

## STAND MANAGEMENT COOPERATIVE SPRING MEETING

April 22-23, 2015

[UW Waterfront Activities Center](#), 3710 Montlake Blvd NE, Seattle, WA 98195

<b>April 22</b>	<b>AGENDA</b>	
8:30	Coffee & Rolls	
9:00	Welcome & Introductions: Candace Cahill, Policy Committee Chair; Greg Ettl, Director	
9:10	<p>Accomplishments</p> <ol style="list-style-type: none"> <li>1) 2014 at a glance <ul style="list-style-type: none"> <li>✓ Budget, \$200,000 carryover and now 10% overhead rate</li> <li>✓ Hired analyst Jason and Maureen</li> <li>✓ Field Measurements</li> <li>✓ Research highlights</li> </ul> </li> <li>2) Unfinished business <ul style="list-style-type: none"> <li>✓ Cleaning database—Jason Cross working through data</li> </ul> </li> <li>3) 2015 budget <ul style="list-style-type: none"> <li>✓ External funding CAFS, NCASI</li> <li>✓ Contracting out field measurement trial</li> <li>✓ Funding RFP's</li> </ul> </li> <li>4) Student Updates <ul style="list-style-type: none"> <li>✓ Finished</li> <li>✓ Started</li> </ul> </li> <li>5) Meetings 2014-2015 <ul style="list-style-type: none"> <li>✓ Joint Technical Advisory Committee: 12-8-2014 Reviewed proposals: a) paired fertilization plot study b) hemlock genetic gain, c) sun-setting Type I protocol, d) Paired tree wood quality</li> <li>✓ Installation Review (IR) Committee: 1-13-2015 (planned for sun-setting at rotation installations)</li> <li>✓ Policy Advisory Committee: 2-20-2014 Budget projection and dues</li> <li>✓ Policy Advisory Committee: 9- 3-2014 NSF/CAFS Phase II Funding, Joint Proposal for Installation 704, Request for access to SMC database</li> <li>✓ CAFS Annual Meeting 5-20-21, 2014 Coeur d'Alene, ID</li> </ul> </li> </ol>	
	<b>Technical Report</b>	
9:35	<p>Eric Turnblom and Maureen Kennedy</p> <ul style="list-style-type: none"> <li>✓ (SMC)<sup>2</sup> Report (a.k.a. SMC Performance Report)</li> <li>✓ PCT Analysis updates</li> </ul>	
10:05	<p>Nate Osborn, OSU</p> <ul style="list-style-type: none"> <li>✓ CT scanning large cores</li> </ul>	
10:20	<b>BREAK</b>	
10:35	<b>Proposals</b>	
10:40	1. Paired-tree Extension	Littke, Harrison,
11:05	2. SMC Type I Sunset Protocol	Lowell, Turnblom
11:30	3. Assessing impacts of Soil Parent Material, "Responsiveness," and N-Fertilization	Lowell, Turnblom
11:55	Tom DeLuca, Director, School of Environmental and Forest Sciences (SEFS)	

12:00	<b>Lunch</b>	
<b>Proposals continued</b>		
1:00	4. Refit SMC DF Plantation Site Curves	Flewelling , Marshall
1:25	5. Biomass Equations for Coastal Douglas-fir	Cross, Comnick, Turnblom
1:50	6. Stand and Tree Response to Late Rotation Fertilization	de Montigny, Harrison, , et al.
2:15	7. Estimate of Bole and Crown size of Douglas-fir	Miller, Turnblom
2:40	8. 2 <sup>nd</sup> Generation Genetic Gain Western Hemlock	Jayawickrama, et al.
3:10	<b>BREAK</b>	
3:25	Proposals Discussion and Voting	
4:10	Director's Introductory Preface: <ul style="list-style-type: none"> <li>✓ SMC September fall meeting             <ul style="list-style-type: none"> <li>▪ BC Sept 9-10, 2015</li> </ul> </li> <li>✓ Separate TAC Meetings for Nutrition and Silviculture: Set dates ASAP</li> <li>✓ Installation Review (IR) Committee: Set dates ASAP</li> <li>✓ SMC Review Measurements Approach (RMA) Committee Set dates ASAP</li> </ul>	
4:40	Wrap-up	
5:00-7:00	Social Hour—drinks and light hors d'oeuvres	

STAND MANAGEMENT COOPERATIVE SPRING WORKSHOPS  
April 23, 2015

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April 23	<b>AGENDA</b>
8:00	Coffee & Rolls
8:15	Welcome & Introductions: Greg Ettl, Director
8:20	1. Jason Cross: I will be leading a discussion on the SMC database, the general schema according to the 2013 data dictionary; establishing the relationships in Access and enforcing referential integrity; and the possible division of the database into two or more databases (e.g. tables in one and queries/reports in a second). Poster used in discussion available upon request, <a href="mailto:crossco@uw.edu">crossco@uw.edu</a>
10:20	<b>BREAK</b>
10:30	2. Kim Littke: I will be demonstrating the use of various models based on the Type V Paired-tree Study for predicting fertilizer response. These models are based on two-year and four-year single-tree response to fertilization. Please contact Kim Littke ( <a href="mailto:littkek@uw.edu">littkek@uw.edu</a> ) if you would like to calculate predictions for actual stands (7-27 years at breast height) during the workshop.
12:30	<b>LUNCH</b>
1:30	3. Eric Turnblom and Jason Cross: We will be demonstrating how the Tree List Generation Database can be accessed and run to create Tree Lists three different ways: 1) in 'batch mode' using formatted input & output files; 2) using the GUI front end; and 3) Using output generated from the SMC Plantation Yield Calculator. We will also show how the tree lists thus created can be automatically re-formatted into SMC-ORGANON input files. Finally, how models and methods resulting from the PCT Analysis can be fit into this same framework will be discussed. <a href="mailto:ect@uw.edu">ect@uw.edu</a>
3:00	Wrap-up, plans for follow up workshops
3:30	<b>ADJOURN</b>

<b>Type I</b>					
<b>Inst.</b>	<b>Name</b>	<b>Job</b>	<b>Date</b>	<b>Company</b>	<b>Comments</b>
701	Mason Lake	Full Measurement	1/7/2014	Green Dia	Plot 4 RD , wait
702	Adam River	Full Measurement		BC	
703	Longbell Road	Full Measurement	2/12/2015	DNR	Plot 10 RD 54.3, wait
705	East Twin Creek	RD check	1/9/2014	Hancock	Plot 3 RD 55.7, marked
713	Saulk Mt.	RD check	11/12/2014	Grady lake	Plot 10 RD 51.6, wait
715	Davie River	RD check	1/1/2015	BC	RD check plot 6, Likely
716	Quilla Creek	RD check	1/1/2015	BC	RD check plot 3, likely
725	Sandy Shore	Full Measurement	1/27/2015	Olympic	
726	Toledo	Full Measurement	2/26/2015	Plum Cr	Plot 1 RD 51.3, marked, Plot 4 RD, Plot 6 RD Plot 9 RD
727	American Mill	Full Measurement	2/20/2015	Rayonier	
728	LaPush	Full Measurement	3/26/2015	Rayonier	Plot 5 RD 66.3, wait Plot 6 RD 68.9, wait
729	Gnat Creek	Full Measurement	2/3/2015	ODF	Plot 1 RD 55.2, mark, Plot 4 RD 53.2, wait, Plot 6 RD 46.9, wait
730	Big River	Full Measurement	1/29/2014	Campbell	
731	Dingle 4	Full Measurement	10/23/2014	USFS	Plot 4 RD 59.1, marked
732	100-Lens Creek	Full Measurement	1/1/2015	BC	RD check plot 7, likely
733	Stowe Creek	Full Measurement	1/1/2015	BC	
734	Upper Canada Creek	RD check	12/11/2014	Hampton	Plot 5 RD 53.4, wait
736	Twin Peaks	RD check	12/22/2014	Hancok	Plot 8 RD 55.2, marked Plot 12 RD 53.2, wait
737	Allegany	RD check	12/3/2014	ODF	Plot 2 RD 53.7, wait
<b>Type II</b>					
<b>Inst.</b>	<b>Inst. Name</b>	<b>Job</b>	<b>Date</b>	<b>Company</b>	<b>Comments</b>
802	Catt Creek	Full Measurement	11/13/2014	DNR	
810	J2 Nnaimo River	Full Measurement		BC	
812	Panther Creek	Full Measurement	12/9/2014	USFS	

<b>Type III</b>					
<b>Inst.</b>	<b>Inst. Name</b>	<b>Job</b>	<b>Date</b>	<b>Company</b>	<b>Comments</b>
915	Big Tree	Full Measurement	2/5/2015	Weyer	
922	Holder 1A	Full Measurement	4/9/2015	DNR	
930	Forks 1	Full Measurement	4/13/015	Rayonier	
931	Forks 2	Full Measurement	4/12/2015	Rayonier	
932	Forks 3	Full Measurement	4/10/2015	Rayonier	
942	Cat Ballew	Meas. Plots 10,11,12,18,24	4/8/2015	DNR	Thin Plots 10,11,12,18,24

<b>Type V</b>					
<b>Inst.</b>	<b>Inst. Name</b>	<b>Job</b>	<b>Date</b>	<b>Company</b>	<b>Comments</b>
827	Nestucca	Full Measurement	10/7/2014	Weyer	
828	Bunker Creek	Full Measurement	12'16'14	Weyer	
829	Grants Pass	Full Measurement	12/15/2014	Weyer	
830	Weikswoods Flat	Full Measurement	X	Weyer	Dropped
831	Rancho Ranchera PP	Full Measurement	10/1/2014	Plum creek	
832	Clarke Creek PP	Full Measurement	9/30/2014	Plum creek	
833	Clarke Creek DF	Full Measurement	9/3-/14	Plum creek	
834	Dudley	Full Measurement	10/1/2014	Plum creek	
835	Weikswoods Slope	Full Measurement	X	Weyer	Dropped
836	Rabbit Creek	Full Measurement	1/17/2014	Green Dia	
837	Mill Creek #2	Full Measurement	12/19/2014	Green Dia	
838	Star Lake	Full Measurement	12/17/2014	Green Dia	
839	Russel Ranch	Full Measurement	11/24/2014	DNR	
840	Coyote Ridge	Full Measurement	11/25/2014	DNR	
841	Cascadia Tree Farm	Full Measurement	12/10/2014	Cascade TC	
842	Scott Mountain	Full Measurement	12/10/2014	Cascade TC	
843	DeVore Mountain	Full Measurement	12/4/2014	Lone Rock	
844	Brush Creek	Full Measurement	12/4/2014	Lone Rock	
845	Hanes Ranch	Full Measurement	12/4/2014	Roseburg	

**Type V. cont.**

<b>Inst.</b>	<b>Inst. Name</b>	<b>Job</b>	<b>Date</b>	<b>Company</b>	<b>Comments</b>
846	Armstron-Janicki	Full Measurement	11/26/2014	Pilchuck	
847	Victoria	Full Measurement	11/25/2014	Pilchuck	
848	McKinely	Full Measurement	11/26/2014	Pilchuck	
849	Pender Harbor	Full Measurement	1/1/2015	BC	
850	Steel Creek	Full Measurement	1/1/2015	BC	
851	Upper Campbell	Full Measurement	1/1/2015	BC	
852	Fanny Bay	Full Measurement	1/1/2015	BC	
853	Copper Canyon 1	Full Measurement	1/1/2015	BC	
883	Alderbrook C.C.	Full Measurement	1/6/2015	Green Dia	
884	Carson Lake	Full Measurement	1/6/2015	Green Dia	
885	Stoner	Full Measurement	12/18/2014	Green Dia	
886	Beeville rd. South	Full Measurement	12/18/2014	Green Dia	
887	St. Helen's	Full Measurement	10/6/2014	Weyer	
888	Fall River Fertilization	Full Measurement	12/16/2014	Weyer	
889	Deadhorse	Full Measurement	10/7/2014	Weyer	
890	Ditch creek road	Full Measurement	10/2/2014	Hancock	
891	Red Hill	Full Measurement	10/2/2014	Roseburg	
892	Castle Rock	Full Measurement	12/2/2014	Weyer	
893	Frozen Creek	Full Measurement	12/2/2014	Roseburg	

**SMC Review Measurements Approach (RMA)****Conference call July 3, 2012 and email follow ups**

Bob Gonyea and Bert Hasselberg have said they will retire in 2 or more years; therefore we need to prepare for a transition. A committee with Connie Harrington, USFS PNWRS as Chair formed to review methods and develop a plan for future data collection and quality assurance. Other attending members included Sean Garber and Scott Holmen, Olympic Resource Management, Louise de Montigny, BC Ministry of Forest, and Megan O'Shea, SMC.

**5 Methods discussed to accomplish SMC measurements after Bert and Bob retire****1. Hire 2 replacements for Bert and Bob**

- + Employees become familiar with codes, locations, etc
- + Available to help with other projects at SEFS
- + Can be swapped to different projects if priorities change
- + Can incorporate "in-kind" contributions
- New employees not necessarily "career field measurers"; may be more turnover than in past
- Committed to pay salaries each year regardless of planned work load
- Need for university vehicle, office space, supplies (this may not be important consideration since a contract crew will factor these costs into their bid)
- Unless built into process, assumption usually made that employee's work does not need inspection (That is, from a QA/QC standpoint, may need to plan for periodic checks -- Note: SMC Quality TAC did a check cruise on Bert and Bob's work a few years ago and the error was -.01)

**2. Contract out all remeasurements and other desired field work**

- + Allows flexibility in changing workloads from year to year
- + Can specify different requirements for various jobs
- +/- Depending on how contract is setup, can have flexibility in scheduling jobs and changing codes
- + Inspected work (as needed for contracting) results in documentation for QA/QC process
- Need to invest time to set up specific contracting process to ensure quality work
- Could be hard to get a contractor to re-measure a few plots spread out over OR and WA, BC (but may not be an issue if work set up in advance)
- Each contractor will have to become familiar with codes and measurement protocols (but could use a small number of contractors)
- Not easy to incorporate "in-kind" contributions (possibly could use in-kind for inspections and plot maintenance)
- Need to have someone in place to set up contracts, coordinate with Randy to get data from last measurement, conduct check measurements and inspect work (Several tasks but these could be part of one or more than position with other responsibilities, not a full time job)

### 3. Mix of in-house at UW and contracting

- Could combine needs of SMC and other groups at UW for various tasks and accomplish with a mix of in-house people and contractors
- +/- Depends if other UW groups have similar needs
- Hard to find research groups at UW with consistent fieldwork and willing to pay above what they could for a student

### 4. Work with other regional coops

- +Other coops may have similar needs and combined workload could be managed more efficiently (through either employees or contracts)
- +Some potential overlaps with other coops, could be cost effective
- +Potential for more discussion/collaborative work between coops
- Complications could arise from the fact the SMC has an overhead rate of 26%, (established in 1984) and other coops may have much higher rates
- /+Could avoid having commitments to salary/office space etc
- /+Need to have someone take on the task of contacting coops, arranging fieldwork, contracts, measurement protocol, inspecting work
- Measurement and maintenance needs vary between coops
- Each contractor (or other coop employees) will have to become familiar with various codes and measurement protocols used by multiple organizations
- Not easy to incorporate "in-kind" contributions (possibly could use in-kind for inspections and plot maintenance)

### 5. Members do measurements

- +Avoids having a salary commitment (and associated office/vehicle costs) for SMC every year
- Hard to insure SMC high standards
- Not easy to arrange/finance an in-house field crew for work on a small # of plots
- Each company will have to become familiar with codes and measurement protocols
- Still will need someone to coordinate the fieldwork and assure QA/QC

### **Comments**

There is no intent to change the structure of how we are measuring while Bob and Bert are still employed. The members feel they are currently getting high quality data and the program seems to run pretty efficiently. The challenge is to continue to collect high quality, long-term data while also increasing the emphasis on analysis.

*Note to Greg: The main goal of this document is to provide some options to get SMC members to brainstorm and suggest ideas on how we should be organized moving forward. It was suggested we include in the intro a little more detail on the current mix of Bert/Bob/ Bill? /students) but that is a job for an SMC person rather than the committee. Additional planning can be done once the Policy Committee provides input back to the Review Measurements Approach Committee.*

We laid out 5 methods to accomplish SMC measurements after Bert and Bob retire, that is, in the future how do we replace the data acquisition/maintenance needs, still get high quality of data and also retain the flexibility to complete more analyses of the data. All 5 methods will



require someone to oversee the process and in some cases, not only a manager/coordinator but also someone to provide the data and check the measurements (particularly if contractors or non-SMC crews are used). We discussed that this topic might be broadened to think of the roles of other SMC employees also. Thus, current SMC employees could take on some needed roles so that even if one or more new SMC employees are hired, they may be tasked with a different mix of tasks than Bob and Bert have had.



(SMC)<sup>2</sup>

Silviculture manipulation consequences in stand management cooperative installations

Maureen C. Kennedy  
Eric Tumblom  
SMC Spring Meeting  
April 22, 2015  
mkenn@uw.edu



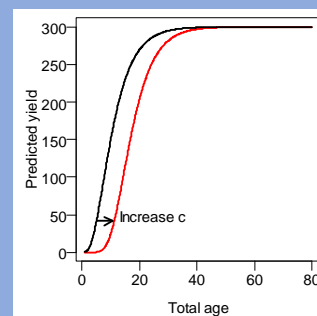
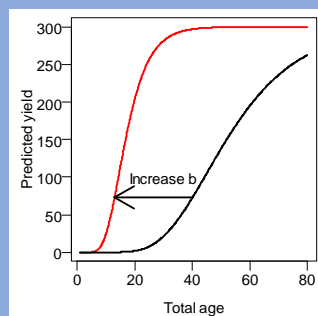
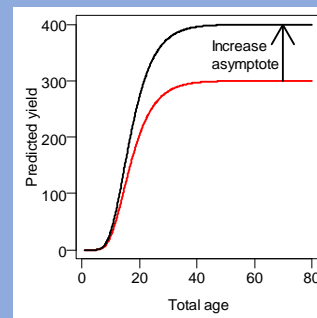
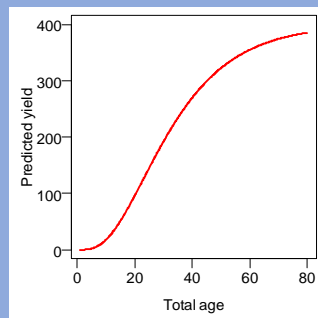
## Performance report

- Analysis goals
- Asymptote difficulties with Type III installations— why do we care?
- Yield predictions with varying Initial TPA
- Yield predictions with varying SI30
- Yield predictions Douglas-fir v. Western hemlock v. mixed

## Analysis goals

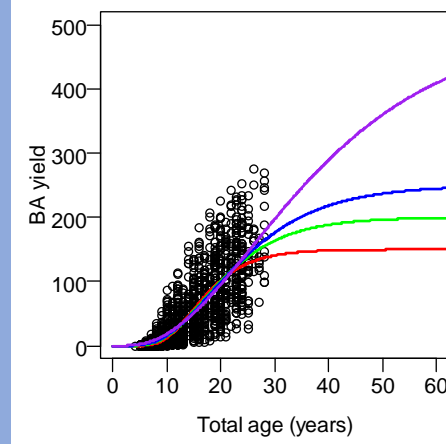
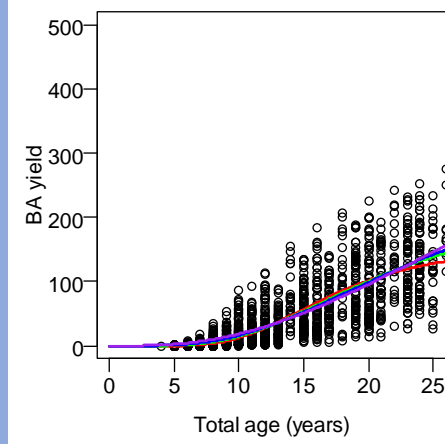
- Predict yield using Chapman-Richards
  - BA, QMD, [TPA], CVT, CV4, CV6, BF4, BF6
- Test differences in yield curves with site characteristics
  - Initial TPA, SI30, species (DF, WH, or Mixed), elevation, latitude, longitude
- Begin with Type III, untreated yield
- Improve asymptote estimates

## Chapman Richards: asymptote, rate parameter, shape parameter



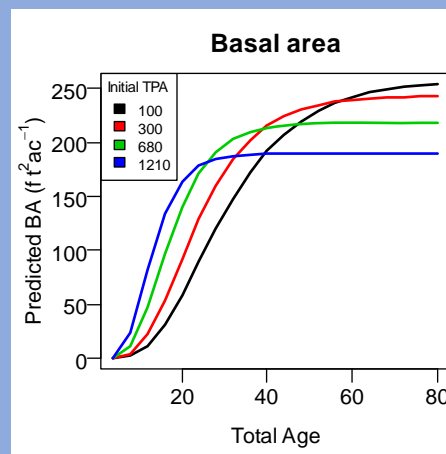
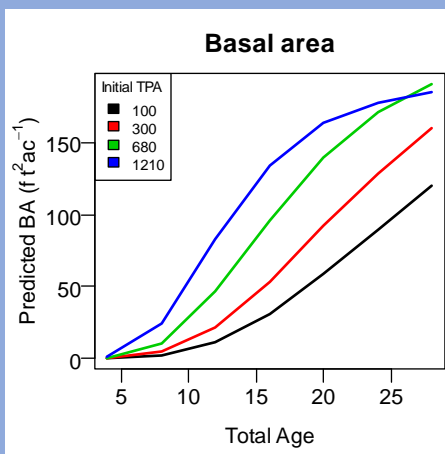
## Chapman Richards: Type III stands

Estimating the asymptote is difficult for young stands



Bounding the optimization search to feasible asymptote ranges improves identification of asymptotes using data from young stands.

## Yield varies with Initial TPA

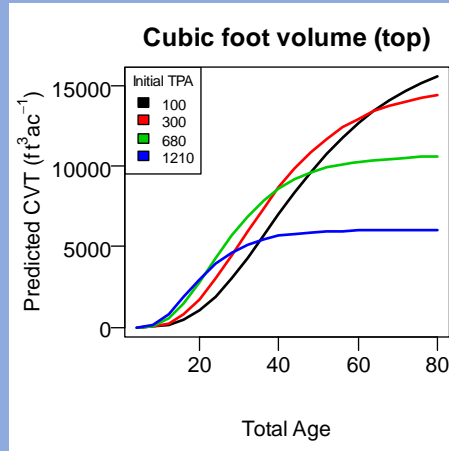
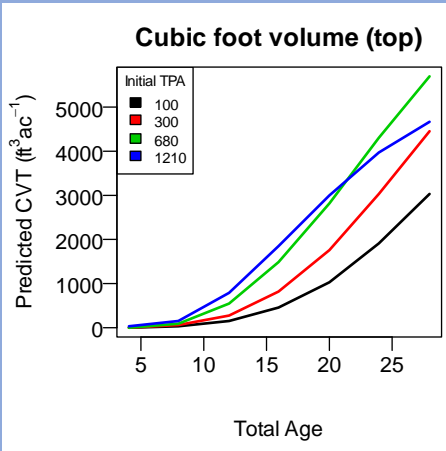


Douglas-fir  
Latitude = 47

Site Index (30) = 85  
Longitude = 123

Elevation = 1000

### Yield varies with Initial TPA

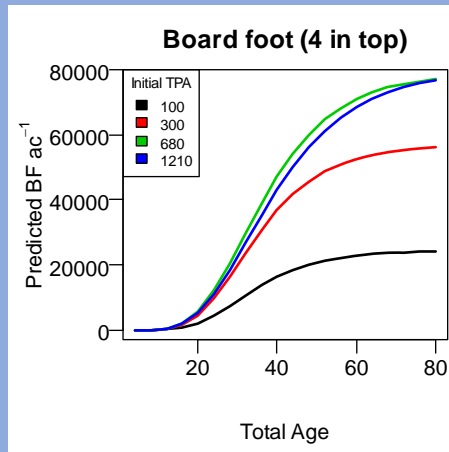
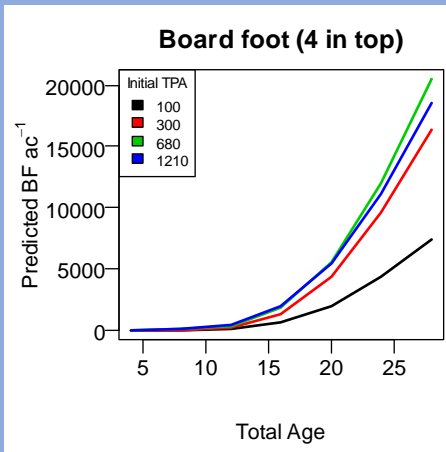


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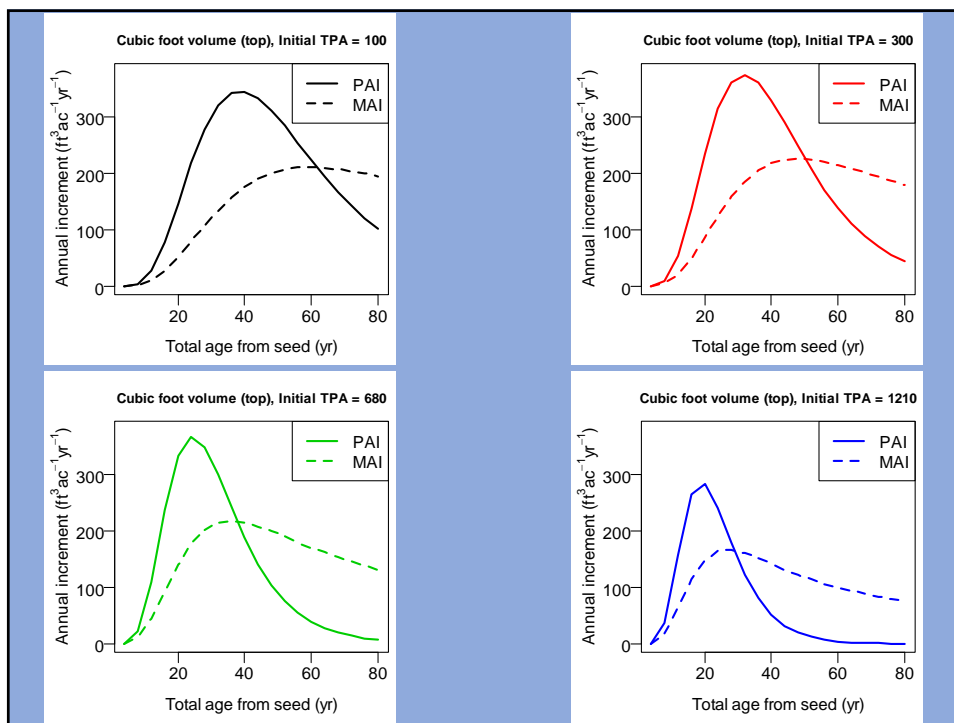
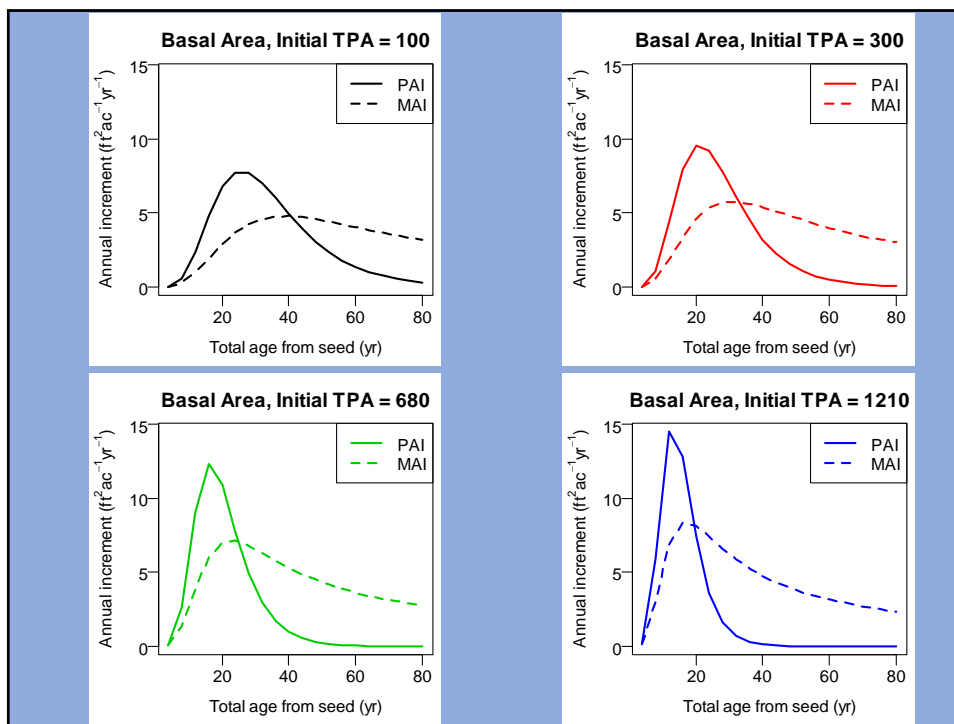
### Yield varies with Initial TPA

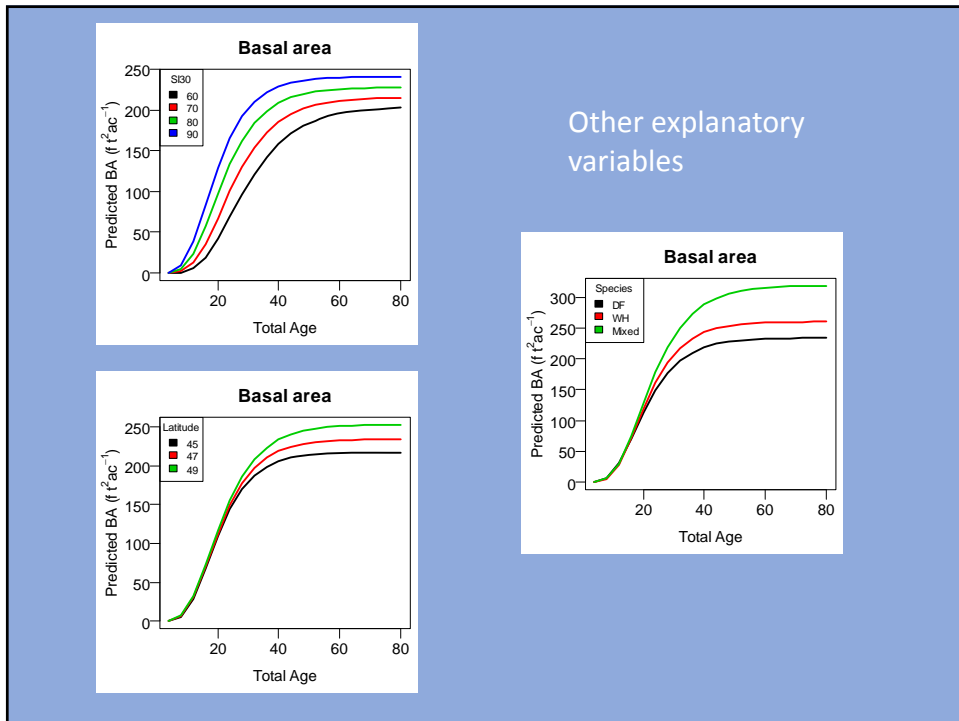
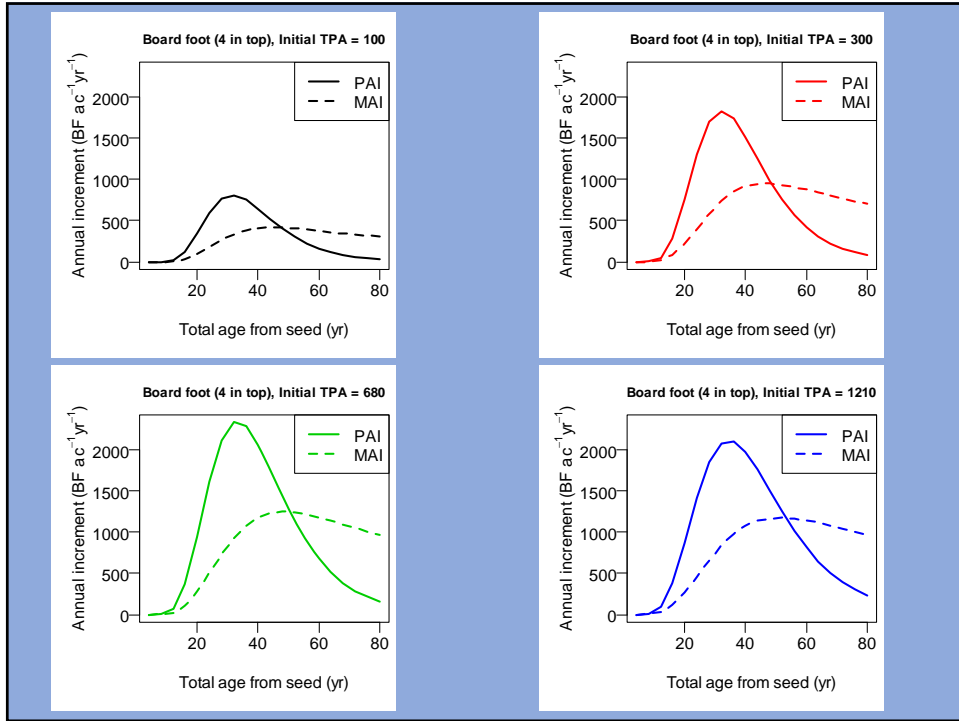


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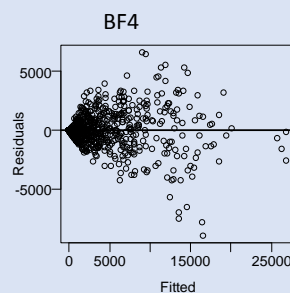
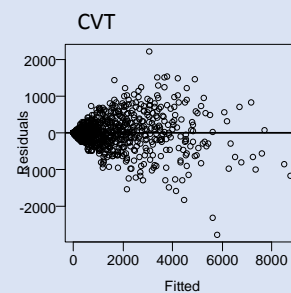
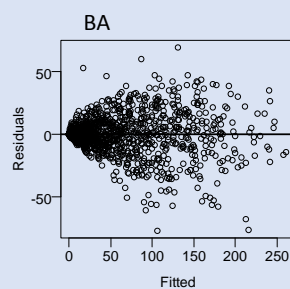




## Summary and timeline

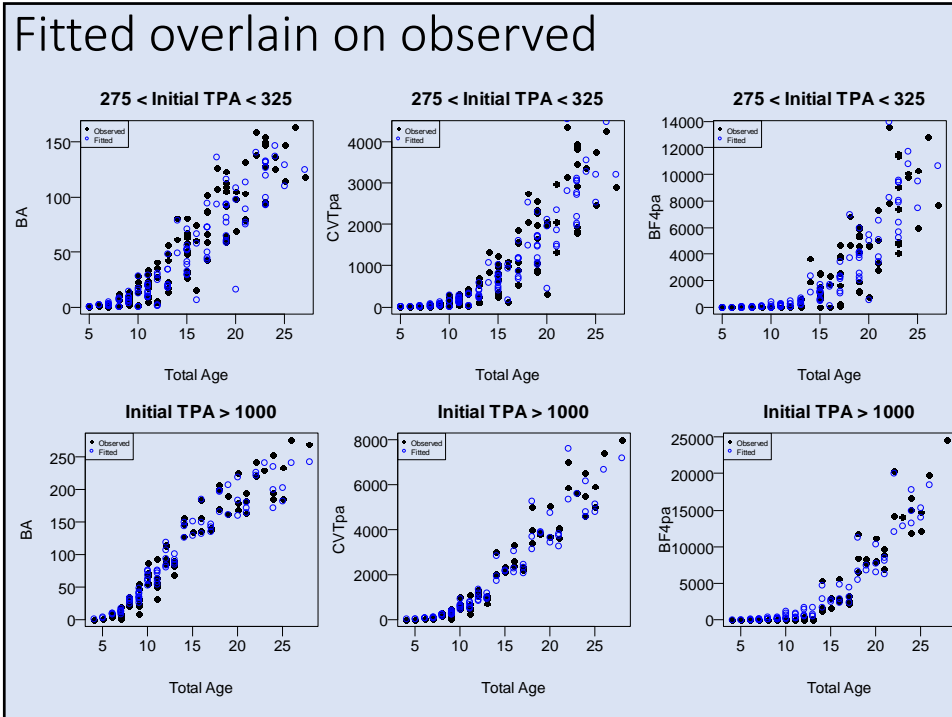
- The Chapman-Richards fits show varying yields with combinations of site characteristics
- For some yield variables increasing initial TPA shows higher yield early in stand development, then switches to lower asymptotes later in stand development.
- Type I/II fits are almost complete
- Updated browser calculator anticipated by May 2015
- Report anticipated by mid-Summer 2015

## Residual plots




We use weighted least squares to account for the mean-variance relationship during estimation (weights =  $1/\sqrt{\text{Total age}}$ )





# PCT Analysis Update

Eric C. Turnblom  
Silviculture Project Leader




SILVICULTURE • NUTRITION  
WOOD QUALITY • MODELING

Spring Policy Meeting 22 April 2015

# PCT Analysis Update

- Rationale
- Objectives
- Experimental Plan
- Results to date
- Next Steps



Spring Policy Meeting 2 22 April 2015

## Rationale

- SMC members seek to maximize timber volume / value, but also place some degree of priority on less conventional stand attributes such as:
  - Live Crown Length
  - Branch Size
  - Other habitat values
- The impacts of timing / intensity of PCT on these attributes are not well understood / publicized



## Experimental Plan

- Use existing SMC data –
  - Type I data
    - Two levels of spacing (ISPA/2, /4)
    - Two types of spacing (systematic, select best trees)
    - Applied at different ages
    - Twenty-nine (29) Type I installations were available for analysis, 12 contained auxiliary “Best Tree Selection” (BST) plots
    - ISPA ranged from 250 to 700; age at PCT from 5 to 17 yr; 30-yr SI ranged from 40 to 90 ft



## Experimental Plan

- Use existing SMC data –
  - Type III data
    - PCT is combination of two factors
      - Timing: early / late
      - Intensity: light / heavy



## Experimental Plan

- Objective 1: Describe Stand yield
  - Multiple linear or nonlinear response surface
  - Experimentally controlled factors are fixed effects
  - Other factors are random effects

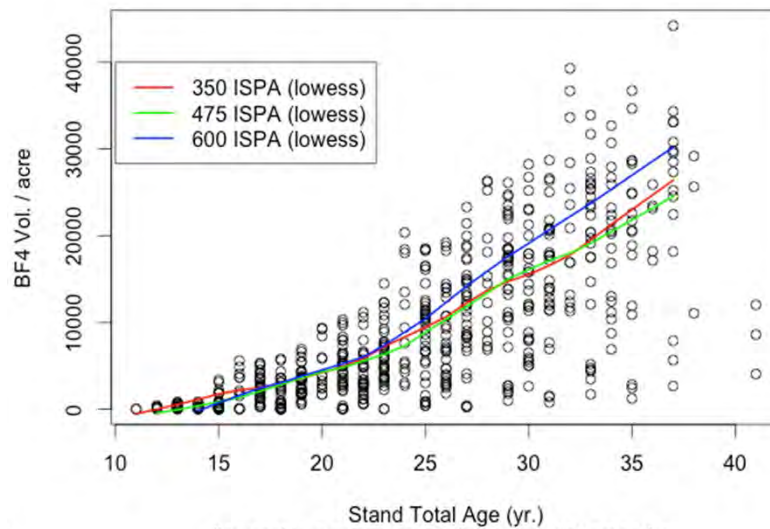


## Results to date

- Responses in Type I installations
  - QMD & CVT per acre yield (reported last Fall)
  - BF volume to 4" top
- Independent variables used:-
  - ISPA, percent stems retained (PRT), SI30, Elev, Tot. Age, Age at PCT, and their interactions
- Analysis included extensive plotting of response variables by plot and in groups
- A flexible function, the generalized allometric equation was chosen for analysis and modeling responses to PCT



Actual BF4 over time, PCT and non-PCT avg. trends shown



## Results to date

- Major determinants affecting accumulation of BF 4" top vol:-
  - Site Index ( $p << 0.0001$ )
  - Percent Retained ( $p < 0.0001$ )
  - Age at PCT ( $p < 0.0001$ )
- Also strong evidence for effects of:-
  - Elevation ( $p = 0.0009$ )
  - Best Tree Selec. ( $p = 0.0210$ )



## Next Steps

- Add response variables
  - LCR
  - BF 6" Volume
- Stand / Stock Tables
- Add Type III installations
- Wood quality



## Benefits

- Better understanding of how stands with given characteristics could be most profitably managed for the mix of materials that might be produced
- Resulting whole stand models will provide independent corroboration of growth modeling work



## Expected Deliverables

- Models describing yields in stands with & w/o PCT across sites, densities, timings in SMC Working Paper
- Mechanism to deliver tree lists corresponding to defined reporting ages and useful combinations of input variables



Addendum F



**Preparing for a Comprehensive Regional Douglas-fir Wood Density Profile Model**

Nate Osborne and Derek Gourley  
*SMC 2015 Annual Meeting*





**Samples are drawn across the diameter distribution**



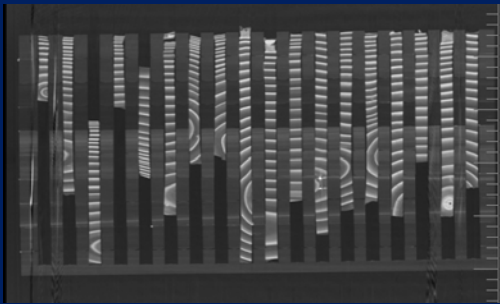

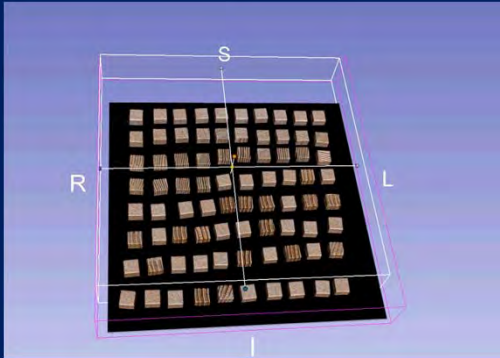
Large dominant trees      Smaller co-dominants      Suppressed

**Large**      **Small**



Jason Wiest: OSU VETMED

Programming to take full advantage of the voxel output from CT scanning

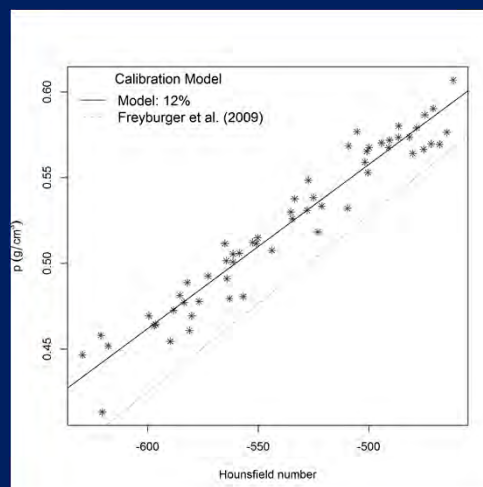




## Calibration Analysis for $H$ to $\rho$

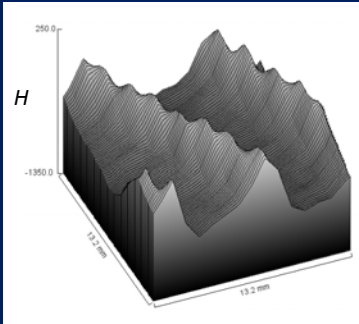
Address unresolved questions and confirm expectations!



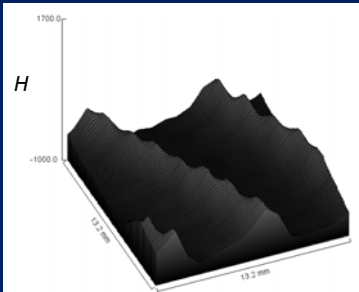
Desiccator with silica base



### Lung Filter 80 mA & 120 kVp

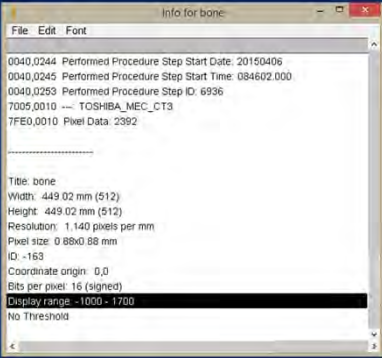


### Bone Filter 80 mA & 120 kVp



## What is the Effect of Filter on Smoothed Attenuation Values?

$H_{bone} = -573.44$      $H_{lung} = -573.64$



```


Info for bone:
File Edit Font
-----
0040,0244 Performed Procedure Step Start Date: 20150406
0040,0245 Performed Procedure Step Start Time: 084602.000
0040,0253 Performed Procedure Step ID: 6936
7005,0010 --- TOSHIBA_MEC_CTS3
7FE0,0010 Pixel Data: 2382
-----
Title: bone
Width: 449.02 mm (512)
Height: 449.02 mm (512)
Resolution: 1.140 pixels per mm
Pixel size: 0.88x0.88 mm
ID: -163
Coordinate origin: 0,0
Bits per pixel: 16 (signed)
Display range: -1000 - 1700
No Threshold
    
```

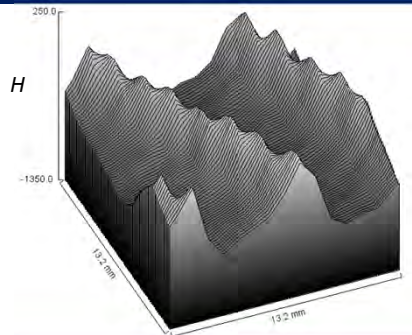
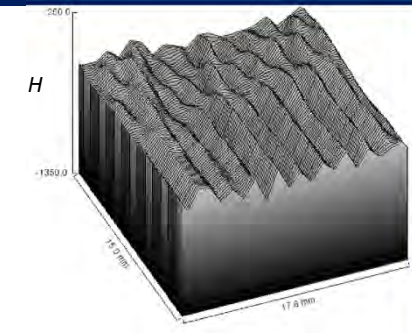
## Chance to see growth ring boundary

Likely

Maybe?

Unlikely



Adapted from Long et al. 1984

## Growth & Yield

Linking these models at a high resolution is novel

### Virtual Stem in *cipsr*

- Branches
- Knots
- Heartwood
- Sapwood
- Density
- Earlywood
- Latewood

F. Colin et al.

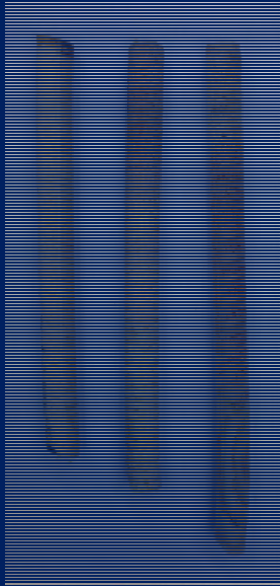
## & Quality

## Implied Knot Characteristics

Distance from Tree Pith (cm)

Modified Weibull for knot radius  
Inverse polynomial for knot pith

Linear near the tip  
Becomes curvilinear near the tree base



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4/17/2015