into updating the small landownwer survey that was conducted as part of the Washington Timber Supply study and that this be extended to include those from Oregon. Dave Briggs and Doug Maguire will follow up and review surveys for possible changes.

5. Review and Update the Strategic Plan

We reviewed the last version of the Strategic Plan, noting changes that needed to be made. It was agreed that D. Briggs would email copies to each Project Leader for their changes and would compile a new draft for review by the Committee. This would be completed so the new version can be presented at the Spring Policy Committee meeting.

6. Recommend priorities for discussion at the Spring meeting in preparation for the NSF CAFS meeting in late April 2010.

We felt that the aforementioned Type I project concept would be a great priority, especially since NSF appears to be looking to CAFS for more cross-institution, cross region projects. Our local projects that are being supported by the UW CAFS funds are on track and we will report on them at the Spring Meeting.

7. Begin planning for the 25th anniversary of the SMC.

The committee felt that some type of recognition event should be planned for the Fall Meeting. Two ideas that surfaced were

- Have a recognition plaque for each member who has an installation on their land
- Have a recognition plaque for those current member organizations that were also founders of the SMC.
- Create a video history of the SMC using photos from various sources. Matt McLaughlin with RTI has done several excellent videos and will be contacted.

8. Discuss ways to improve coordination between CIPS, PFC, and SMC

Several collaboration opportunities became evident during the preceding discussions and three points became obvious

- These are already collaborating in a number of areas but the collective group has done a poor job of documenting them. The design and structure of the paired tree trials and the joint funding through AGENDA 2020 between SMC and CIPS is just one example. Somehow these organizations need to place more emphasis on publicizing their collaborative efforts.
- Communications could be improved. More use of videoconferencing of meetings would

help, especially with travel and time restrictions. We should investigate various videoconferencing systems, select one to use, and become proficient with it. Issuing a joint Newsletter would be another avenue.

- With the current economic climate, funding of all CIPS, PFC, and SMC has been significantly reduced. While we can plan for collaborations, implementation will be very difficult until funding improves.

The meeting adjourned at noon.

Stand Management Cooperative Spring Meeting, April 13-14, 2010
Gifford Pinchot National Forest Headquarters , Vancouver, WA.

Attendees: Campbell Group, Dave Hamlin, Dave Rumker ; Consultants, Jim Flewelling, Mel Scott Canadian Wood Fibre Center Ross Koppenaal; Forest Capital Partners, Bruce Ripley, Mark McKelvie; Green Diamond Resource Company, Randall Greggs, Steve Loy; Hancock Forest Management, Dean Stuck; International Forestry Consultants Griffin Chamberlain, Jess Saunders, Lone Rock Timber Co., Jake Gbbs, Chris Sexton; Olympic Resource Management, Scott Holmen; Plum Creek Timber Co., Steve Wickham, Steve Gavelle; Port Blakely Tree Farms LP, Jeff Madsen; Quinault Indian Nation, Jim Plampin, Mark Stamen; Rayonier Forest Resources, Candace Cahill; Roseburg Forest Products, Sean Garber, Mark Wall;; Stimson Lumber Co, Margaret Banks, Scott Gray; University of Washington, Dave Briggs, Keven Ceder, Jeff Comnick, Bob Gonyea, Bert Hasselberg, Austin Hines, Rapeepan Kantavichai, Bruce Lippke, Kim Littke, Megan O'Shea, Nai Saetern, Eric Turnblom; USFS PNW RS, Eini Lowell; WA DNR, Scott McLeo. Rob Hoff, Rick Palmer, John Trobaugh, Norm Anderson (ret); West Fork Timber CO, Gene McCaul; Weyerhaeuser Company, Scott Holub, Greg Johnson, Dave Marshall; Visiting Scholar, Vitalie Gulcahell

The meeting, at the Olympic National Forest Headquarters in Olympia, WA., began at 9:30 with the agenda in Appendix A; There were 48 attendees from 23 organizations. Policy Committee Chair Dave Rumker opened the meeting, welcomed the attendees and commented on the importance of the budget and strategic plan discussions on the agenda.

ACCOMPLISHMENTS

Dave Briggs reviewed accomplishments to date. A few highlights:

- Total 1985-2010 funding of the SMC from landowner member dues, external grants, and institutional members reached $20.4 million.
- Membership: International Forestry Consultants joined the SMC.
- GGTIV installations: we terminated vegetation control for the 2005 plantings last year and will do likewise for the 2006 plantings this year and will need a vegetation survey on them this summer.
- 5 articles in print and 3 in review.
- AGENDA 2020 has provided $25,000 for the paired tree fertilization study.
- NCASI has provided $15,000 for a life-cycle assessment of intensively managed plantations and $24,000 to support continued work at Fall River, Matlock, and Molalla.

ANNOUNCEMENTS

- NSF Center for Advanced Forest Systems meeting will be on April 27-29, in Indianapolis.
- The Fall 2010 meeting will be held at Oregon State University on September 21-22.

BUDGET

The 2009 budget which ended with a balance of $89,029. This exceeded a target of $80,000 set in Spring 2009 in response to the economic downturn that was causing members to consider reducing dues. The target was achieved by laying off one of our two database management staff and imposing a 2-week shut down for all remaining personnel during the last half of 2009. At the Fall 2009 meeting the following motion was approved. *It is moved that*

1 *The SMC invoice those who have indicated mandated dues cuts at their resultant dues amounts for 2010.*

2 *The SMC invoice all others at 80% of their full 2010 dues (a 20% cut).*

3 *That the SMC 2010 budget be managed to produce an ending balance of $20,000.*

4 *Since the Fall 2009 meeting there have been meetings to discuss Strategic Plan updates, on red alder modeling (ORGANON), on CONIFERS modification and modeling (VMRC/CIPS), on collaboration with the Wood Quality TAC on wood quality modeling and discussion with the Silviculture TAC on growth model evaluations.*

A. Contacts for models

- CONIFERS: Martin Ritchie (mritchie@fs.fed.us) http://www.fs.fed.us/psw/programs/ecology_of_western_forests/projects/conifers/
- FVS: Erin Smith-Mateja (eesmith@fs.fed.us); http://www.fs.fed.us/fmsc/
- ORGANON: David Hann (david.hann@oregonstate.edu); http://www.cof.orst.edu/cof/fr/research/organon/

B. Strategic Plan Update

Of the six goals in the Strategic Plan, Goa1 3 "Analyze the high quality data to produce information that furthers global competitiveness of the forest products sector and improves environmental benefits to society" is especially relevant to the Modeling TAC. Within this goal specific tasks under discussion include deciding on when to do the next major modeling upgrade with new data in the database, developing plans for model improvements (e.g. wood quality, biomass/carbon, and productivity), and seeking collaboration with other projects and cooperatives to improve models and add capabilities (SMC TACs, CIPS). Current Modeling TAC Strategic Plan priorities are

- Priority 1
  - ➢ Completion of red alder analysis; the FVS version is available and the ORGANON version is nearly finished.

- Collaborate with CIPS on a process model proposal.
- Collaborate with CIPS on Improvements to the CONIFERS model.
- Collaborate with the Silviculture TAC on growth model evaluation; a plan has been developed.

- Priority 2
  - Work with Wood Quality TAC on wood quality modeling.
  - Update thinning and fertilization.
- Priority 3
  - Develop proposals and seek funding opportunities to support biomass and carbon modeling and for climate and weather modeling.
- Priority 4
  - That the Strategic Planning Committee examine concerns regarding restitution for unpaid dues and make recommendations for inclusion in the SMC By Laws.
  - That this vote is just for 2010 dues and budget management. The Finance Committee will assess the situation for 2011 as 2010 unfolds and develop a recommendation for the 2011 budget for vote at the Fall 2010 meeting.

A projection for 2010 indicating that it is on track to meet the $20,000 target for the end of the year. As 2010 unfolds the Finance Committee will survey members for their dues level expectations for 2011-2013 and develop projections for scenarios indicated by the survey. The committee will examine the scenarios and make recommendations at the Fall meeting.

STRATEGIC PLAN

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The Strategic Planning Committee held a meeting in January after the TAC's had held meetings. This led to a new, updated draft which was reviewed. Small editing changes were suggested for Goals 1-5 but many felt that Goal # 6 was less than satisfying as written and should be revised to "liven it up". A second key point related to the need for more technology transfer and the numerous analyses that could be produced from the database. D. Briggs suggested that the SMC form a committee of members to identify important analyses and deliverable products, establish a cost estimate and timetable and identify who might be the best to complete the project on time. These projects would be presented to the Policy Committee for prioritization and discussion of how funding could be achieved. It was decided to form an SMC Technology Transfer Committee and several individuals indicated willingness to participate. D. Briggs will follow up with an email to the members to confirm these individuals and determine if others who were not at the meeting would like to participate.

Modeling Project Report: Dave Marshall

Since the Fall 2009 meeting there have been meetings to discuss Strategic Plan updates, on red alder modeling (ORGANON), on CONIFERS modification and modeling (VMRC/CIPS), on collaboration with the Wood Quality TAC on wood quality modeling and discussion with the Silviculture TAC on growth model evaluations.

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  - ➢ Work with Wood Quality TAC on wood quality modeling.
  - ➢ Update thinning and fertilization.
- Priority 3
  - ➢ Develop proposals and seek funding opportunities to support biomass and carbon modeling and for climate and weather modeling.

Nutrition Project Report: Rob Harrison

Kim Littke reported for Rob who was attending another meeting.

- Carryover Study: Paul Footen (M.S. student) found small but statistically significant differences in mean DBH, total height, and understory after about the 5th year since planting. An article has been published in Forest Ecology & Management
- Paired Tree Fertilization Study: 60 installations have been created; Kim Littke presented a status report in the afternoon session. A final $25,000 from AGEDNA 2020 bringing the total to $75K at UW and $75K OSU.
- Fall River, Matlock, and Mollalla Long-term site productivity studies: Received $24,000 new funding from NCASI; cumulative total from all sources is $579,000. Carol Shilling is developing biomass estimates.
- Students
  - Paul Footen returning as PhD tentatively will work on the LTSP sites.
  - Joy Liu is a new student from Taiwan; working on a Centralia, WA. reclamation study and nutrient hydrology.
  - 2 or 3 new students entering Summer-Fall 2010.
  - Approx $100K/year equivalent from UW Teaching Assistantships and Gessel fellowships supports graduate students

Silviculture Project Report: Eric Turnblom

A. 2009/10 Field Season Summary. 68 installations (422 plots) measured, includes 2 installations (12 plots) in BC measured by MC Ministry of Forests, second measurement of the 3 GGTIV installations (66 plots) planted in 2006, full measurement of 34 Type V paired tree fertilization installations, 3 special contract installations (31 plots), and final foliage sampling on the last of the 9 Type I's with fertilized auxiliary plots.

B. GGTIV Installations: Fences were repaired as required. The 3 installations planted in 2006 received their last, 5th, herbicide treatment. This matches the number of treatments on the 3 installations planted in 2005. The decision was made that herbicide treatment will be discontinued.

C. Summer 2010 Plan: Visit the GGTIV planted in 2006 for final vegetation surveys. Visit a subset of Type I, II, and III installations measured in 09/10 dormant season for vegetation and habitat surveys.

D. Silviculture TAC meeting held in December 2009

Discussed criteria for "retirement" of installations. A matrix is being developed to show the number of measurements on each installation until the harvest date defined by the landowner.

Model Validation: Benchmarking Douglas-fir growth and yield models.

- Co-PIs are Greg Johnson, Dave Hamlin, David Marshall, Eric Turnblom
- Three phases
  - Exhaustive Literature Review. Examine reported treatment responses, identifying consistencies and inconsistencies resulting in informed expectation of responses. Identify which models to compare in study.
  - Develop validation database (mainly SMC data). Use other 'high quality' data sets if available, finalize list of compared models, gather support of model authors, develop way to automate standard set of model runs.
  - Perform model runs, analyze results, write report discussing how well the models predict the validation database and how well each model's predictions line up with the informed expectation developed in first phase.

The structure and content of LOGS style performance summaries of Type I, II, and III installations was discussed. MS Student Nai Saetern and PhD student Jeff Comnick are developing these reports and gave presentations during the Technical Session.

E. Other projects

1. Vegetation Composition and Succession in Managed, Coastal Douglas-fir Ecosystems. Sponsored by NCASI, Western Wildlife Program. PhD student Kevin Ceder presented results during the technical session.
2. Sun-Tree Identification in Tree Lists of Multi-Strata Stands. Sponsored by USFS, cooperating with OESF / ONRC. Conjecture: top level or uppermost stratum may "drive" size / density relationships, hence stand dynamics. PhD student Nick Vaughn is, examining various metrics for crown closure distribution, crown length distribution, etc.
3. Collaboration on wood quality studies. Work modeling the diameter of the largest branch in the breast-height region (DLLBH) was completed with 1 publication in print and another in review. Work on modeling wood density as affected by treatments and climate using data from disks taken from logs during the Pack Forest highway thinning recovery study has led to 2 published articles.

Wood Quality Project Report: Eini Lowell

A. NDT Study (AGENDA 2020 2004)

1. In 2005, SMC collaborated with PNWTIRC on use of acoustic tools to evaluate wood stiffness in progeny trials. This has led to the following publications
   - Cherry, M.L., Howe, G.T., Briggs, D., Cress, D., Vikram, V. 2007. Genetic Variation in Wood Quality in a Clonal Douglas-fir Seed Orchard. PNWTIRC Report 26. Pacific Northwest Tree Improvement Research Cooperative, Oregon State University, Corvallis, OR. 11pp
   - Cherry, M.L., Vikram, V., Briggs, D., Cress, D., Howe, G.T. 2007. Genetic Variation in Direct and Indirect Measures of Wood Stiffness in Coastal Douglas-fir. PNWTIRC Report 27.

Pacific Northwest Tree Improvement Research Cooperative, Oregon State University, Corvallis, OR. 30pp

- Cherry, M.L., Vikram, V., Briggs, D., Cress, D., and Howe, G.T. 2008. Genetic variation in direct and indirect measures of wood stiffness in coastal Douglas-fir. Can. J. For. Res. 38:2476-2486.

- Vikram, Vikas, Marilyn L. Cherry, David Briggs, Daniel W. Cress, Robert Evans, and Glenn T. Howe. (2010 submilled). Stiffness of Douglas-fir Lumber: Effects of Wood Properties and Genetics. Canadian Journal of Forest Research.

2. In 2006-2007 SMC sampled trees from four Type II installations that were converted into lumber and veneer. Disks obtained at the stump and top of each 16 ft sawlog and 17 ft peeler. Both whole disk and x-ray densitometer, done by Weyerhaeuser, data was collected from each disk. Lumber and veneer from the study logs was tested by the US Forest Products Laboratory in Madison, WI. and a sample of veneer was photographed for glass-log knot modeling. Analyses completed or underway include

   - Briggs, D.G, G. Thienel, E. C. Turnblom, E. Lowell, D. Dykstra, R. J. Ross, X. Wang, P. Carter. 2008. Influence of Thinning on Acoustic Velocity of Douglas-fir Trees in Western Washington and Western Oregon. In Proc. 15th International Symposium on Nondestructive Testing of Wood, R.J. Ross, X. Wang, B.K. Brashaw, eds. Duluth, MN. Sept 10-12, 2007. Forest Products Society, Madison, WI. pp 113-124.

   - Todoroki, C.L., E.C. Lowell, D.P. Dykstra. 2010. Automated knot detection on Douglas-fir veneer images. Computers in Engineering and Agriculture. 70(1): 163-171.

   - UW PhD student Rapeepan Kantavichai is using disk data to model wood density and biomass increment as affected by ring age, tree stand, treatment (thinning), and local climate variables.

   - Eini Lowell and Dennis Dykstra are analyzing lumber and veneer quality in relation to treatment.

   - A comprehensive database of all information from this product recovery study is nearly complete and will facilitate additional analyses.

B. Determining the effect of thinning, site quality and stand density on wood quality using non-destructive testing to develop predictive models of stiffness, wood density and other properties. Sponsored by the PNW Research Station, Canadian Forest Service (Wood Fibre Centre), the Precision Forestry Coop erative and the SMC. The sample consists of 4 LOGS Installations (135 trees/installation); 3 treatments (thinning regimes and control); 3 plots per treatment; 15 trees per plot. ST300 acoustic velocity data collection has been completed and a summary was presented during the technical session. UW Precision Forestry Cooperative obtained a Resistograph and will collect data this spring/summer. Increment cores have been collected from a sub-sample of trees on site and the balance will be collected when the sites are visited for Resistograph readings. Cores will be sent to USFS Southern Research Station for x-ray densitometry and near-infrared spectroscopy. Discussion is underway to expand sampling to include SMC Type I installations, most likely the 9 with auxiliary fertilization plots.

C. Paired-Tree Fertilization Project.

   - Wood quality measurements, including acoustic velocity and wood density, will be obtained after treatments have been implemented and sufficient post-treatment growing

seasons have elapsed. Destructive sampling is not envisioned without supplemental grant funds.

- Terrestrial Lidar is not being collected due to expense, stand density, etc. but some type of crown information should be collected. We need to develop a plan for what information to collect.

D. Biomass (carbon, bio-energy).

D. Briggs presented a 2-page draft proposal that would use a transect of SMC installations to develop models to improve estimation of biomass and associated carbon and energy balances of intensively managed plantations. There was consensus that a full proposal should be developed with the objective of seeking grant funds. D. Briggs will work on this.

E. Wood Quality TAC Meeting

1. Interest in Type II installations. While the remainder will continue to be measured, the Wood Quality TAC does not plan to initiate studies in them.

2. Interest in Type III installations. These are still developing. Branch protocol data is being collected so there could be a project to assess changes with age and the influence of initial spacing and thinning. The pruned plots offer opportunities as well but no interest was expressed at this time.

3. Strategic Plan Review. The WQ TAC reviewed the Strategic Plan and developed the following comments and questions for further discussion.

- Goal 1A: *Design and Establish Field Research Installations*. WQ TAC reviews new designs to ensure wood quality components and defines wood quality hypotheses.

- Goal 1 C: *Develop Field Procedure Manual*. Does wood quality need standardization for new procedures? It was felt that protocols shuld be defined for nondestructive sampling procedures and correct methods for using equipment (Hit man, ST 300, resistograph).

- Goal 3A *Maintain & refine past modeling efforts*. Refinements could include wood quality, biomass/carbon/density (EW/LW), and productivity. Discussion is underway with the Modeling TAC.

- Goal 3C *Develop decision support tools*. Where does SMC fit with LIDAR use? Specifically list items to concentrate on; carbon, biomass, density, branch protocol modeling, latewood indicators.

FOLLOW UP ACTIONS

1. Develop program details for the Fall Meeting..

2. Encourage each TAC to hold a meeting before the Fall meeting.

3. Establish the SMC Technology Transfer Committee and set up schedule to identify high-interest projects and deliverables for discussion and prioritization at the Fall Meeting.

4. Schedule a Strategic Planning Committee to act on comments on the Strategic Plan.

5. Finance Committee will survey members for input on budget levels, conduct scenario analyses for 2011-13, and develop recommendations for the Fall Meeting.

6. Develop biomass proposal.

TECHNICAL SESSION

The afternoon program was devoted to progress reports on projects which can be downloaded from the SMC website (www.standmgt.org).

Carbon Workshop

The morning of April 14 was devoted to the issue of carbon storage by forests. Bruce Lippke provided an overview of research by CORRIM and the role of timber in on-site sequestration and subsequent storage in the form of long term wood products and associated substitution effects. Rob Harrison presented an overview of carbon storage by forests, particularly in soils, an area that needs research with consistent methods. David Briggs followed with a discussion of the problems and errors associated with current methods of estimating biomass, 50% of which is carbon. He also summarized past and current work on live cycle analysis of alternative intensively managed plantation regimes. These presentations are on the SMC website (www.standmgt.org). Discussion following the presentations focused on the potential role of the SMC and it's network of field research sites to address issues related to estimation of biomass and carbon in forest systems. Representatives from Weyerhaeuser summarized a protocol they have developed to address the issue of carbon storage and change associated with harvesting and invited others to participate. A proposal to create a transect across the SMC installations (Type I) which would be sampled for biomass and soil carbon was reviewed. A full proposal for submission to one or more potential large grant organizations will be developed over the summer.

APPENDIX

STAND MANAGEMENT COOPERATIVE SPRING MEETING
Olympic NF HQ, Olympia, WA. April 13-14, 2010

April 13	AGENDA
9:00	Coffee & Rolls
9:30	Welcome & Introductions: Dave Rumker, Policy Committee Chair: David Briggs, Director
9:40	✓ Accomplishments & Plans for 2010– David Briggs ✓ NSF I/UCRC CAFS April 27-29 meeting, Indianapolis ✓ SMC Fall Meeting ➔ week of Sept 21-22, OSU ✓ Other Meetings, Conferences, & Workshops
9:55	Budget Status & Outlook– David Briggs
10:25	Modeling TAC Report – Dave Marshall, Modeling Project Leader
10:45	Nutrition TAC Report – Rob Harrison, Nutrition Project Leader
11:05	Silviculture TAC Report – Eric Turnblom, Silviculture Project Leader
11:25	Wood Quality TAC Report – Eini Lowell, Wood Quality Project Leader
12:00	**Lunch**
1:00	SMC Strategic Plan Update – David Briggs
1:30	Type I Biomass & Carryover Effects Proposal– David Briggs NSF I/UCRC CAFS meeting: What are SMC priorities?
	Research Reports
2:00	"Forestry and Silviculture in Moldavia" Vitalie Gulca, visiting Fulbright Scholar
2:30	Results of Acoustic Velocity Tests on Standing Trees on Levels of Growing Stock (LOGS) Sites. Ross Koppenall
2:50	**Break**
3:00	"Paired Tree Study: Preliminary Results and Ongoing Research" Kim Littke
3:10	LOGS –style Performance Reports for the SMC Type I, II and III Installations. Nai Saetern, Jeff Comnick
3:30	Modeling Annual Biomass (Carbon) Increment Response to Thinning and Climate at Four Coastal Douglas-fir Plantation Sites Rapeepan Kantavichai
3:50	A set of understory models for young, managed stands. Kevin Ceder
4:30	Adjourn
April 14	**Forest Carbon Workshop**
8:00	Coffee & rolls
8:05	Tracking Carbon Through the Forest – Product – Use - Disposal System Bruce Lippke, CORRIM
8:35	The Forest System Carbon Cycle: What is in the Soil, What is in the Trees and Vegetation. Rob Harrison
9:05	Estimating Biomass in Douglas-fir Trees: Status of Equations and Models. David Briggs, Rob Harrison
9:35	Life Cycle Analysis of Silvicultural Regimes. David Briggs
10:05	Break
10:25	Discussion: What Role Can (Should) the SMC Play to Leverage its Suites of Field Research Installations to Improve Forest Carbon Models and Accounting?
12:00	Adjourn

Stand Management Cooperative Fall Meeting Minutes
Sept 21-22, 2010 Oregon State University

Attendees: Agrotain, Ben Thompson; BC Ministry of Forests, Louise deMontigney; Bureau of Land Management, Jeannette Griese; The Campbell Group, Dave Hamlin, Dave Rumker; Consultant, Rich Gratefendt; Forest Capital Partners, Mark McKelvie; Green Diamond Resource Company, Randall Greggs; Hampton Resources, Dennis Creel; Hancock Forest Management, Dean Stuck; Lone Rock Timber Co., Jake Gibbs, Brian Nelson, Chris Sexton; Mason, Bruce, & Girard, Chuck Stiff; Murray Pacific/West Fork Timber CO, Gene McCaul; Olympic Resource Management, Scott Holmen; Oregon State University, Doug Maguire, Glenn Howe, Doug Mainwaring[Plum Creek Timber Co., Conner Fristoe, Steve Wickham, Steve Gavelle; Port Blakely Tree Farms LP, Jeff Madsen, Mike Warjone; Quinault Indian Nation, Jim Hargrove, John Mitchell, Jim Plampin; Rayonier Forest Resources, Candace Cahill, Jim Gent, John McTague; Roseburg Forest Products, Sean Garber; Stimson Lumber Co, Margaret Banks, Roger VanDyke; TimberWest-Coast Timberlands, Tim Crowder; University of Washington, Dave Briggs, Keven Ceder, Bob Gonyea, Rob Harrison, Megan O'Shea, Eric Turnblom, Rob Harrison; USFS PNW RS, Eini Lowell; WA DNR, Scott McLeod; Weyerhaeuser Company, Scott Holub, Dave Marshall.

The meeting, at Oregon State University, Corvallis, OR., began at 8:30 with the agenda in Appendix A; There were 45 attendees from 25 organizations. Policy Committee Chair Dave Rumker opened the meeting, welcomed the attendees and commented on the continuing importance of the SMC as a critical information source for forest land managers.

ACCOMPLISHMENTS

Dave Briggs reviewed accomplishments to date. A few highlights:

- Cumulative funding since 1985 has reached $20.1 million.
- David Briggs received continuation of the Corkery Family Foundation Chair through June 2013.
- International Forestry Consultants and Agrotain joined the SMC.
- 7 articles are in print, 2 have been accepted and 5 are in review.
- SMC has 5 PhD and 4 Masters students in residence.

ANNOUNCEMENTS

NSF Center for Advanced Forest Systems annual meeting will be in Seattle in June 13-16, 2011.

The Spring and Fall 2011 meetings are tentatively scheduled for April 19-20 and Sept 20-21 respectively. To encourage wider participation and technology transfer, the format of the Spring meeting will have reports on continuing and completed projects in the morning of the 19th followed by a workshop. The business meeting will be in the morning of the 20th. D. Briggs will solicit ideas for workshop topics from the members.

STRATEGIC PLAN

A Technology Transfer Committee was formed at the Spring meeting to solicit brief descriptions of proposals for transfer projects from the TAC's and from members. The objective is to focus on projects for which most data was already available that could be accomplished within a 2 year time frame, likely by a Masters student, and which had high interest by member organizations. Table 1 lists the titles of 2 continuing and 9 new project that were received. After 10 minute presentation and discussion of each project, each voting member was given a copy of the project descriptions and three red stickers worth 3, 2, and 1 points respectively. A member would place the sticker worth 3 points on the project they felt would be most valuable, the sticker worth 2 points on the project they felt would be the second most valuable, and the sticker worth 1 point on the project they felt would be third most valuable. They could also combine stickers on just 1 or 2 projects if they wished. The right column of Table 1 shows the final tally. This will greatly help the SMC focus on projects that are of greatest importance to members and help with recruiting students that would best match them.

Table 1. Continuing and proposed SMC Technology Transfer Projects and total points received from voting members

Project Title	Point Total
Continuing: Growth and yield performance of SMC Type I, II, and III installations	**43**
Continuing: 2010 SMC Owner Survey	**17**
New: Response of wood quality parameters to stand density regime and nitrogen fertilization	**13**
New: Effect of management regimes of SMC Type I, II, and III Installations on Wood Quality: Knots	**10**
New: Development of models and software to predict changes in the young stand systems.	**10**
New: Develop methodology for relating height growth of young stands to site index and future yields	**10**
New: Evaluating site and climatic factors in a management-oriented, dynamical forest system model.	**9**
New: Canopy characterization of SMC Type V studies	**5**
New: Develop a model that predicts wood density, acoustic velocity, and modulus of elasticity longitudinally and radially in the stem from common inventory data	**3**
New: Assessing vegetation response to herbicide application in GGTIV installations	**0**
New: Development of a Wood Quality Website	**0**
New: Update Wood Quality module for inclusion in individual tree models	**0**

BUDGET

The 2010 budget with actual expenses through August and projections for the balance of the year was reviewed. The budget is based on the vote in 2009 for 80% of full funding (20% cut). An estimated end of year balance of $36,580 is that would carry forward into 2011. This exceeds the end of year target orf $20,000 established at the Fall 2009 meeting. This balance reflects cost cutting actions taken in mid-2009, including a 2-week shut down with no pay for SMC faculty and staff and the permanent layoff of the database programmer.

The SMC Finance Committee developed 0%, 5%, 10%, 15%, and 20% cut scenarios for 2011-13, starting with the targeted $20,000 balance from 2010 and assuming 0% and 3% inflation. It was found that the heavier cut levels led to balances that were either negative or below the $20,000 ending balance goal. It was moved (Randall Greggs) and seconded (Gene McCaul) that

1. The SMC invoice Oregon Department of Forestry and Washington DNR at their the same % cut level as in 2010
2. The SMC invoice all others at 95% of their full 2010 dues (a 5% cut).
3. That the SMC 2011 budget be managed to produce an ending balance of $20,000.
4. That this vote is just for 2011 dues and budget management. The Finance Committee will assess the situation for 2012 as 2011 unfolds and develop a recommendation for the 2012 budget for vote at the Fall 2011 meeting.

The motion was approved by a vote of 11 in favor and 6 opposed.

Modeling Project Report: Dave Marshall

A. Purpose

- Develop research plans, proposals for external funding, etc.
- Develop appropriate collaborations with other cooperatives.
- Develop experimental designs, field measurement protocols, etc.

B. 2010 activities

- Strategic plan: The Modeling Project has met many of its 5-year goals, including the PNW-CONIFERS young stand model and updating ORGANON SMC and genetics models.
- Review of CIPS (VMRC) young stand modeling work to build on the previous young stand model by the SMC (PNW-CONIFERS) using vegetation treatment data available from the VMR.
- Participation in the ORGANON red alder plantation model project (Hardwood Silviculture Cooperative). The database was created through a contract with the SMC. The Modeling TAC provided requested review of model components. The modeling is complete and beta testers are needed; contact Dave Marshall if you are interested.

- SMC TAC Collaborations. The Modeling and Wood Quality TAC's are discussing wood quality modeling and is collaborating with the Silviculture: TAC on growth model evaluations. The Modeling TAC has facilitated FVS / ORGANON collaboration that will involve Erin Smith-Mateja and David Hann who will be working on folding the ORGANON model into the FVS interface. Potential funding from BLM is being explored.

C. 2011 Activity Plan

- Define the Modeling TAC role under CAFS, biomass, biofuels, carbon and climate initiatives.
- Continue to encourage collaboration with other cooperatives — CIPS, VMRC, NWTIC, PNWTIRC, HSC and others.
- Seek beta testers for the ORGANON red alder model.
- Identify priority projects. One under discussion is re-evaluation of models for fertilization and thinning. Six models tested show a wide range of responses to thinning, fertilization, and their combination. No one model adhered to all of general research findings on these treatments. (G. Johnson, GMUG Growth Model Runoff II).

Nutrition Project Report: Rob Harrison

A. Carryover Study. Paul Footen (M.S. student) found small but statistically significant differences in mean DBH and height after about the 5th year since planting, also understory differences. Paul is now completing understory/site characterization work, snf has a manuscript published for North American Forest Soils conference http://soilslab.cfr.washington/edu/publications/Footen-etal-2009.pdf and an additional paper being prepared. Funding is primarily from TA/Gessel and sample analysis/ travel paid from SMC

B. Paired Tree Fertilization Study. Kim Littke Ph.D., has completed her qualifying exam and is about 1 year from graduation;. She has submitted 2 manuscripts, one to the Soil Science Society of America Journal, and one to Forest Science. Austin Himes (M.S. student, B.S. from U. Oregon) will start Fall quarter on this project. Funding from TA/Gessel, NSF (2 grants), USFS and Agenda 2020.

C. Fall River/Matlock/Molalla LTSPs. Received $24K in 2010-2011 for $579K since the project began. Warren Devine is working on biomass equations; Ghazala Yaseem will start winter, 2011. Ghazala Yasmeen, currently a World Forestry Center fellow, 1 new student entering Winter, 2011, will enter Winter 2011 to work on LTSPs.

D. "Use of stable isotopes to trace the fate of applied nitrogen in forest plantations to evaluate fertil izer efficiency and ecosystem impacts." Thomas Fox, Brian Strahm, Virginia Tech; Rob Harrison, University of Washington, Jose Stape, North Carolina State University; Douglas Jacobs. Purdue Uni versity. Submitted as a Center for Adavced Forest Systems project to the National Science Founda tion and funded for $195,708.

E. Deep Soils issue of Forest Science (8 papers), editors Rob Harrison, Dan Richter (Duke), Tom Fox (V Tech); highlights SMC work related to carbon in soils.

Silviculture Project Report: Eric Turnblom

A. 2010/11 field season

- Type I Installations. Well-established juvenile stands at or near a stage of stand development conducive to pre-commercial thinning (1970s cohort. Each has 7 basic spacing and thinning treatments but some also have 3 to 8 Auxiliary plots for fertilization and pruning. 22 Type I installations (135 plots total) will be visited including three installations in B.C. that will be measured by the BC Ministry of Forests. Twelve installations will receive full measurements and all but five have thinning plots near RD triggers so some may be thinned.

- Type II Installations. Plantations or natural stands at or near a stage of development receptive to commercial thinning (1950/60s cohort). Each has a control plot and four thinning plots. Only 4 of the original 12 remain active. Three installations (15 plots) are scheduled for measurement.

- Type III Installations. Plantations planted in at six pre-specified spacings ranging from 100 to 1210 stems per acre (late 1980s to '90s cohort). Treatments include thinning based on relative spacing in the three densest plantings and pruning in the three widest plantings. Ten Type III installations (68 plots) will be measured and one plot will be thinned.

- Genetic Gain Trial / Type IV (GGTIV) Installations. 3 planted in 2005, 3 planted in 2006. The *Genetic gain trial component* has 440 stems per acre (10x10 feet spacing) with three genetic gain levels, and complete vegetation control. The *SMC Type IV component* has three spacings, 7x7, 10x10, 15x15 (200, 440, 890 stems per acre), two genetic gain levels, and two vegetation control levels The three installations (22 plots each) planted in 2005 will be measured. In lieu of covering cost of weed control, NWTIC will send crews to measure the installations planted in 2005. Basal diameters, some now reaching 6", will continue to measured as a systematic 50-tree sample until >90% of trees have surpassed breast height by plot. Complete vegetation control, an 80% bare ground specification, included spraying relevant plots at the three installations planted in 2006. Vegetation surveys were conducted by the summer field crew in summer 2010. It has been determined that no further efforts to maintain the complete vegetation control will be needed.

- TYPE V Installations. Each installation contains multiple pairs of closely matched Douglas-fir trees of which one is randomly chosen to receive 200lb./ac of fertilizer (N as urea). A new component, sponsored by the National Science Foundation will use the N15 isotope to track the fate of N through the system. 76 installations have been located; measured, paired, and fertilized since fall 2007. Twenty eight will be re-measured and twelve (12) will receive initial measurements and be fertilized.

- Summer 2010 Field Work. Vegetation and habitat measurements were completed on the three GGTIV installations (66 plots), planted in 2006 and measured in 09/10. Vegetation and habitat measurements were completed on three Type and one Type III installation. Stem mapping at Forks #1, #2, #3 and Brittain Creek #1, #2, #3.

B. Other projects

1. Vegetation Composition and Succession in Managed, Coastal Douglas-fir Ecosystems. Sponsored by NCASI with the objective to develop overstory / understory relationships in young, managed Dou-

glas-fir stands at the species level. This has been completed and presented to the NCASI Western Wildlife Committee and a project report in final draft stage. Just received Mc-Stennis funding to begin developing a state-space, dynamical system model that will be the basis for Kevin Ceder's Ph.D dissertation.

2. Sun-Tree Identification in Tree Lists of Multi-Strata Stands. Sponsored by the USFSwith cooperation with ONCR / OESF. Conjecture is that top level or uppermost stratum may "drive" size / density relationships, hence stand dynamics. Graduate student Nick Vaughn developed a robust algorithm and surveys have been distributed to silviculture experts to validate algorithm estimates.

3. Logging Residues for Biomass / bio-energy. Sponsored by USFS with cooperation from the Olympic Natural Resources Center. The focus is on the following questions for the Olympic Peninsula. How do current utilization standards affect residue amount compared with historic levels? How does harvesting system affect residue level? How does forest type affect residue level? Field data collection is underway.

4. Stand Structural differences in mixed vs. pure species stands. Currently not sponsored, cooperating with E. Zenner at Penn State to address the following questions. How does stand structure (as measured by SSI) impact stand dynamics, growth, and yield? How is cumulative stand diameter (or basal area) increment distributed spatially over the individual trees? Stem-mapped 24 plots last July.

C. Strategic Plan Projects

1. LOGS style performance summaries of Type I, II, and III installations. Growth and yield analysis of DBH, height, tree volume, stand volume, survival (TPA), size distributions. Kevin Ceder, Jeff Comnick, and Nai Saetern are working on analyses to be followed by technical reports, workshops, and a web-based calculator tool.

2. Installation retirement criteria. The Silviculture TAC decided to poll land owners for their planned harvest year for each installation. Have heard back from all except for installations now on non-member land. In the process of contacting them.

3. Model Validation. Co-PIs are Greg Johnson, Dave Hamlin, and David Marshal. Recent observations have shown models to exhibit different effects of thinning and fertilization. Attempts to refine, restructure, hybridize empirical models would be well informed by identification of knowledge gaps that may be causing differences in modeling treatment effects. The project has four phases. First, identify criteria and indicators for sources of high quality data in concert with meta-analysis of available literature and begin identifying existing models for validation. Second, use the criteria and indicators from phase 1 to search for data sets, obtain necessary agreements for data sharing; finalize the list of models to validate and develop a standard set of model runs. Third, perform the model runs and analyze the results. Fourth, deliver a technical report and hold a workshop for model developers, data sharing agencies, SMC cooperators, collaborators, etc. Financial support required to do this is one graduate student for 2.25 yr, computer & software, supplies and materials; total would be about $34,200.

4. 2010 Database is available. Contact Randy Collier, rcollier@uw.edu, for a copy. We will be polling members to set a date for a database workshop.

Wood Quality Project Report: Eini Lowell

A. Effect of thinning, site quality and stand density on wood quality using non-destructive testing to develop predictive models.

- Collaborators. PNW Research Station ($30,000), Canadian Forest Service Wood Fibre Centre (include $17,400), SMC ($5000) and PFC ($7,000).
- Sample: 5 levels of growing stock (LOGS) sites. 3 treatments (2 thinning regimes and a control); 3 plots per treatment; 15 trees per plot yields 135 sample trees/installationfor ST-300 readings. Three trees from each plot were selected from which to take increment cores and collect resistograph measurements (total 9 trees/treatment or 27 trees per installation).
- Data collection: ST300 (longitudinal acoustic velocity) and Resistograph (bark to pith resistance profile), and increment cores (x-ray densitometry, near-infrared spectroscopy).
- Progress: Poster presented at a Canadian Wood Fibre Centre forum with ST-300 results for 4 sites. X-ray densitometry data from Shawnigan Lake and Sayward have been received and need to be checked. Resistograph readings and increment cores were taken in July-August 2010 at Iron Creek, Hoskins, Shawnigan Lake, and Sayward. Cores from US sites have been sent to the Southern Research Station for x-ray densitometry and NIRS.
- Stampede Creek measurements will be done in late September. Resistograph measurements have been made on the SMC Type I installation Roaring River. Results will be presented during the field trip.

B. Strategic Plan. Wood Quality TAC developed three project proposals that were presented as part of the proposal prioritization process during the business meeting.

C. Update on the Agenda 2020 (2004) study "Non-destructive evaluation of wood quality in standing Douglas-fir trees and logs" with Co-pi's Briggs, Lowell, Turnblom, Lippke, Carter. Most of the inte grated database has been completed and analyses are underway. X-ray densitometer data from ends of each 5m log received from Weyerhaeuser is being analyzed for PhD by Rapeepan Kantavichai, who is looking at wood density profiles and biomass increments as affected by treatments and growing environment (climate and soil). Veneer modeling continues in cooperation with Christine Todoroki, SCION, New Zealand. Initial knot detection from veneer image work has been published. Currently, we are looking at the effect of silvicultural treatment by modeling stiffness variation in veneer sheets (radially and vertically within the tree) and determining predictability based on ST-300 data from standing tree and Hitman data from merchantable bole and short logs.

D. A proposal not presented in the morning session but worth mentioning is analyzing animal damage on SMC installations (specifically bear). A previous study done on Capitol Forest found a decrease in volume and value of butt logs damaged by bears to be 5-6 % less. An analysis of the animal damage recorded in the SMC database to determine losses throughout the range of SMC data could be performed to assess the stand conditions that increase damage risk and determine the overall level of loss. Investigators would be George McFadden (BLM), Eini Lowell (PNW), Connie Harrington (PNW), Dave Marshall (Weyerhaeuser) and others. No field data collection is required and it would take a 2-year Masters student ($32,000/yr, $64,000 total) to complete. The analysis could also be done by some of the cooperating PIs.

FOLLOW UP ACTIONS

- Schedule the Spring and Fall 2011 meetings. Develop tech transfer workshop for the Spring meeting.
- Work with TAC's to schedule TAC meetings.
- Director Briggs indicated his plan to retire in 2013. He will work with the Policy Committee Chair to form a committee to develop a succession plan fro discussion with the UW. D. Briggs will initiate discussions with the Director of the School of Forest Resources to define issues and identify those at UW who should be included in the discussion.
- The Finance Committee will continue to monitor the budget as it unfolds in 2011.

TECHNICAL SESSION and Field Trip

The technical session presentations listed in the agenda can be downloaded from the SMC website (www.standmgt.org). The field trip to Roaring River, a Type I installation that has the basic 7 and all of the auziliary plots, was a great opportunity to observe and discuss performance. We also had demonstrations of the Fible Gen ST-300 and Fakopp Treesonic tools for estimating acoustic velocity as a proxy for wood stiffness in standing trees and discussed and compared results from four levels of growing stock sties and treatment plots at Roaring River. There was also a demonstration of the Resistograph which measures resistance as a drill bit bores through a tree. This takes about the same time as taking an increment core and one has the resistance data in memory of the unit for downloading and analysis. We are taking increment cores and hope to establish a relationship to calibrate resistance (Reisitograph) to wood density (increment core). Successful calibration would pave the way fro field sampling to estimate local wood density.

Appendix A

STAND MANAGEMENT COOPERATIVE FALL MEETING
Oregon State University, Corvallis, OR. September 21-22, 2010

	AGENDA
21 Sept	**BUSINESS MEETING**
8:00	Registration. Coffee & Rolls
8:30	Welcome & Introductions **Dave Rumker**, Policy Committee Chair
8:40	2010 Accomplishment; Spring 2011 Meeting (Day 1 project reports; tech transfer workshop; day 2 business meeting); SMC Owner Survey; Other Announcements **Dave Briggs**
8:50	The AFRI Project: Update and Plan **Glenn Howe**
9:10	Strategic Plan Technology Transfer Projects: **Technology Transfer Committee**
10:00	**BREAK**
10:20 S	trategic Plan Technology Transfer Projects, cont.
11:10	2010 Budget Status, SMC Finance Committee **Dave Briggs**
11:20	2011 Budget Projection and Dues Vote, SMC Finance Committee **Dave Briggs**
12:00	**LUNCH**
	PROJECT LEADER REPORTS
12:40	Modeling Project Report: **David Marshall**
1:00	Wood Quality Project Report: **Eini Lowell**
1:20	**Nutrition** Project Report **Rob Harrison**
1:40	Silviculture Project Report: **Eric Turnblom**
	TECHNICAL SESSION
2:00	"Sustaining Productivity Under Intensive Forest Management: Synthesis and Implications of Five Year Results from Two Contrasting Sites in the Pacific Northwest" **Warren Devine for Tim Harrington**
2:20	"Vegetation control effects on nitrogen and carbon pools for year-5 Douglas-fir plantations on three LTSP sites differing in productivity." **Warren Devine**
2:40	Tom Terry's talk, which I'll present, is on a web-based BMP document sponsored by the Northwest Forest Soils Council. **Scott Holub**
3:00	**BREAK**
3:20	remote canopy characterization. **Rich Grotefendt, Rob Harrison**
	PROJECT PROGRESS REPORTS
3:40	Type I , II, III performance **Kevin Ceder, Jeff Comnick, Nai Saetern, Eric Turnblom**
4:00	the N-15 paired-tree study **Kim Littke, Rob Harrison**
4:20	Comparing Carbon Footprints of Intensively Managed Plantations: Do Your Growth Model and Biomass Equation Choices Matter? **Nick Vaughn, Dave Briggs**
4:40	**ADJOURN**
	Dinner (Location TBA at meeting)
22 Sept	**FIELD TRIP** **Safety gear will be provided by Weyerhaeuser, bring proper footwear**
8:00	Depart from Corvallis
9:00	Arrive at Roaring River (Type I (trail through contrasting treatment plots; demonstration of acoustic (TreeSonic) and resistance (Resistograph) F400 tools
11:00	8:00 Leave Roaring River
11:30	Lunch near Lebanon
12:30	Roseburg Forest Products seed orchard in Lebanon **Sara Lipow and Mike Albrecht**
1:30	Valley ponderosa pine plantation
2:30	2:30 Adjourn

STAND MANAGEMENT COOPERATIVE STAFF

University of Washington, Seattle:	Dave Briggs, SMC Director William Bizak, Hourly Field Assistant Randy Collier, Senior Computer Specialist Bob Gonyea, Field Coordinator Rob Harrison, Nutrition Project Leader Bert Hasselberg, Field Technician Megan O'Shea, Administrative Specialist Eric Turnblom, Silviculture Project Leader
B.C. Ministry of Forests, Victoria:	Louise de Montigny, B.C. Research Forester
PNW Research Station, Portland:	Eini Lowell, Wood Quality Project Leader
Weyerhaeuser Company:	Dave Marshall, Modeling Project Leader
Graduate Students:	Kevin Ceder, PhD Jeff Comnick, PhD Paul Footen, MS AustinHimes, MS Rapeepan Kantavichai, PhD Kim Littke, PhD Nick Vaughn, PhD
Undergraduate Students:	None at this time

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